Aalto University
School of Business

31E2300
MACROECONOMICS: POLICY

THE THREE EQUATION MODEL FOR OPEN ECONOMIES (CONTINUED)

TODAY (AND WEDNESDAY SPILLOVER?)

- The AD-ERU Model
- CB Stabilization in the Open Economy and the RX Curve.
- Exchange Rate Overshooting/Volatility and Its Causes.

MEDIUM RUN EQUILIBRIUM: THE AD-ERU FRAMEWORK

- Medium-run equilibrium (MRE): WS-PS intersection pins down the equilibrium rate of unemployment (ERU) at constant inflation.
- **ERU**: Supply side in equilibrium, inflation is constant.
- **AD**: Goods market in equilibrium, int. rate equals world level ($i = i^*$). NOTE: THERE IS NO REQUIREMENT, THEN, THAT ECONOMY "BE ON" THE AD SCHEDULE IN THE SHORT RUN. ALSO, THIS IS *NOT* THE USUAL – OR INDEED, ANY SORT – OF "AGGREGATE DEMAND" SCHEDULE.

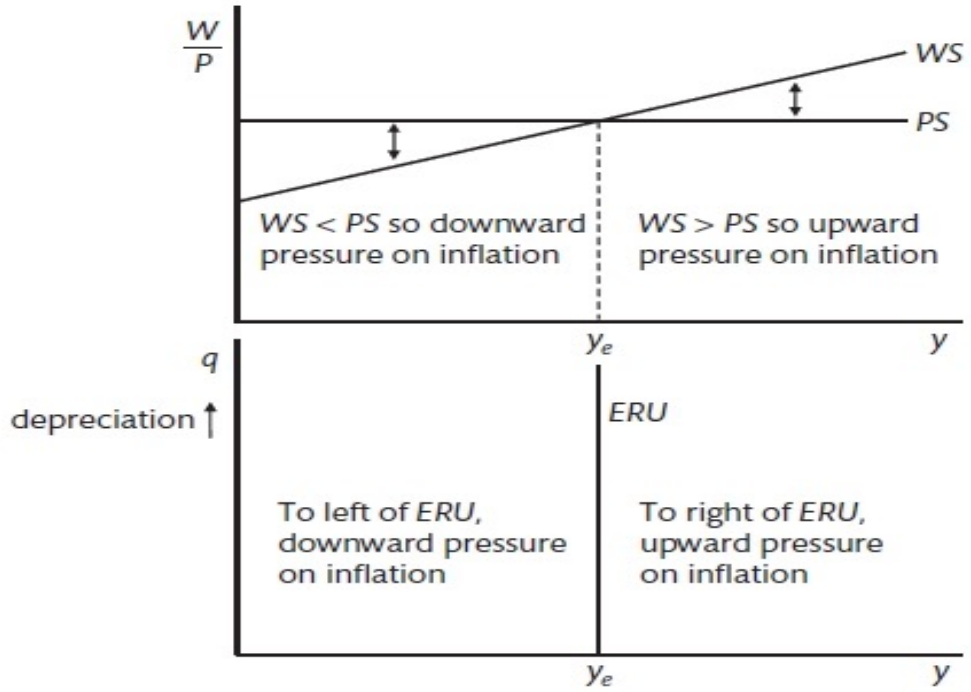


Figure 9.5 Supply-side equilibrium and the *ERU* curve.

<u>Supply-side Equilibrium (Ch. 2):</u>

ERU curve: combinations of RER (q) and y at which $w^{PS} = w^{WS}$.

Note: q is log of RER: $q \equiv \log Q$

BUILDING THE OPEN ECONOMY MODEL

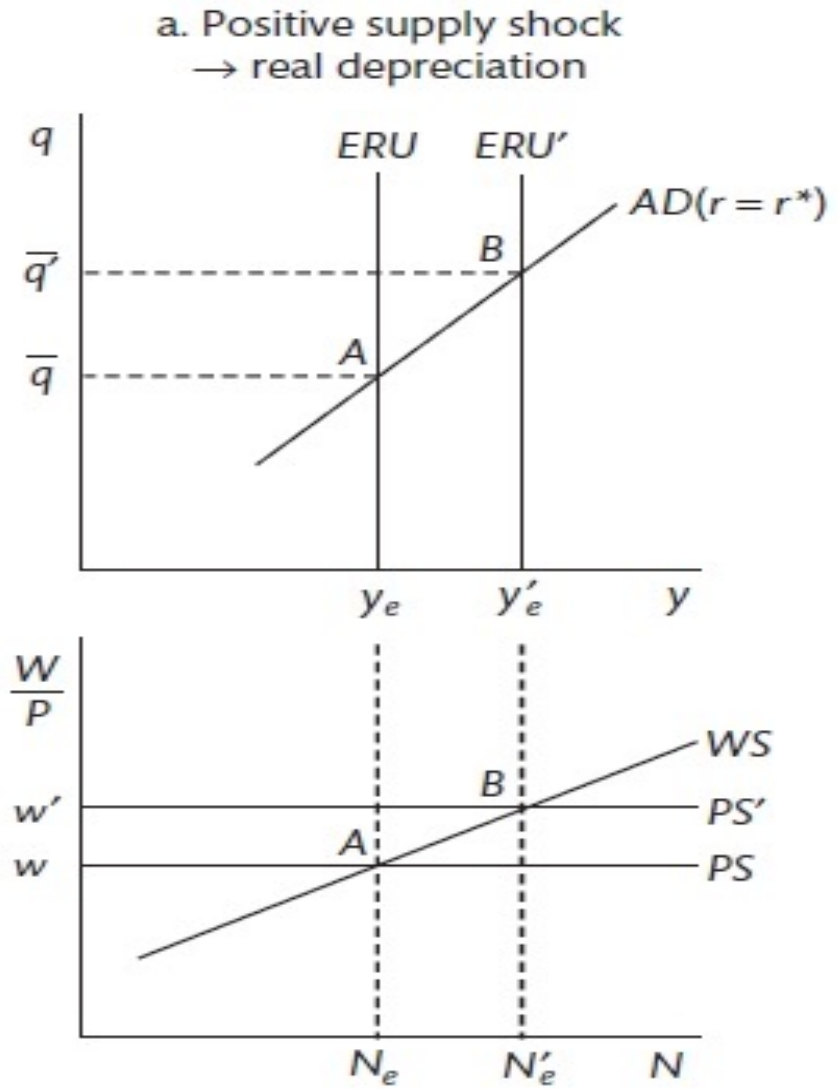
- Open economy IS curve: $y_t = A_t - ar_{t-1} + bq_{t-1}$.
- $r = r^*$ in MRE b/C under the *real* UIP condition: $r_t - r^* = q^E_{t+1} - q_t$, $r = r^*$ is necessary for a constant RER.
- Open economy AD curve: $y = A - ar^* + bq$ (depreciated RER → y ↑)
- AD curve: Medium-run combinations of real exchange rate and output where the goods market is in equilibrium and $r = r^*$.

