

The price specie flow mechanism

Slides for Chapter 6.6 of Open Economy Macroeconomics

Asbjørn Rødseth

University of Oslo

7th April 2010

Hume's specie-flow theory

The country has a trade deficit

- Gold and silver flows out
- Wealth declines gradually
- Domestic demand falls
- Prices of home goods (and wages) decline
- Imports go down, exports up
- Trade balance improves until deficit is eliminated

Some assumptions

Home and foreign goods

Prices determined by wage cost (plus mark-up)

Fixed exchange rate, no change expected

Fixed interest rate, either

- 1 perfect capital mobility and credible exchange rate, or
- 2 low capital mobility, interest rate set independently

Government budget balanced

No investment

No imported inflation

The consumption function

$$C = C(Y_p, W_p, \rho, \rho_*) \quad 0 < C_Y < 1, \quad C_W > 0$$

In our case

$$W_p = -\frac{EF_*}{P} - W_g = -W'_* - W_g$$

W'_* = value of foreign debt measured in home goods

$$Y_p = Y - i_* \frac{EF_*}{P} - G = Y + i_* W_p + i_* W_g - G$$

Savings: $S_p = Y_p - C$

Assumption: $\frac{dS_p}{dW_p} = i_*(1 - C_Y) - C_W < 0$

The net export function

$$X = X(R, Y, Y_*), \quad R = EP_*/P$$

$$X_R > 0, \quad X_Y < 0, \quad X_{Y_*} > 0$$

Marshall-Lerner condition: Sum of demand elasticities for exports and imports greater than 1.

The model

IS-curve:

$$Y = C \left(Y - i_* \frac{EF_*}{P} - G, -\frac{EF_*}{P} - W_g, i, i_* \right) + G + X \left(\frac{EP_*}{P}, Y, Y_* \right) \quad (1)$$

Phillips-curve:

$$\dot{P} = P\gamma(Y - \bar{Y}) \quad (2)$$

Accumulation of foreign debt:

$$\dot{F}_* = i_* F_* - \frac{P}{E} X \left(\frac{EP_*}{P}, Y, Y_* \right) \quad (3)$$

Endogenous variables: Y , P and F_*

Initial conditions: $P(0) = P_0$, $F_*(0) = F_{*0}$

$$W_g(0) = (-M_0 - B_0 + E(0)F_{g0})/P_0$$

The temporary equilibrium

$$Y = C\left(Y - i_* \frac{EF_*}{P} - G, -\frac{EF_*}{P} - W_g, i, i_*\right) + G + X\left(\frac{EP_*}{P}, Y, Y_*\right)$$

IS-equation determines Y given P and F_* .

Solution:

$$Y = Y(P, F_*, \mathbf{x}), \quad \mathbf{x} = (i_*, P_*, Y_*, G, i, E, W_g) \quad (4)$$

Increased foreign debt, F_* , reduces consumption demand and output

$$\frac{\partial Y}{\partial F_*} = \frac{(-i_* C_Y - C_W)E/P}{1 - C_Y - X_Y} < 0 \quad (5)$$

Temporary equilibrium: Effect of the price level on output

Wealth effect. $P \uparrow \rightarrow$ Reduced real value of F_* . Aggregate demand up if $F_* > 0$, down if $F_* < 0$

Real exchange rate effect. Demand shifts away from home goods. Aggregate demand down.

Total effect. Always negative for creditor country, may be positive for countries with large debt.

$$\frac{\partial Y}{\partial P} = \frac{(i_* C_Y + C_W) W'_* - X_R R}{1 - C_Y - X_Y} \frac{1}{P} \quad (6)$$

Our assumption: $\partial Y / \partial P < 0$.

The dynamic equations

If we insert for Y from (4) in (2) and (3) we get a system of two differential equations:

$$\dot{P} = \phi_1(P, F_*, \mathbf{x}) = P\gamma[Y(P, F_*, \mathbf{x}) - \bar{Y}] \quad (7)$$

$$\dot{F}_* = \phi_2(P, F_*, \mathbf{x}) = i_*F_* - PX(EP_*/P, Y(P, F_*, \mathbf{x}), Y_*)/E \quad (8)$$

The stationary equilibrium

$$\dot{P} = \phi_1(P, F_*, \mathbf{x}) = 0 \Leftrightarrow Y = Y(P, F_*, \mathbf{x}) = \bar{Y} \quad (9)$$

$$\dot{F}_* = \phi_2(P, F_*, \mathbf{x}) = 0 \Leftrightarrow PX(EP_*/P, Y, Y_*) = i_*EF_* \quad (10)$$

