Aalto University
School of Business

31E2300
MACROECONOMICS: POLICY

THE MONETARY POLICY RULE (MR SCHEDULE)
AND
THE THREE EQUATION (‘NEW KEYNSIAN’) MODEL

Objectives:

Our “three equation model” consists of the IS curve, the PC or Phillips curve, and a “monetary rule” or MR curve.

We shall derive the MR curve on the basis of “optimizing behavior” of central banks.

Next time, we’ll look at some examples of inflation stabilization …

… and, time permitting, the so-called deflation trap.

Overview:

The 3-equation model: IS, PC and MR (Assume Shape For Now) Curves, Permanent AD Shift

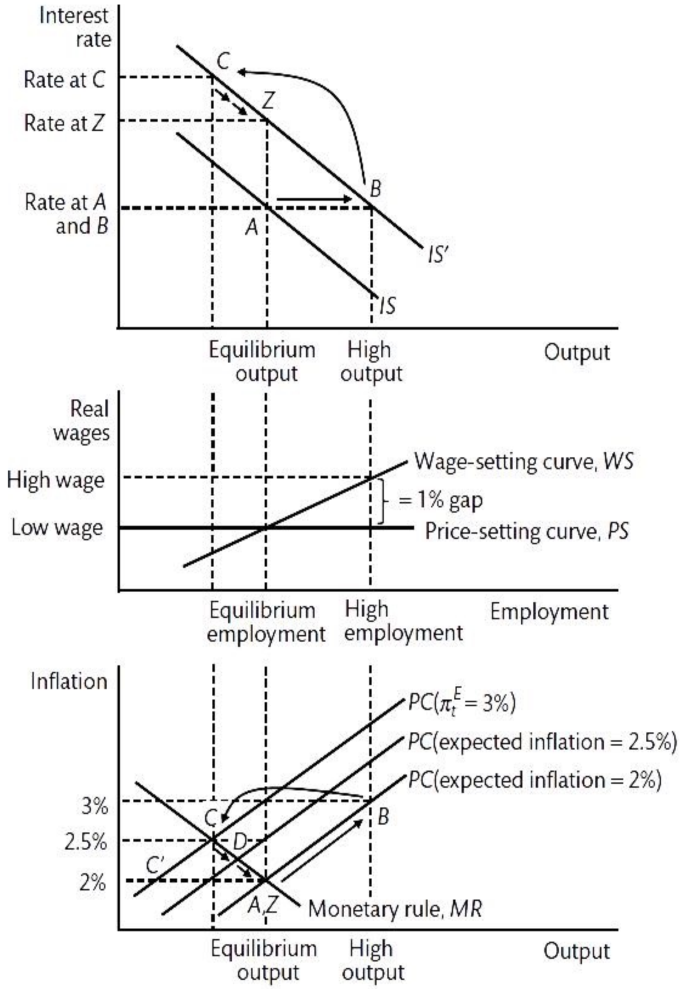


Figure 3.4 The 3-equation model: the adjustment of the economy to a permanent demand shock.

- The IS Curve (Ch. 1) reflects the demand side; The PC Curve (Ch. 2) reflects the supply side.
- The Monetary Rule (MR) Curve shows the *optimal way* in which the central bank responds to shocks, given its objectives.
- Let's look at a permanent demand shock that increases inflation above its 2% target → the central bank increases the interest rate to cut inflation. In the process of doing so, it follows the given MR curve.

FOUR STEP DERIVATION OF THE MONETARY RULE (MR)

1. Define the *central bank's preferences* in terms of deviations from inflation target and equilibrium output.

2. Define the central bank's constraints from the supply side, ie the Phillips Curve (PC)

3. Derive the best response monetary rule in the output-inflation space, which gives the MR curve.

4. Once the optimal output-inflation combination is determined using the MR, the central bank uses the IS curve to implement its choice (by setting the interest rate, with lagged effect).

1. CENTRAL BANK PREFERENCES

The central bank's preferences are given by a loss function:

$$L = (y_t - y_e)^2 + \beta(\pi_t - \pi^T)^2$$

- Similar to a utility function. The higher the loss (L), the worse off is the CB.
- The central bank is worse off the further inflation (π_t) is away from its target level (π^T), and the further output (y_t) is away from its equilibrium level (y_e); β reflects the relative degree of inflation aversion of the CB.