<u>The basic medium-run AD-ERU model:</u>

1. **AD** curve: Demand side, $y = y^{AD}$ (GME), $r = r^*$.
2. **ERU** curve: Supply side, $y = y_e$, constant inflation.
3. **MRE**: AD intersects wt. ERU; $r = r^* \rightarrow q = \bar{q}$; $y = y_e \rightarrow$ π constant.

- Closed economy: New stabilizing r_S at the medium run after a shock.
- Small open economy: Medium run r pinned down by r^* ($r = r^*$), therefore it is q that moves in response to a shock.

EXAMPLE



↑ depreciation

Example:

a. +ve supply Shock

→ PS shifts up

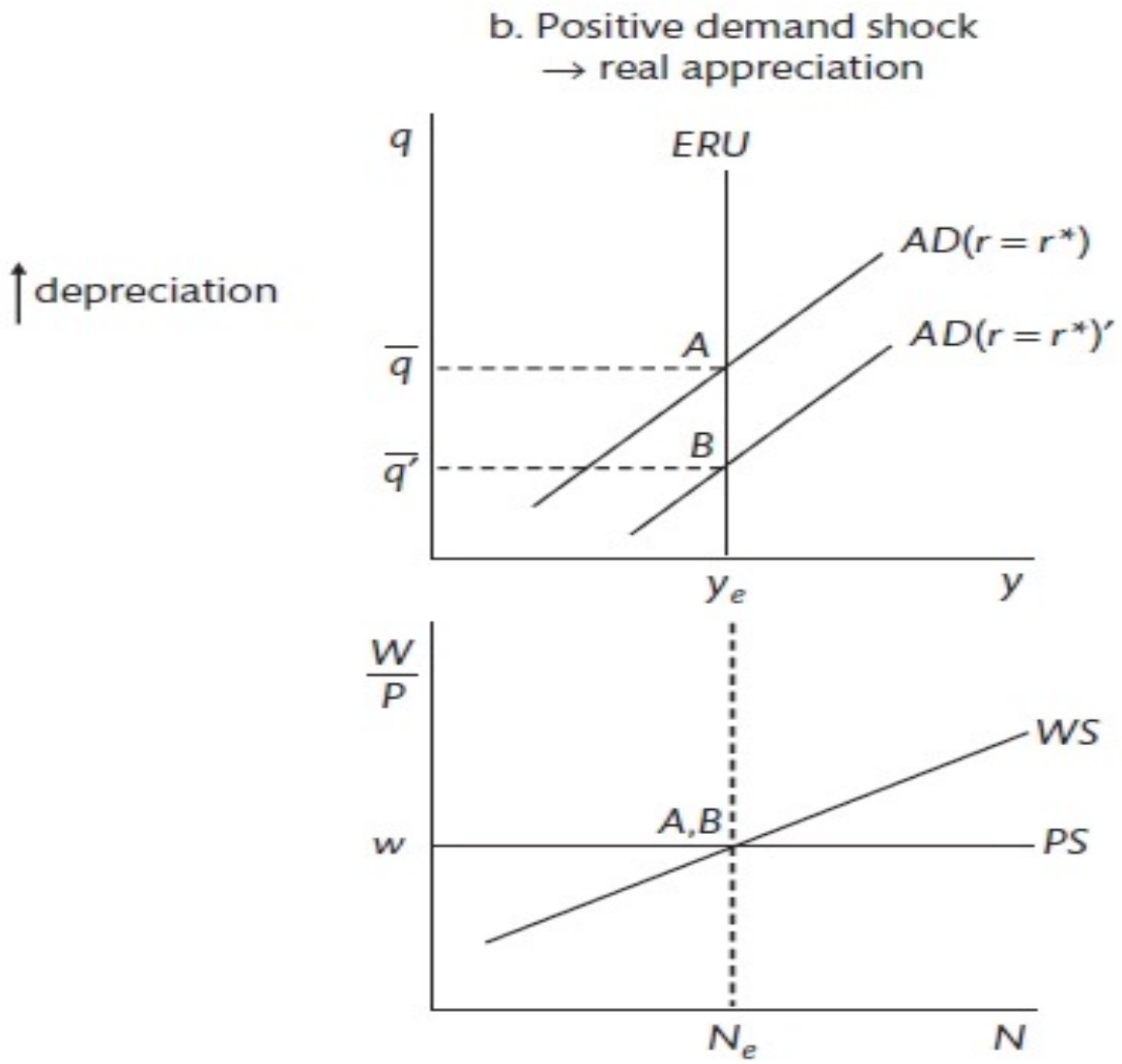
→ ERU shifts right

→ New equilibrium $\bar{q}' \uparrow$ (depreciation)

& $y_e \uparrow$

→ For $y_{AD} = y_e{}'$, need $q \uparrow$.