(9) - internal balance

(10) - external balance

Together they determine F_* and P in stationary equilibrium

The stationary (long run) equilibrium

Since a stationary equilibrium is also a temporary equilibrium:

$$C(\bar{Y} - i_* W'_* - G, -W'_* - W_g, i, i_*) + G + X(R, \bar{Y}, Y_*) = \bar{Y} \quad (11)$$

With $Y = \bar{Y}$ external balance requires

$$i_* W'_* = X(R, \bar{Y}, Y_*) \quad (12)$$

Use (12) to eliminate X from (11):

$$C(\bar{Y} - i_* W'_* - G, -W'_* - W_g, i, i_*) + G = \bar{Y} - i_* W'_* \quad (13)$$

(13) determines W'_*

(12) then determines R

Long run equilibrium

Solution is recursive

Y determined by supply (capacity)

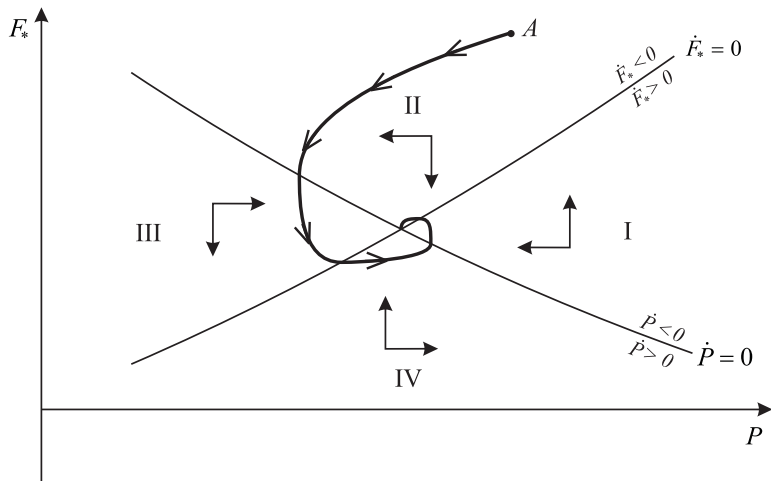
W_* determined by savings behavior

R determined by demand for exports and imports

P determined by exchange rate

Implicitly: Wage level has to be low enough that a sufficient share of world demand is directed towards home goods.

Transition to long run equilibrium, cyclic path



Locus for internal balance

$$\dot{P} = \phi_1(P, F_*; \mathbf{x}) = 0 \iff Y = \bar{Y}$$

Combinations of P and F_* that yields internal balance

$$Y(P, F_*, \mathbf{x}) = \bar{Y}, \quad \partial Y / \partial P < 0, \partial Y / \partial F_* > 0$$

High price level

- low demand for home goods
- negative output gap
- falling prices ($\phi_{11} < 0$)

High foreign debt

- low demand for home goods
- negative output gap
- falling prices ($\phi_{12} < 0$)

If P increases, a reduction in F_* is needed to keep $Y = \bar{Y}$
 P above $\dot{P} = 0$ -locus → falling prices on home goods

Locus for external balance

Combinations of P and F_* that yields external balance are defined by:

$$\dot{F}_* = \phi_2(P, F_*; \mathbf{x}) = 0$$

$$X(EP_*/P, Y(P, F_*, \mathbf{x}), Y_*) - i_*EF_*/P = 0$$

Increase in F_*

Two opposing effects on the current account:

- more interest payments on foreign debt

- improved trade balance since output is down

Our assumption:

- Trade effect dominates, current account improved ($\phi_{22} < 0$)

Locus for external balance

$$X(EP_*/P, Y(P, F_*, \mathbf{x}), Y_*) - i_*EF_*/P = 0$$

Increase in P

Effects through two channels:

1. A real appreciation, which worsen the current account
2. A change in the real value of the foreign debt.

The sign of the second effect depends on the sign of F_* :

If $F_* > 0$, $P \uparrow$ works like a reduction in F_* , assumed above to worsen the current account.

