Dynamics: The price-specie-flow mechanism
Lecture 13, ECON 4330

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(Adopted from Asbjørn Rødseth)

April 3/24, 2017

Today: The move from short to long run equilibrium

- Specie-flow theory
- short term equilibrium in goods and FX markets
- Prices and stocks of foreign debt/assets adjust to the long run equilibrium

Todays lecture can be seen as closing the circle. Main topics you have covered:

- Current account, real exchange rate and debt in the infinite horizon representative agent model
  - Long run equilibrium
  - Supply driven economy
  - Simple real valued assets and complete markets
- Portfolio choice with and without money
  - Short term equilibrium in limited assets
  - Nominal rigidities
- MFT-model with goods and FX-markets
  - Short term equilibrium in goods and FX-markets
  - Demand driven economy

Today we move from the short run equilibrium in the MFT models back to long run equilibria where levels in the economy are driven by supply side factors. There are nominal rigidities, but these only affect the short term equilibria.

Hume's specie-flow theory

- The country has a trade deficit
- $\rightarrow$ Gold and silver flows out
- $\rightarrow$ Wealth declines gradually
- $\rightarrow$ Domestic demand falls
- $\rightarrow$ Prices of home goods (and wages) decline
- $\rightarrow$ Imports go down, exports up
- $\rightarrow$ 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

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

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

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

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

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

Short term equilibrium, the IS-curve:

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

The IS-curve gives us the short term equilibrium in the goods market given prices (P), foreign debt (F_*) and exogenous variables.

Dynamic relationships

We have temporary equilibrium in the goods market, but prices and the level of foreign debt/assets move over time.

Phillips-curve gives us changes in prices:

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

Accumulation of foreign debt or assets:

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

The stationary (long term) equilibrium will be when these changes are zero.

The model

IS-curve:

$$Y = C\left(Y - i_* \frac{EF_*}{P} - G, -\frac{EF_*}{P} - W_g, i, i_*\right) + G + X\left(\frac{EP_*}{P}, Y, Y_*\right) \tag{4}$$

Phillips-curve:

$$\dot{P} = P\gamma(Y - \bar{Y}) \tag{5}$$

Accumulation of foreign debt:

$$\dot{F}_* = i_* F_* - \frac{P}{E} X\left(\frac{EP_*}{P}, Y, Y_*\right) \tag{6}$$

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

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

IS-equation determines Y given P and F_* .
Solution:
$$Y = Y(P, F_*, x), \qquad x = (i_*, P_*, Y_*, G, i, E, W_g) \tag{7}$$

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

$$\frac{\partial Y}{\partial F_*} = \frac{(-i_* C_Y - C_W)E/P}{1 - C_Y - X_Y} < 0 \tag{8}$$

- *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.

$$\frac{\partial Y}{\partial P} = \frac{(i_* C_Y + C_W)W'_* - X_R R}{1 - C_Y - X_Y} \frac{1}{P} \tag{9}$$

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

The dynamic equations

If we insert for Y from (7) in (5) and (6) we get a system of two differential equations:

$$\dot{P} = \phi_1(P, F_*, \mathbf{x}) = P\gamma[Y(P, F_*, \mathbf{x}) - \bar{Y}] \tag{10}$$

$$\dot{F}_* = \phi_2(P, F_*, \mathbf{x}) = i_* F_* - PX(EP_*/P, Y(P, F_*, \mathbf{x}), Y_*)/E \tag{11}$$

The stationary equilibrium

$$\dot{P} = \phi_1(P, F_*, \mathbf{x}) = 0 \quad \Leftrightarrow \quad Y = Y(P, F_*, \mathbf{x}) = \bar{Y} \tag{12}$$

$$\dot{F}_* = \phi_2(P, F_*, \mathbf{x}) = 0 \quad \Leftrightarrow \quad PX(EP_*/P, Y, Y_*) = i_* E F_* \tag{13}$$

- (12) - internal balance
- (13) - 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:

$$C(\bar{Y} - i_* W'_* - G, -W'_* - W_g, i, i_*) + G + X(R, \bar{Y}, Y_*) = \bar{Y} \tag{14}$$

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

$$i_* W'_* = X(R, \bar{Y}, Y_*) \tag{15}$$

Use (15) to eliminate X from (14):

$$C(\bar{Y} - i_* W'_* - G, -W'_* - W_g, i, i_*) + G = \bar{Y} - i_* W'_* \tag{16}$$

- (16) determines W'_*
- (15) then determines R

Long run equilibrium

Solution is recursive

- $Y = \overline{Y}$ determined by supply (capacity)
- W'_* determined by savings behavior (consumption function)
- R determined by demand for exports and imports
- P determined by exchange rate (as $R = \frac{EP_*}{P}$)