EXAMPLE



Example:

b. +ve AD Shock

→ AD shifts rightwards

→ New equilibrium $\bar{q}' \downarrow$ (appreciation)

& y_e costant.

→ r is fixed at r^*, so need $q \downarrow$ for $y_{AD} = y_e$.

EFFECTS OF SHOCKS ON MEDIUM RUN EQUILIBRIUM

Quick Summary: *Shock implications for the med-run equilibrium*

Table 9.1 Supply and demand shocks: implications for medium-run equilibrium.

	Shock		
	Rise in productivity	**Fall in union bargaining power**	**Increase in autonomous consumption**
Equilibrium unemployment	↓	↓	no change
Real exchange rate	depreciation	depreciation	appreciation
Real wage	↑	no change	no change

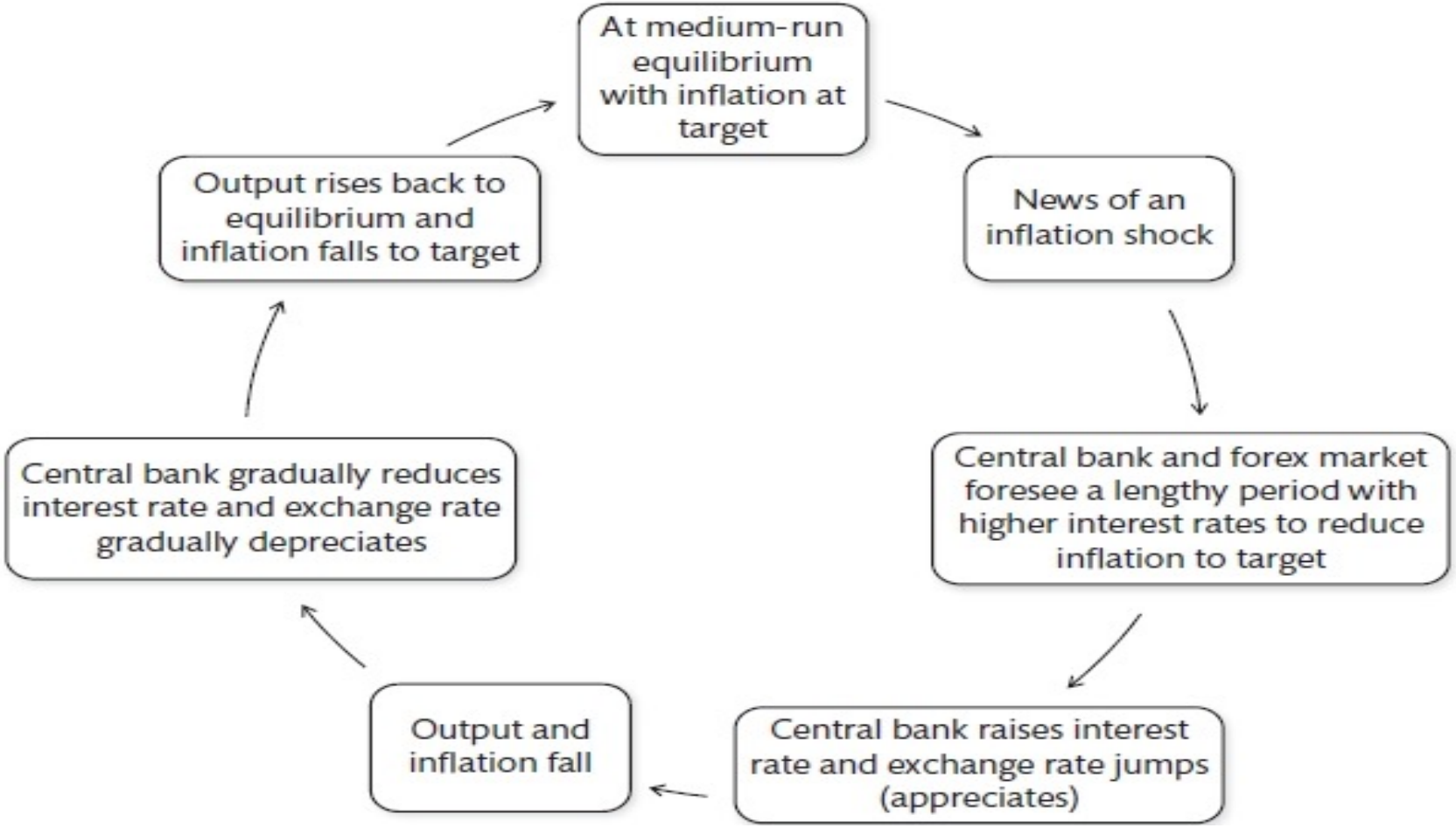
Note: ↑ means the variable is higher in the new medium-run equilibrium, ↓ means it is lower and 'no change' means it is unchanged. We assume a flat PS curve throughout.

STABILIZATION IN THE SHORT RUN: THE RX CURVE UNDER FLEXIBLE EXCHANGE RATES

- RX curve in the 3-eqn model: Shows the CB's best r —response taking into account forex market reactions.
- Assume the CB targets domestic π (excl. imports) and factors in:
  - *Forward-looking forex market behaviour*
  - *The effect of q on y.*
- As before, the CB minimizes its loss function subject to the PC, which yields the MR curve showing the desired y-gap.
- The desired y-gap is now implemented through the choice of r:
  - *using the open economy IS curve, and …*
  - *… factoring in the reaction of the forward-looking forex market.*
- Instead of adjusting back to equilibrium on the IS, the CB adjusts along the flatter RX curve (smaller Δr needed since q moves too).

