The Dornbusch overshooting model

Slides for Chapter 6.7 of Open Economy Macroeconomics

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Motivation

Bretton-Woods system of fixed rates collapsed in 1971

Major countries began floating (USA, Japan, Germany, UK)

Volatility of of exchange rates higher than expected

Extends the monetary model

Home and foreign goods

Price of home goods do not jump (short run nominal price rigidity)

The model

IS	$Y = C(Y) + X(EP_*/P, Y, Y_*)$	(1)
LM	$M/P = m(i, Y)$	(2)
Phillips	$\dot{P}/P = \gamma(Y - \bar{Y})$	(3)
UIP	$\dot{E}/E = i - i_*$	(4)

Endogenous variables: Y, i, P and E

Exogenous variables: Y_*, P_*, i_*, M

Initial condition: $P(0) = P_0$

The temporary equilibrium

$$
\begin{aligned}
Y &= Y(EP_*/P, Y_*) \quad (5) \\
i &= i(M/P, EP_*/P, Y_*) \quad (6)
\end{aligned}
$$

Solves (1) and (2)

The dynamics

$$
\begin{aligned}
\dot{P} &= P\gamma[(Y(EP_*/P, Y_*) - \bar{Y}] = \phi_1(P, E; Y_*, P_*) \quad (7) \\
\dot{E} &= E[i(M/P, EP_*/P, Y_*) - i_*] = \phi_2(P, E; M, Y_*, P_*, i_*) \quad (8)
\end{aligned}
$$

Temporary equilibrium inserted in (3) and (4)

The stationary equilibrium

$$\dot{P} = 0 \iff Y = Y(EP_*/P, Y_*) = \bar{Y} \tag{9}$$
$$\dot{E} = 0 \iff i = i(M/P, EP_*/P, Y_*) = i_* \tag{10}$$

Determines stationary values of P and E.

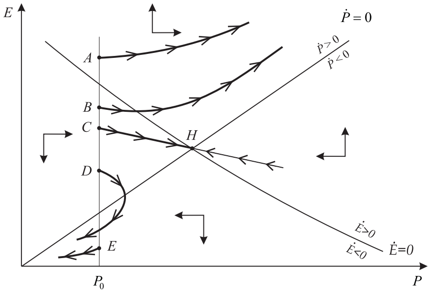
Questions

Does the economy move towards the stationary equilibrium in the long run? (Stability?)

How to determine the initial value of E?

How is the path from the initial temporary equilibrium to the stationary equilibrium?

The phase diagram

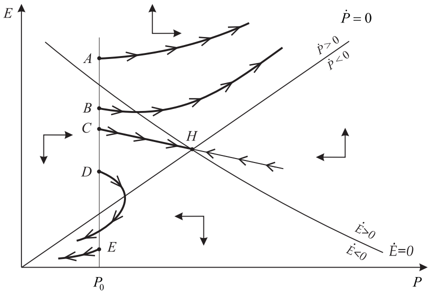


Internal balance: The $\dot{P} = 0$-locus

$$\dot{P} = 0 \Longleftrightarrow Y = Y(EP_*/P, Y_*) = \bar{Y}$$

Y depends on ratio P/E
To keep Y constant at $\bar{Y}$, E must increase proportionally with P
P above $\dot{P} = 0$ means Y low, P declining

The phase diagram



The $\dot{E} = 0$-locus

$$\dot{E} = 0 \Longleftrightarrow i(M/P, EP_*/P, Y_*) = i_*$$

Ambiguous slope

$P \uparrow \Longrightarrow Y \downarrow, M/P \downarrow, \Longrightarrow i \downarrow\uparrow ?$

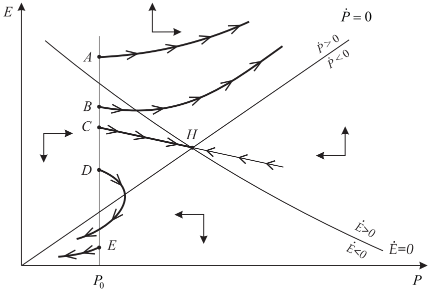
$E \uparrow \Longrightarrow Y \uparrow \Longrightarrow i \uparrow$

Assume $P \uparrow \Longrightarrow i \uparrow$

$\dot{E} = 0$-locus slopes downward

E above the $\dot{E} = 0$-locus means i high, and E depreciating

The phase diagram



Arrows point away from $\dot{E} = 0$ and towards $\dot{P} = 0$.

- H is stationary equilibrium
- Starting point anywhere on P_0-line
- A, B accelerating inflation forever
- D, E accelerating deflation until $i = 0$
- C saddle path leading to stationary equilibrium

Along the saddle path

- Inflation and appreciation together (left arm)
- Deflation and depreciation together (right arm)
- External and internal value of currency moves in opposite directions

For the record

All exogenous variables, including M, constant over time
Slope of saddle path (and $\dot{E} = 0$-locus) the opposite if increased P lowers i

A closer look at the stationary equilibrium

$$\bar{Y} = C(\bar{Y}) + X(R, \bar{Y}, Y_*) \quad (11)$$

$$\frac{M}{P} = m(i_*, \bar{Y}) \quad (12)$$

$R = EP_*/P$ Real exchange rate

$$E = RP/P_* = RM/P_* m(i_*, \bar{Y})$$

Y determined by supply (resources)