If $F_* < 0$, $P \uparrow$ works like an increase in F_* , improving the current account

Our assumption:

Real exchange rate effects dominate, current account worsens
($\phi_{21} > 0$)

External balance, summing up

Our assumptions:

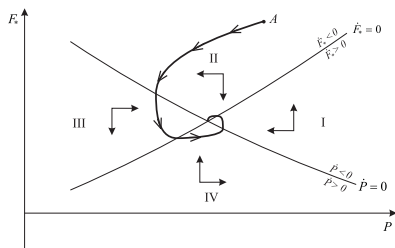
An increase in F_* improves current account ($\phi_{22} < 0$)

An increase in P worsens current account ($\phi_{21} > 0$)

Locus for external balance slopes upward: If P increases, a higher F_* is required to keep current account balanced.

If F_* is above the locus for external balance, F_* is declining.

The transition to long run equilibrium



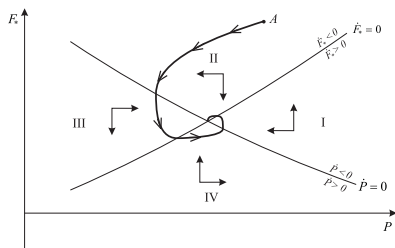
Phase II

Output below capacity
Prices falling

Current account surplus
Foreign debt declining

Until internal balance is reached

The transition to long run equilibrium



Phase III

Output above capacity

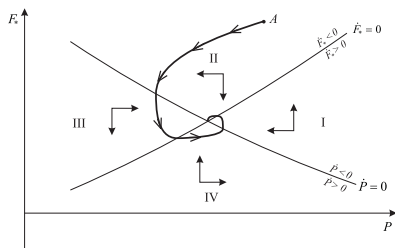
Prices increasing

Current account surplus

Foreign debt declining

Until external balance is reached

The transition to long run equilibrium



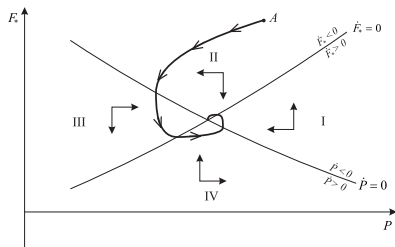
Phase IV

Output above capacity
Prices increasing

Current account deficit
Foreign debt increasing

Until internal balance is reached

The transition to long run equilibrium



Phase I

Output below capacity

Prices falling

Current account deficit

Foreign debt increasing

Until external

balance is reached

Stability conditions

Stability cannot be proved by looking at graphs alone

Jacobian matrix

$$A = \begin{bmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{bmatrix}$$

Necessary and sufficient conditions for stability

$$\text{tr}(A) = \phi_{11} + \phi_{22} < 0$$

and

$$|A| = \phi_{11}\phi_{22} - \phi_{12}\phi_{21} > 0$$

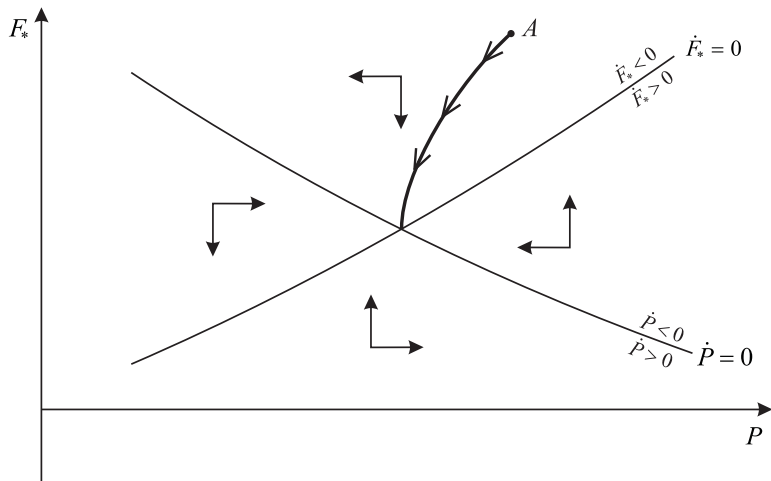
Our assumptions ensure that both conditions are satisfied, but they are stricter than necessary.

Can be shown:

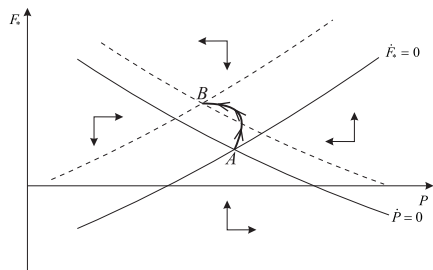
$$|A| > 0 \iff i_*(1 - C_Y) - C_W < 0$$

Or: Increased wealth must lead to reduced savings.