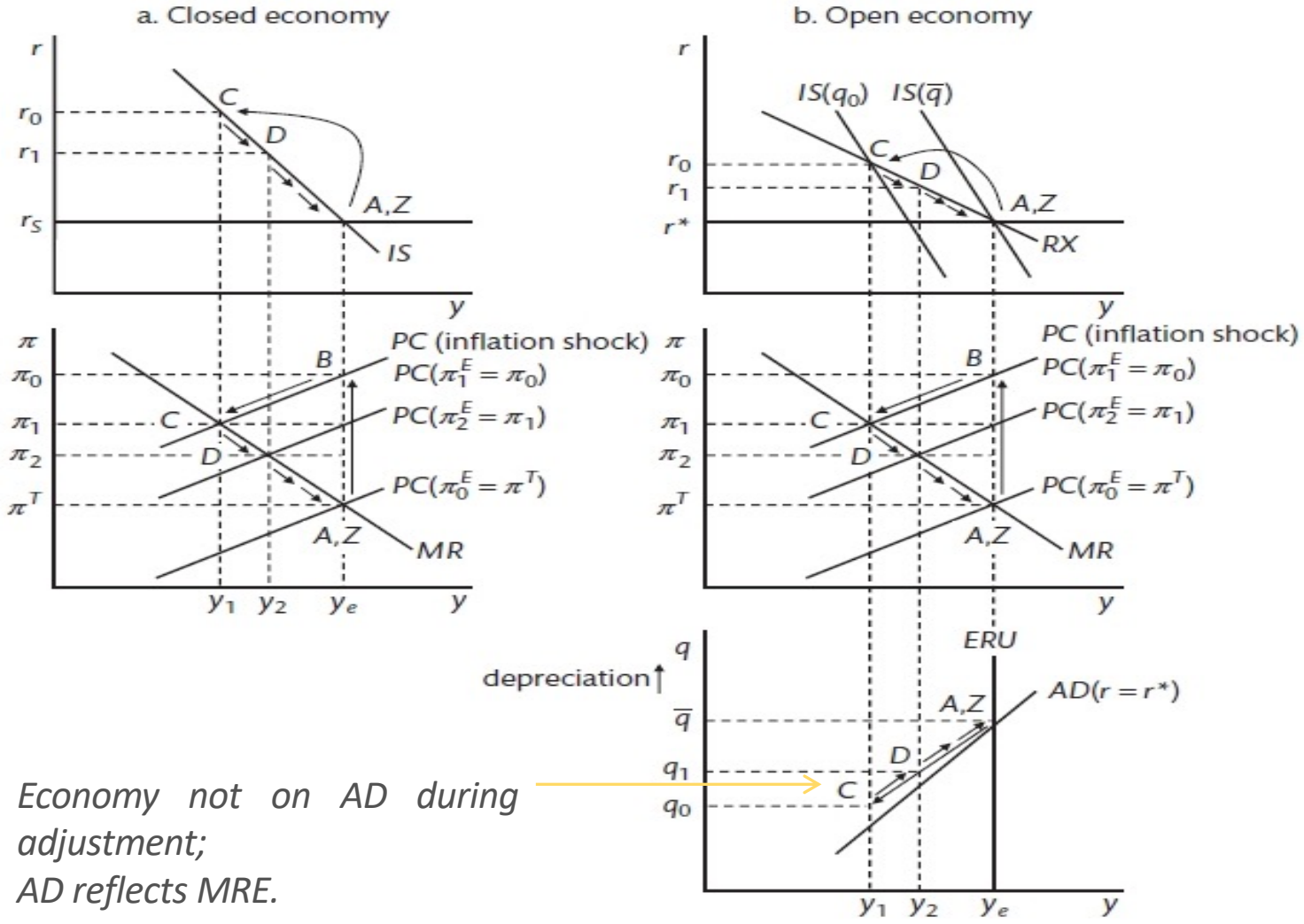
VISUAL REPRESENTATION

Fig 9.7: Dynamic adjustment to an inflation shock under flexible exchange rates and π- targeting



CLOSED V OPEN ECONOMIES: INFLATION SHOCK

Inflation shock: Closed vs Open economies



Economy not on AD during adjustment;
AD reflects MRE.

- Closed economy (Ch. 3)
- Open economy

Shock → Forex mkt foresees $r > r^*$ for some periods → via UIP: q ↓ immediately → to get economy on MR, CB sets r_0 on RX at 'C', which factors in the new $IS(q_0)$.

*Higher r_0 and appreciated q reduces y next period (lag) → y ↓ & π ↓ → PC shifts down & CB desires pt. 'D' now→ ** CB knows that lower r means ↑ q → IS predicted to shift right → As before, CB sets r_1 on RX.*

Process repeats until MRE 'Z' is reached.

CLOSED V OPEN ECONOMIES (INFLATION SHOCK)