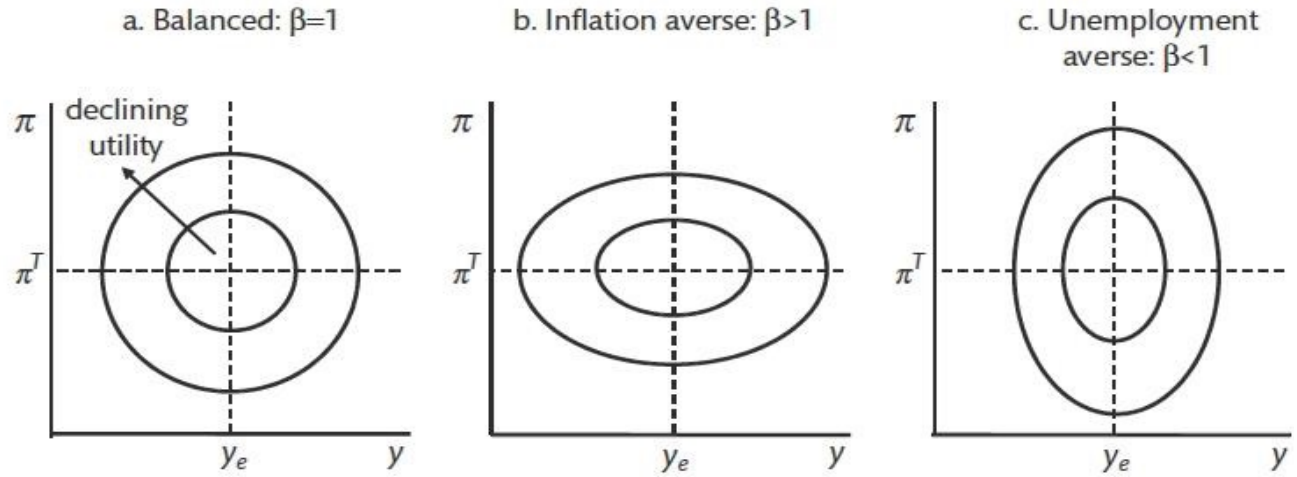


Figure 3.5 Central bank loss functions: utility declines with distance from the 'bliss point'.

2. THE PC CONSTRAINT

Phillips curve constraint faced by the central bank:

$$\pi_t = \pi_t^E + \alpha(y_t - y_e)$$
$$= \pi_{t-1} + \alpha(y_t - y_e) \qquad \text{(Adaptive expectations PC, } \pi_t^E = \pi_{t-1}\text{)}$$

- The PC shows combinations of output and inflation which are *attainable* by the central bank, for a given inflation expectation.

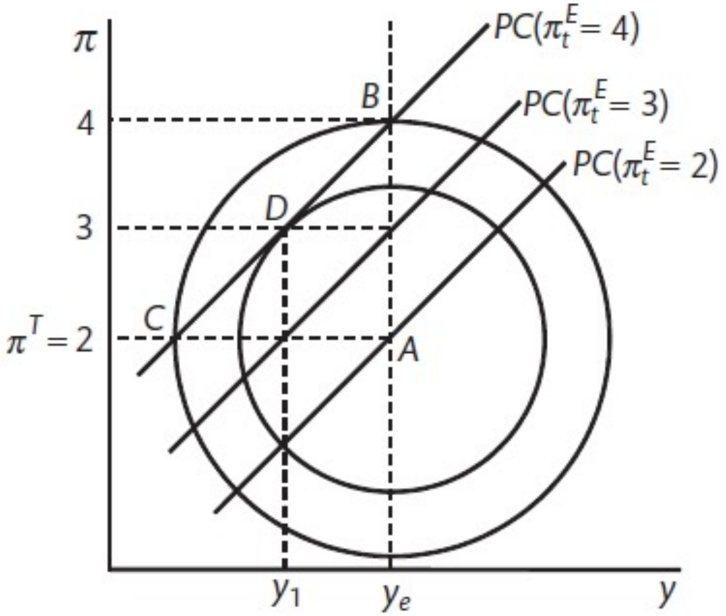


Fig 3.6 Loss circles and Phillips curves.

If the economy is on the PC of $\pi_t^E = 4$, the 'bliss point' A (where $\pi_t = \pi^T$ and $y_e = y_t$, and thus $L = 0$) *cannot be attained*.