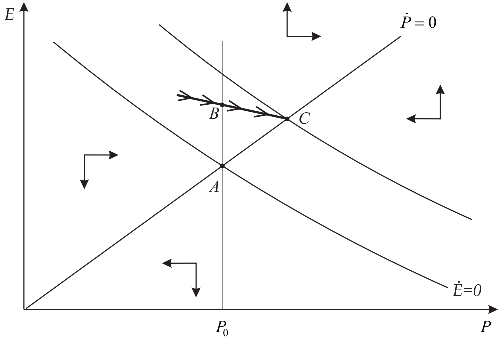
R by demand for home goods

i in international capital markets

P, E by monetary policy

Dichotomy between monetary and real side

A monetary expansion: Overshooting



Starting from A

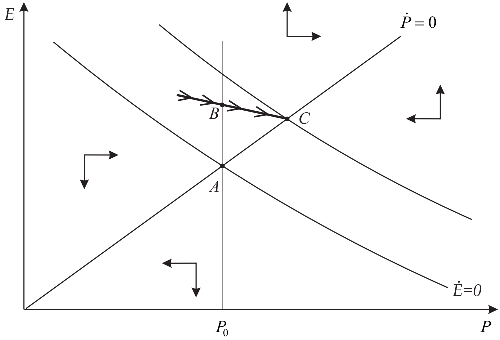
Locus for internal balance unaffected

Locus for $\dot{E} = 0$ shifts upwards

Same price level, lower interest rate, higher E needed to keep $i = i_*$

C new stationary equilibrium

A monetary expansion: Overshooting



- Look for saddle path leading to C
- Immediate depreciation from A to B
- Gradual appreciation from B to C
- Along with gradual inflation and $i < i_*$

Overshooting

Occurs because other prices are slow to change

Also happens in response to shocks to money demand or foreign interest rates

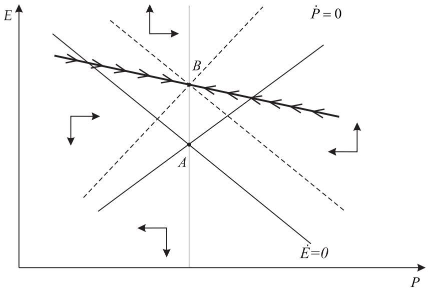
Increases the short-run effect on output of monetary disturbances

May explain the high volatility of floating rates

Empirical evidence mixed

May occur in other flexible prices too?

A negative shock to the trade balance



Depreciation needed to keep Y at $\bar{Y}$ constant $\rightarrow$
$\dot{P} = 0$-locus shifts up

Same depreciation keeps $i = i_*$ $\rightarrow$
$\dot{E} = 0$-locus shifts up equally
Exchange rate jumps from A to B

Results

- A floating exchange rate insulates against demand shocks from abroad
- A floating exchange rate also stops domestic demand shocks from having output effects

Caution!

- Studied only permanent shocks
- Less damping of temporary shocks (see Ch 6.4)
- Less damping if money supply deflated by index containing foreign goods
- Structural change may meet real obstacles

Extending the analysis

Can be solved for any time paths for the exogenous variables.
(Log)linearization necessary for closed-form solutions. (OR Ch 9))
As in monetary model, the present exchange rate depends on the whole future of the exogenous variables.
Phillips-curve problematic in inflationary environment.

Modernizing the Phillips curve (slightly)

$$\frac{\dot{P}}{P} = \left(\frac{\dot{P}_c}{P_c}\right)^e + \gamma'(Y - \bar{Y})$$

With model-consistent expectations

$$\left(\frac{\dot{P}_c}{P_c}\right)^e = \alpha\frac{\dot{P}}{P} + (1-\alpha)\left(\frac{\dot{E}}{E} + \frac{\dot{P}_*}{P_*}\right)$$

Insert in the Phillips-curve above:

$$\frac{\dot{P}}{P} = \frac{\dot{E}}{E} + \frac{\dot{P}_*}{P_*} + \frac{\gamma'}{1-\alpha}(Y - \bar{Y})$$

or

$$\dot{R}/R = -\gamma(Y - \bar{Y}) = -\gamma(Y(R, Y_*) - \bar{Y})$$
$$\dot{E}/E = i(MR/EP_*, R, Y_*) - i_*$$

A steady state with constant inflation

Assume: $\dot{M}/M = \mu$ and $\dot{P}_* P_* = \pi_*$, constant

Definition of steady state:
$\dot{R}/R = 0$,
$\pi = \dot{P}/P = \dot{M}/M = \mu$

$$\bar{Y} = C(\bar{Y}) + X(R, \bar{Y}, Y_*)$$

$$i = i_* + \mu - \pi_* \Longleftrightarrow i - \pi = i_* - \pi_* = \rho_*$$

$$\frac{\dot{E}}{E} = \frac{\dot{P}}{P} - \frac{\dot{P}_*}{P_*}$$

$$\frac{\dot{E}}{E} = \mu - \pi_*$$

$$P = M/m(\rho_* + \mu, \bar{Y})$$

$$E = RP/P_* = RM/P_* m(\rho_* + \mu, \bar{Y})$$

Real interest rate parity $\rho = \rho_*$
Superneutrality: Neither M nor μ affect real economy

Fixed versus floating exchange rates

Assuming (close to) perfect capital mobility in both cases

Floating dampens the output effects of demand shocks

Floating speeds up the demand response to shocks to potential output

Fixed rate insulates the real economy from monetary shocks

Fixed rates dampen the output response to pure cost-push shocks

Shocks from exchange rate expectations / risk premium - difference can go either way

- fixed - main impact through interest rate
- floating - main impact through exchange rate
- effects have opposite sign

Fixed versus floating exchange rates

Does one regime lead to more noise than the other?

- Different credibility of fixed M and fixed E?
- Floating exchange rates require good forecasting abilities

Floating with inflation target is different from floating with money supply target.