Impulse Responses from an inflation shock

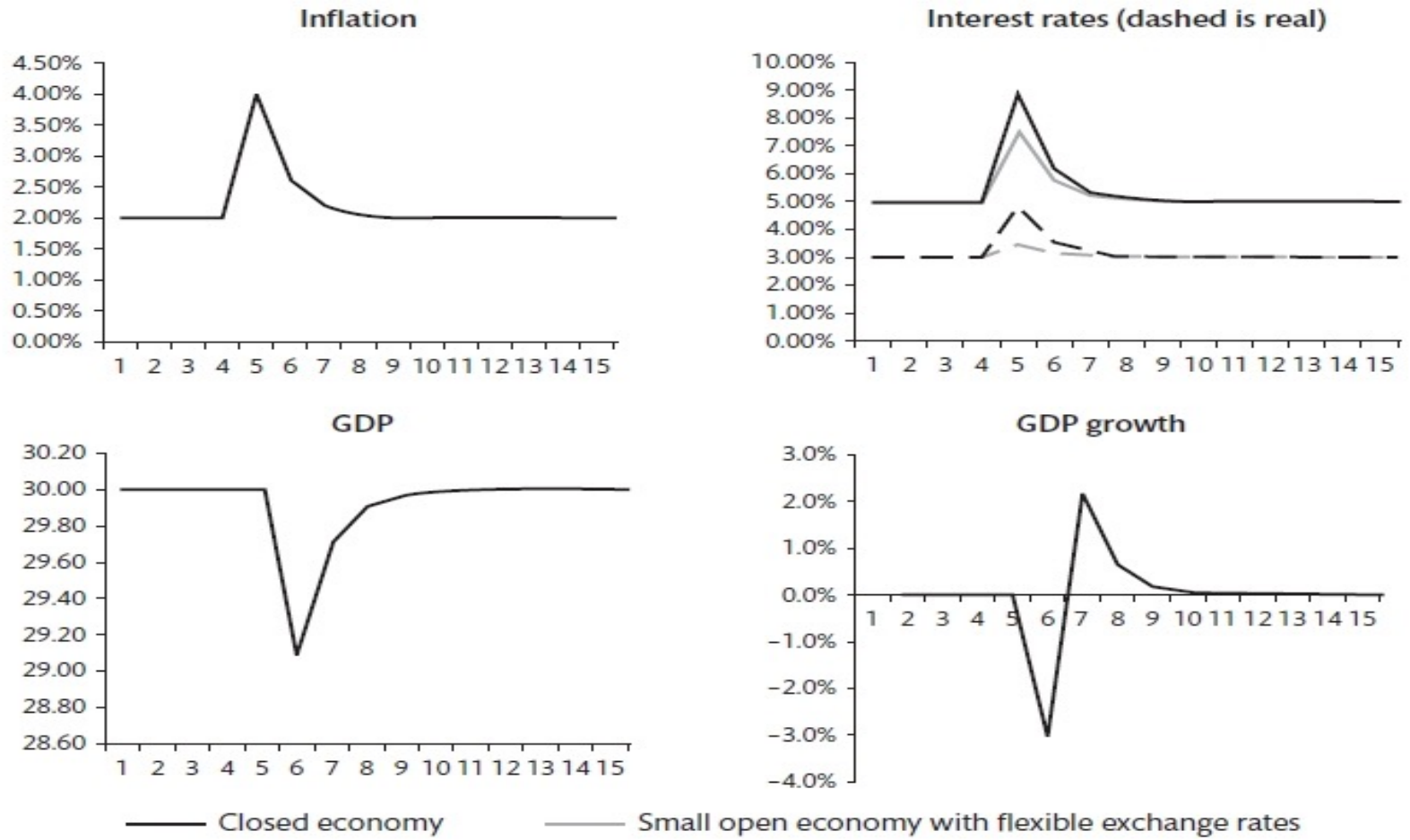


Figure 9.9 Macroeconomic simulator example—Impulse response functions after an inflation shock (in period 5) in a closed economy and a small open economy with flexible exchange rates.

** *Key difference in the interest rate response.*

Source: Macroeconomic Simulator from the Carlin and Soskice webpage

CLOSED V OPEN ECONOMY ADJUSTMENT (CONTINUED)

1. Initial rate hike after π shock (to r_0) is greater in closed economy, q appreciation shoulders the burden.
2. IS shifts each period in the open economy as the change in q also changes y due to net exports.
3. The closed economy moves along IS to equilibrium; the open economy moves along the flatter RX back to equilibrium

<u>Key features of the RX:</u>

1. Goes through the intersection of r^* and y_e; RX shifts iff these shift.
2. Slope reflects (i) int. rate and exchange rate sensitivity of AD, (ii) the CB's preference and (iii) the PC's slope:
   a. *Flatter than the IS: RX is flatter if IS is flatter (ie. higher r or q sensitivity)*
   b. *Flatter if the MR is steeper (i.e. flatter PC or CB is less π averse)*

Note: Flatter RX means CB raises int. rate by less.

APPLICATION: DEMAND AND SUPPLY SHOCKS IN OPEN ECONOMIES

- Both types of shock affect the medium run $\bar{q}$; see the effect of a negative demand shock ($A \downarrow$)in the AD-ERU diagram below:

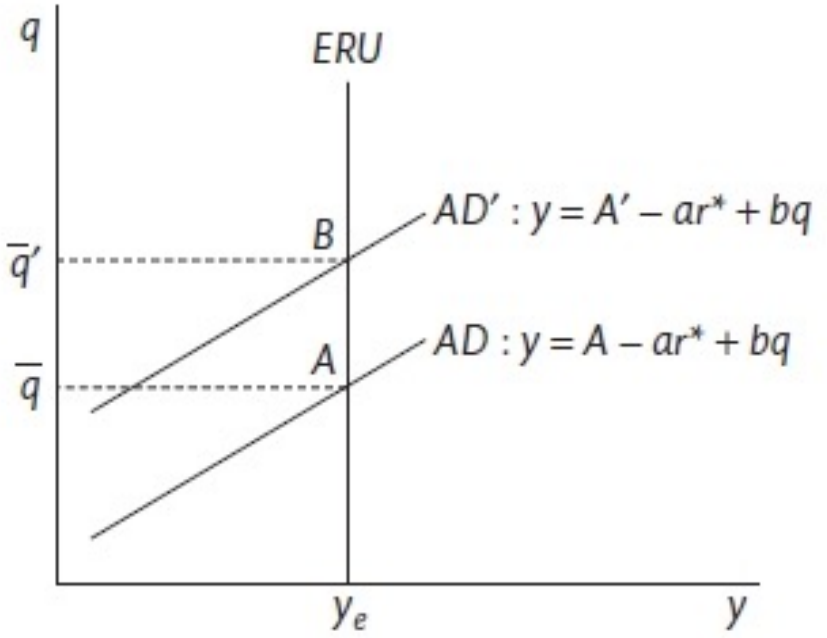
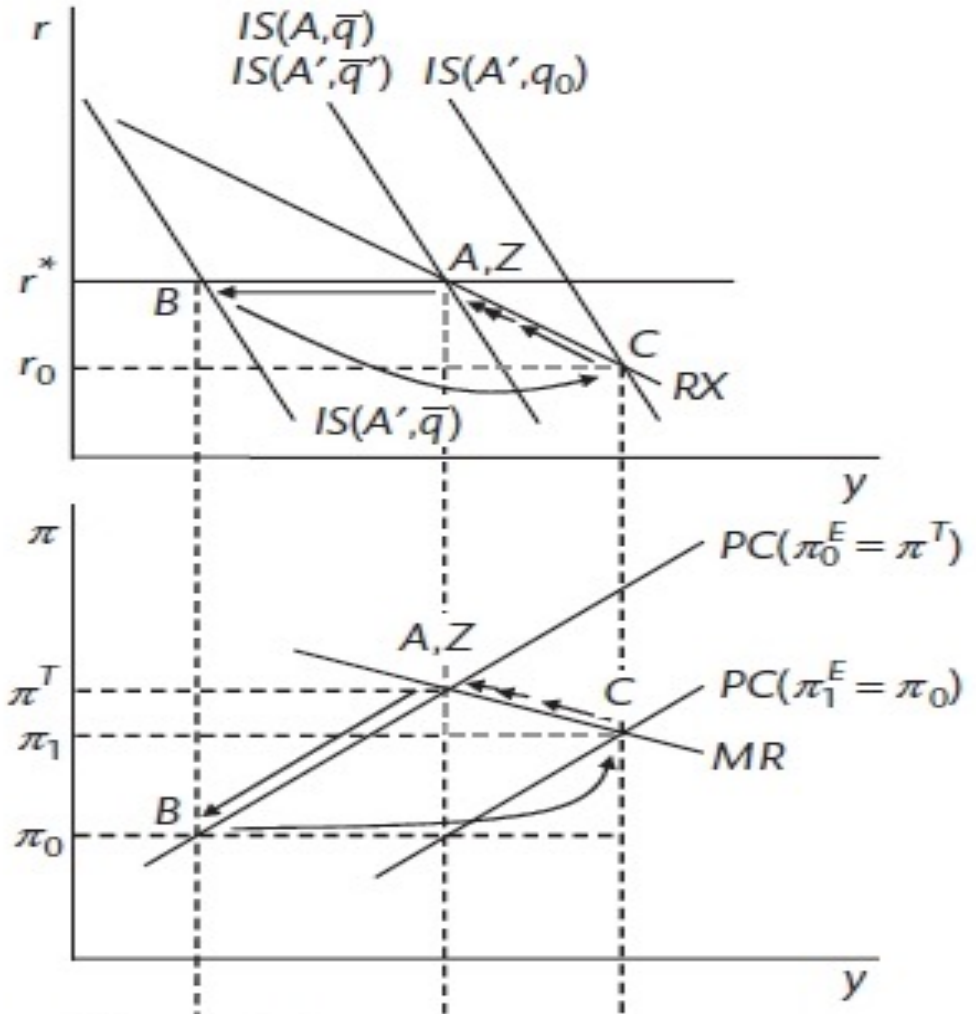


Figure 9.10 Medium-run equilibrium: negative demand shock.

Open Economy:
Since $r = r^*$ (fixed), a depreciated RER is needed to boost exports and offset the fall in A, s.t. $y = y_e$.

Closed economy:
$A \downarrow$ implies a lower stabilizing real interest rate (r_S).

APPLICATION: PERMANENT NEGATIVE AD SHOCK (FOR EXAMPLE?)



Period 0 ('A'):

-ve AD shock: IS shifts to IS(A', $\bar{q}$) → y ↓, π ↓ → CB forecasts PC and chooses desired pt. 'C' → CB ↓ r → Forex mkt predicts $r < r^*$ → q ↑ (UIP) → CB knows this and sets r_0 on RX Economy at: π_0, y_0, r_0 and q_0.

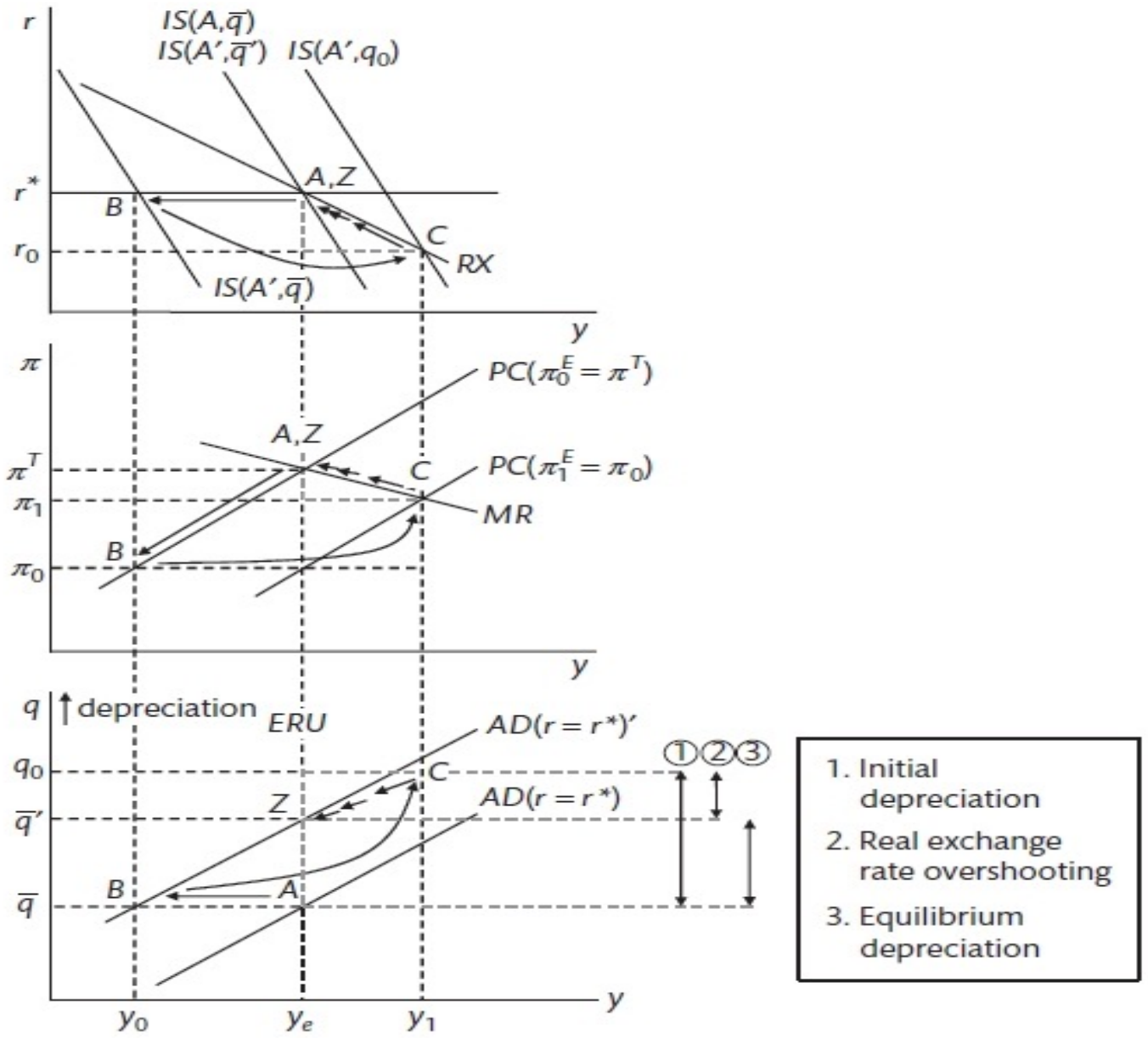
Period 1 onwards:

