

# The price specie flow mechanism

Slides for Chapter 6.6 of Open Economy Macroeconomics

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# 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)

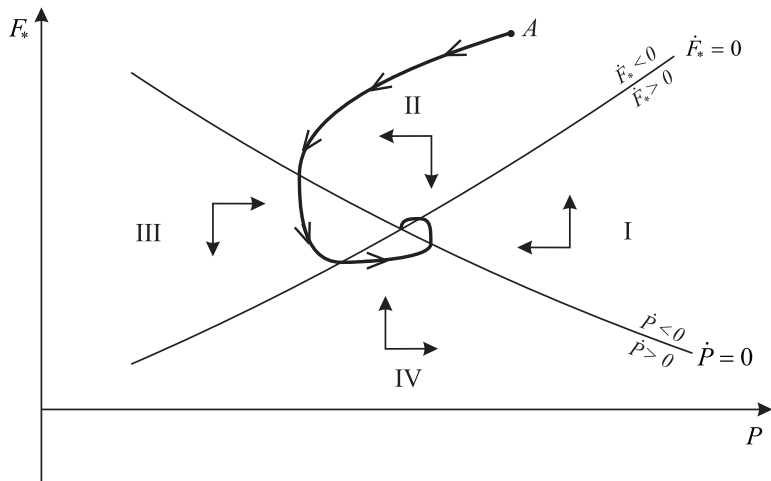
$W_*$  determined by savings behavior

$R$  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 ( $\phi_{22} < 0$ )

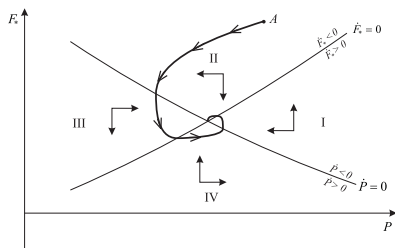
An increase in  $P$  worsens current account ( $\phi_{21} > 0$ )

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



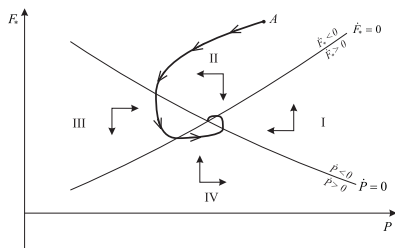
## Phase II

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

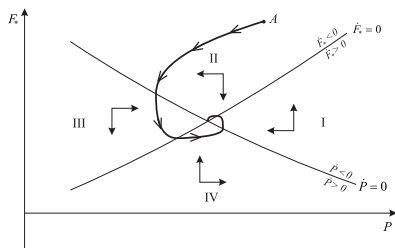
Prices increasing

Current account surplus

Foreign debt declining

Until external balance is reached

# The transition to long run equilibrium



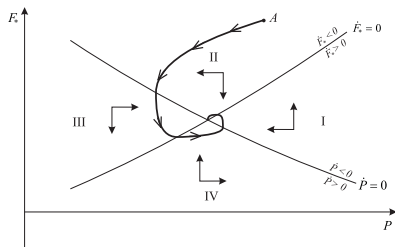
## Phase IV

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

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

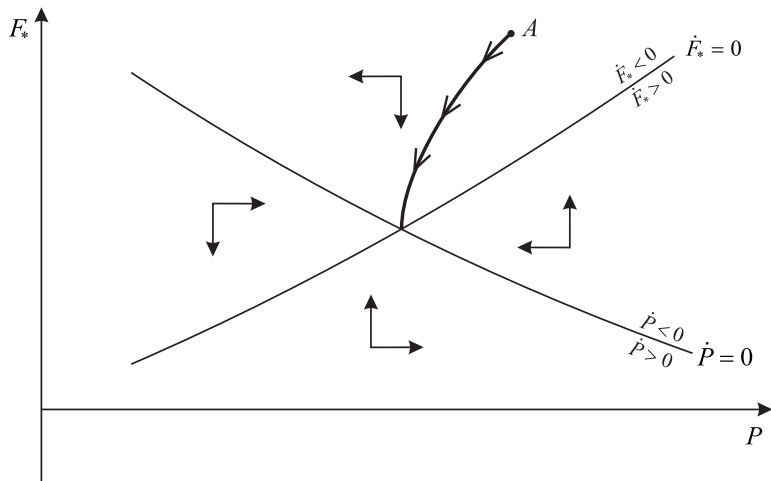
Our assumptions ensure that both conditions are satisfied, but they are stricter than necessary.

Can be shown:

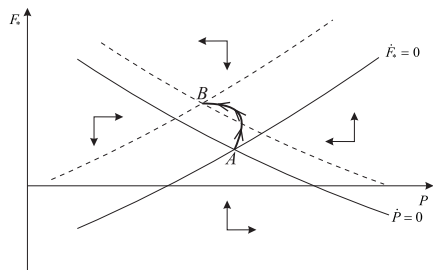
$$|A| > 0 \iff i_*(1 - C_Y) - C_W < 0$$

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.