The transition to long run equilibrium, non-cyclic path



The effect of easier access to credit



Positive shift in domestic demand

Internal balance requires higher prices

External balance requires lower prices

First boom, then recession

First prices increase, then they fall below the initial level

On the price effect

How do we know that the price level will have to fall?

In stationary state:

$$i_* F_* / P_* = (1/R) X(R, \bar{Y}, Y_*) \quad (14)$$

Foreign debt is higher

Interest payments are higher

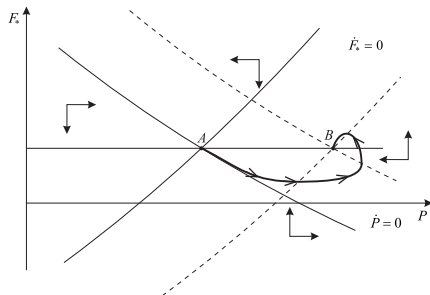
Trade surplus has to be higher

Real exchange rate must depreciate (Marshall-Lerner)

Nominal prices must fall, since exchange rate is fixed

With flexible exchange rate, exchange rate movements may produce the real appreciation.

A devaluation (Assuming $F_{g0} = 0$)



Long run: R and F_* not affected

Current account improves, curve for external balance shifts to the right

Output increases, curve for internal balance shifts to the right

Shifts equal in size (only E/P matters)