Lower r_0 and depreciated q_0 → y ↑, π ↑ *(pt. 'C') → IS curve has shifted to IS(A', q_0) due to depreciation.*

As the econ shifts from 'C' to 'Z', the IS gradually shifts left; the economy moves up the RX and MR as the CB raises r_0 to r^*; RER appreciates to $\bar{q}$.

Note: q *moves for UIP to hold every period.*

APPLICATION: PERMANENT NEGATIVE AD SHOCK, CONTINUED



<u>Bottom panel (AD-ERU):</u>

-ve AD shock → AD shifts left → Initial depreciation ($\bar{q}$ *to* q_0) greater than equilibrium depreciation ($\bar{q}$ *to* $\bar{q}'$) → ie. Exchange rate overshooting.

At pt. 'C', RER q_0 is expected to appreciate over the period to $\bar{q}'$ since $r < r^*$ (UIP).

Pt. 'C' is off the AD curve since $r \neq r^*$. In fact 'C' is to the right of AD as the lower $r < r^*$ results in a higher off-equilibrium y.

EMPIRICAL IMPLICATION: OVERSHOOTING

- Nominal and real exch. rates jump more than equilibrium adjustment to shocks.
- Combination of factors causes overshooting:
  1. An internationally integrated financial market
  2. Rational expectations in the forex market, lead to jumps in exchange. rate
  3. Sluggish adjustment of wages and prices, which requires keeping $r < r^*$ until $\pi = \pi^T$ (for negative AD shock)
  - Integrated financial mkts → real UIP cond. always holds: $r_t - r^* = q_{t+1}^E - q_t$.
  - The greater $r_t - r^*$ is needed (big shock), the more q_t has to overshoot.
  - Initial exch. rate jump = equilibrium change + exch. rate overshooting.
  - Dornbusch: Overshooting explains exch. rate volatility.

EXAMPLE: THE THATCHER RECESSION

Exchange rate overshooting during the Thatcher recession:

Tightening of MP (1979) did not lead to an immediate fall in π, but a sharp appreciation in the pound → permanent damage to manufacturing sector.