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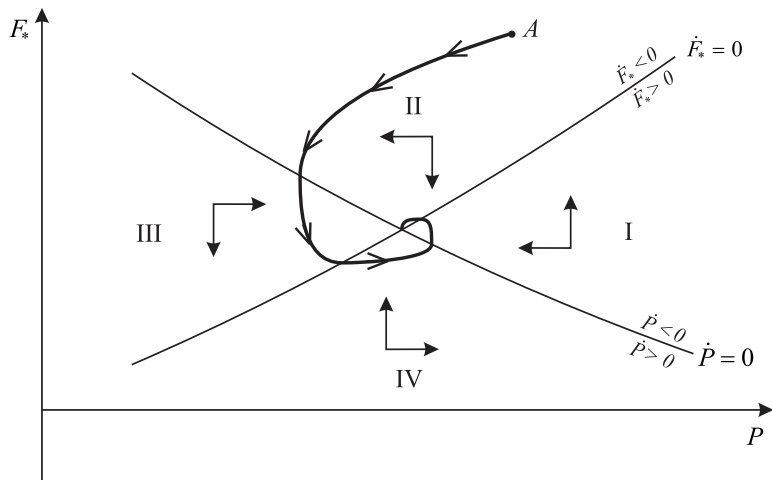
Locus for internal balance

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

Combinations of P and F_* that yields internal balance

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

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

- High foreign debt
- $\rightarrow$ low demand for home goods
- $\rightarrow$ negative output gap
- $\rightarrow$ 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 $\rightarrow$ 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 ($\phi_{21} > 0$)

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.

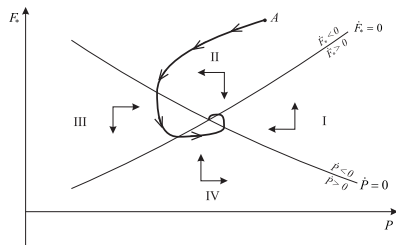If F_* is above the locus for external balance, F_* is declining.

Phase II

- Output below capacity
- Prices falling
-
- Current account surplus
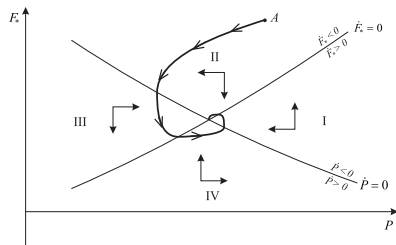- Foreign debt declining
-
- Until internal balance is reached

Phase III

- Output above capacity
- Prices increasing
-
- Current account surplus
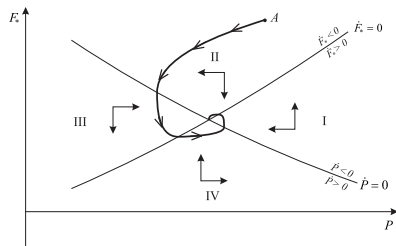- Foreign debt declining
-
- Until external balance is reached

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

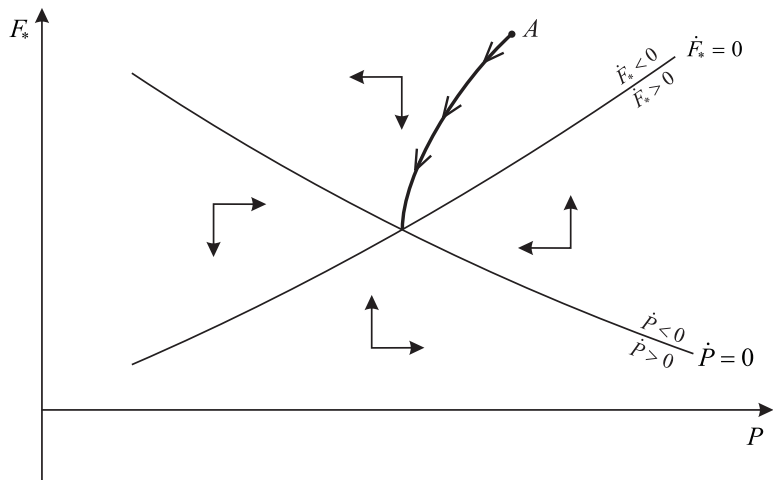$$|A| = \phi_{11}\phi_{22} - \phi_{12}\phi_{21} > 0$$

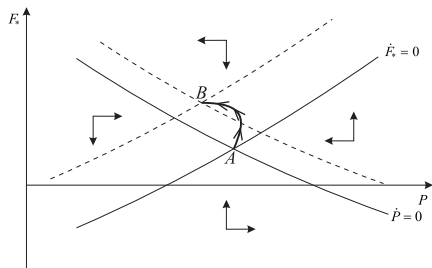Our assumptions ensure that both conditions are satisfied, but they are stricter than necessary.
Can be shown:

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

Or: Increased wealth must lead to reduced savings.

The effect of a positive demand shock

Positive permanent shift in domestic demand
(New cheap credit cards available)

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:

$$i_* F_*/P_* = (1/R)X(R, \bar{Y}, Y_*) \tag{17}$$

- 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.

Today:

- Looked at the move to long run equilibrium
- Introduced the Specie-flow mechanism
- Focus on Solution by Phase-diagram

Exam:

- May 26th at 09:00 (3 hours)
- No resources allowed (Dictionary allowed)
- Everything from the syllabus and the lectures/seminars may be covered

Good Luck!