First boom, then recession

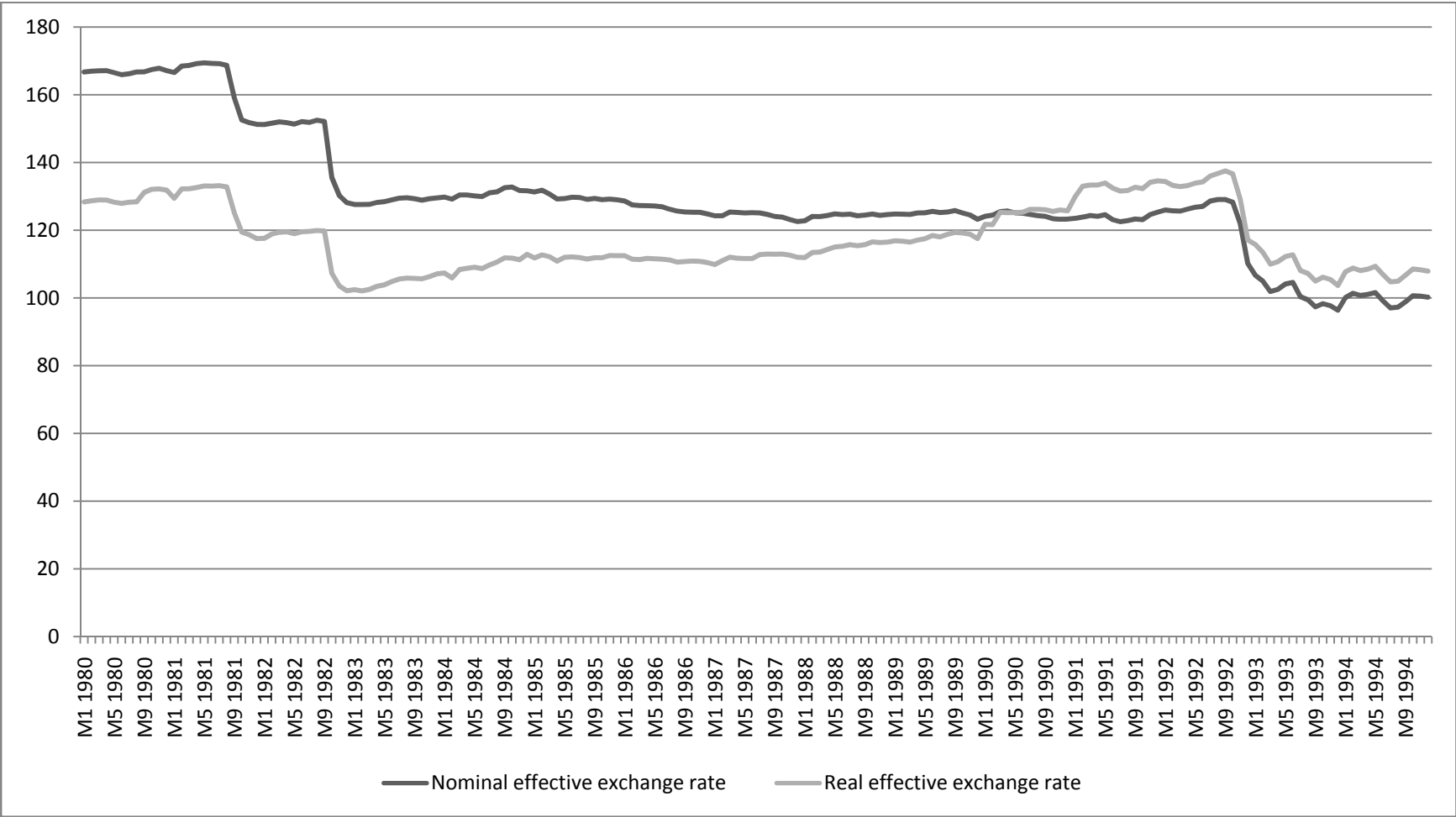
Devaluation cycles

Norway's devaluation decade
1977-86

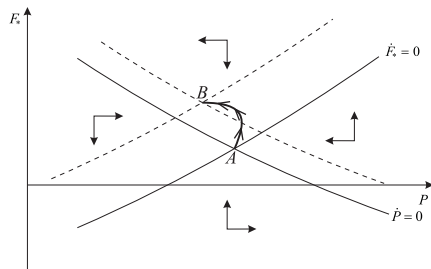
Devaluation cycle. On blackboard

Real and nominal exchange rates Sweden 1980-1994

Source: IMF Financial Statistics. Higher index means appreciation



The effect of easier access to credit



Positive shift in domestic demand

Internal balance requires higher prices

External balance requires lower prices

First boom, then recession

Prices increase first, then fall below initial level

Approach may be cyclic

Devaluation as response to negative shift in savings propensity. On blackboard.

Devaluation as response to negative shift in savings propensity

- ▶ Current account improved in the short run
- ▶ Later deficit will be larger, total change in F_* the same
- ▶ Transition takes place with more inflation and less unemployment
- ▶ May leave legacy of increased inflation expectations
- ▶ Policies designed to break inflationary expectations may create unemployment later

Extended model

Phillips-curve augmented with expected consumer price inflation

$$\dot{P}/P = (\dot{P}_C/P_C)^e + \gamma(Y - \bar{Y})$$

Model consistent expectations

Floating exchange rate

- ▶ Same dynamics for foreign debt and for the real exchange rate
- ▶ Replace P by $1/R$ on the horizontal axis
- ▶ Initial R not given, but determined by monetary policy and expectations
- ▶ Once initial exchange rate has been determined, expected future dynamics are as with fixed rate

Floating exchange rate, target for producer price inflation

Assumptions

i is used to keep P constant by keeping $Y = \bar{Y}$

Perfect capital mobility

The effect of easier access to credit

- ▶ Long run equilibrium: Higher foreign debt, depreciated real *and nominal* exchange rate
- ▶ Short run: Higher interest rate, appreciated exchange rate, current account deficit
- ▶ The path between: Gradual depreciation, gradual increase in foreign debt, equilibrium output
- ▶ Consumer prices first fall, then increase gradually, end up higher than initially

Summing up on current account imbalances 1

- ▶ Persistent imbalances are caused by real factors, mainly saving and investment behavior
- ▶ Imbalances tend to self correct towards sustainable levels without need for policy intervention
- ▶ Government action is required if imbalance stems from government deficit
- ▶ Correction of persistent imbalances usually requires change in real exchange rate. Price level or nominal exchange rate must change.
- ▶ During the adjustment to long-run equilibrium countries may have to go through a period of unemployment

Summing up on current account imbalances 2

- ▶ Devaluations affect the timing of deficits, but not the sum of deficits over time
- ▶ Surprise devaluation may ease transition, but encourage future speculation and inflation
- ▶ Devaluation best suited when home country in recession, rest of the world in boom
- ▶ Floating exchange rate: Level is determined in asset market, not in market for exports and imports
- ▶ Impact of shocks on exchange rate depends on monetary policy
- ▶ Temporary supply shocks and domestic demand shocks affect output in the same direction, trade balance in opposite direction

US is special

- ▷ Foreign debt mainly in domestic currency
- ▷ Foreign assets often in foreign currency
- ▷ Depreciation of the US dollar reduces US debt burden
- ▷ Less need for saving in US
- ▷ Higher current account deficits?