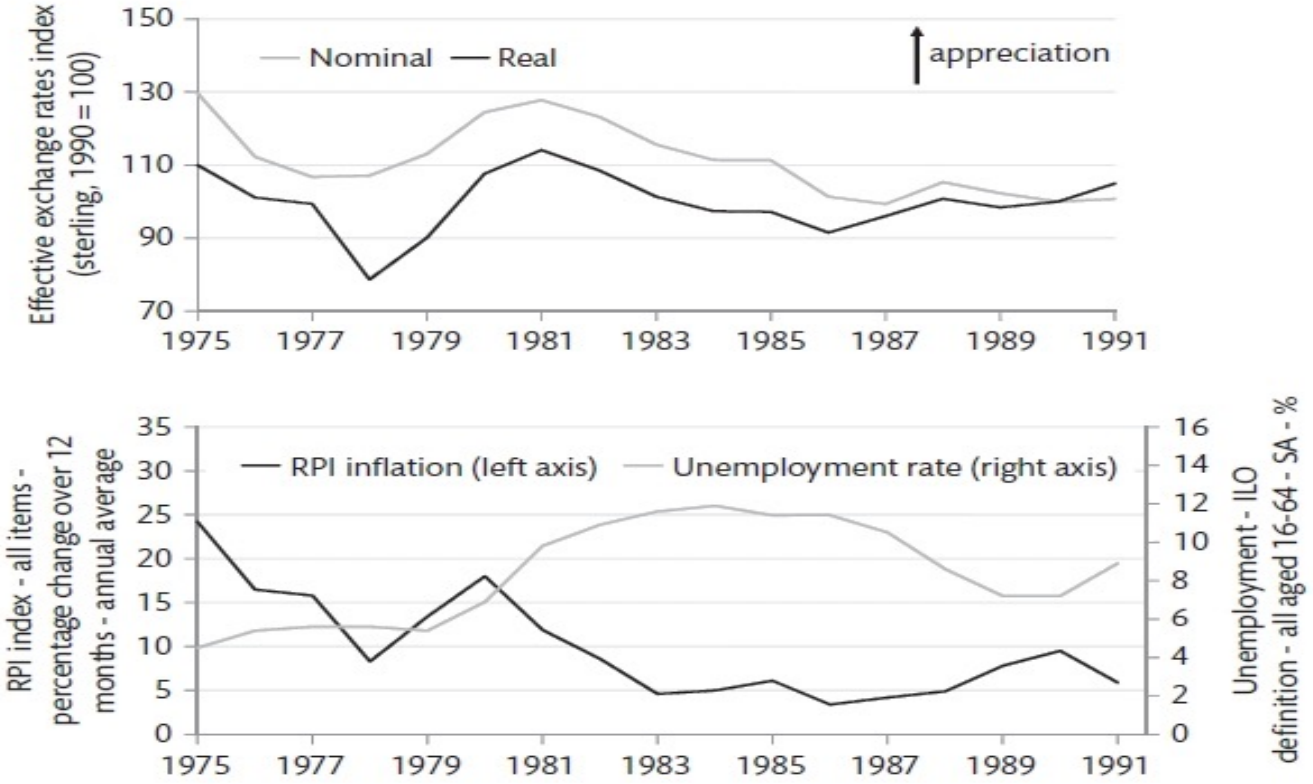


Figure 9.12 UK nominal and real effective exchange rate indices (1990 = 100): 1975–1991 (upper panel) and UK unemployment and inflation: 1975–1991 (lower panel).

MORE ON OVERSHOOTING

Factors determining behaviour of nominal exchange rate:

- 3-equation model focused on the RER (q); nominal e.r. (e) moves according to the definition: $Q \equiv \frac{P^* e}{P}$ (e is simply a residual).
- Below: Stylized path of P, e, q following an inflation shock

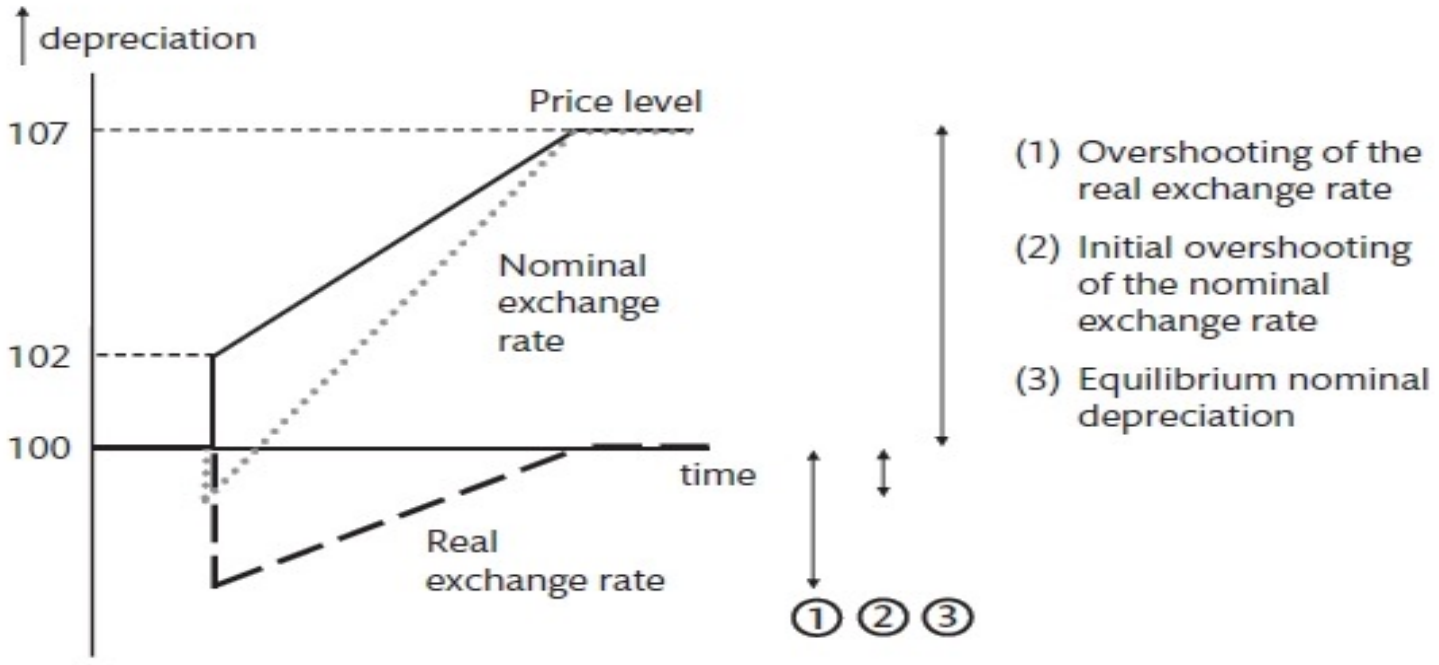


Figure 9.13 Real and nominal exchange rate paths following an inflation shock.

Initial nominal appreciation < real appreciation since π shock produced some of required RER appreciation.

During adjustment, nominal depreciation > real depreciation. Gradual real depreciation due to $r > r^*$, is partially offset by real appreciation due to $\pi > \pi^*$.

SUMMARY

- Arbitrage: Movement into H bonds (due to $i > i^*$) causes immediate appreciation s.t. e depreciates over time (∴ No gain from H over F bonds)
- The UIP condition shows the relation between $i - i^*$ and $\Delta\, e$.
- CB stabilization in the open economy involves factoring in responses by the forward-looking forex market.
- CB's interesy rate response in the open economy is smaller due to the adjustments from the RER channel.
- Overshooting: Initial exch. rate jump > equilibrium change, coming from a persistent period of $r >/< r^*$ due to π persistence and a rational forex market.