$\therefore$ The PC forms a constraint faced by the central bank.

3. DERIVING THE BEST RESPONSE MR

- The MR shows the preferred $\pi - y$ combination for any PC curve faced by the CB, i.e. tangency points between the PC and loss circles. (Can you derive, using calculus?)

- Any deviation from the tangency points results in a higher (than necessary) loss for the CB, and is hence not optimal.

- Joining up the tangency points gives us the best-response MR curve, which is a result of the CB minimizing its loss function (see Fig 3.7b).

MR CURVE - CONTINUED

The MR curve is given by: $(y_t - y_e) = -\alpha\beta(\pi_t - \pi^T)$

Can you derive this? And provide some intuition for it?

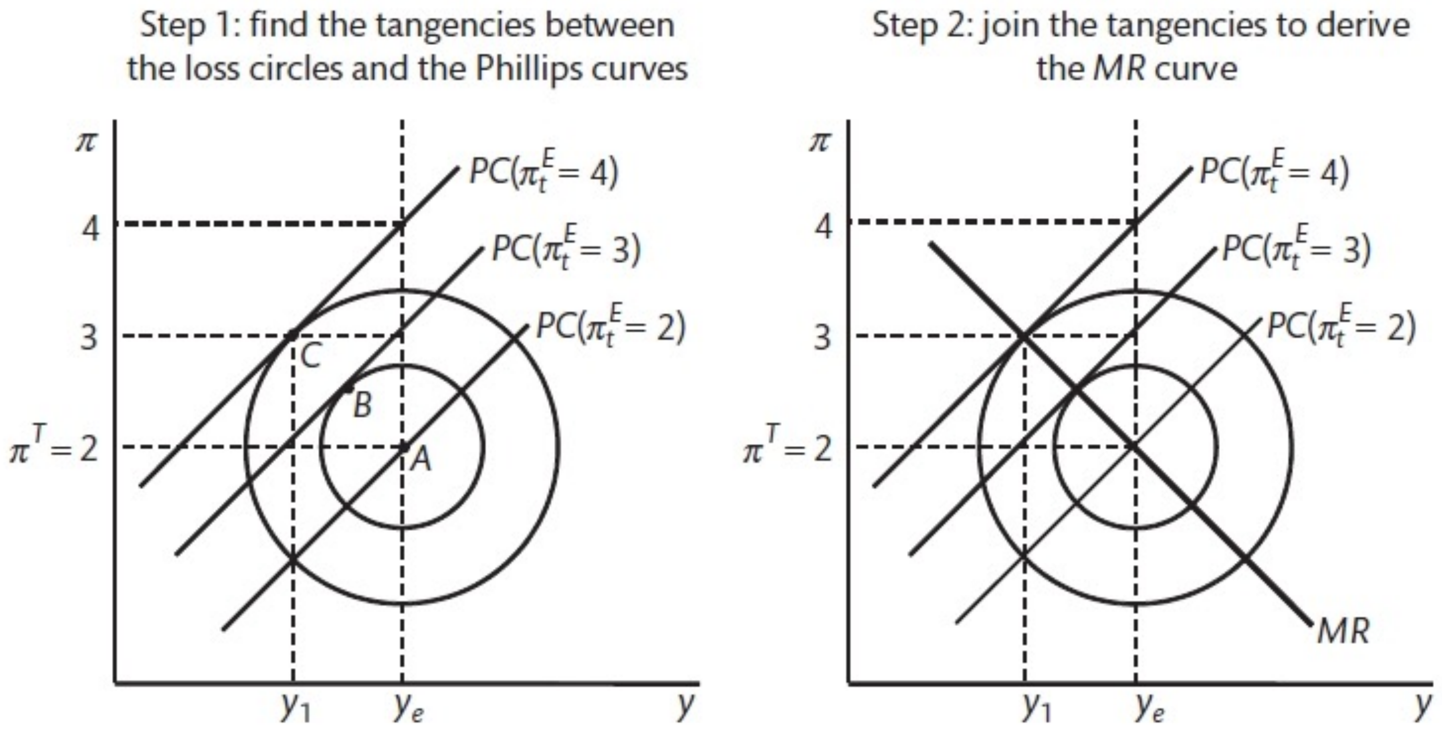


Figure 3.7 Deriving the *MR* curve.

4. BRINGING IT ALL TOGETHER

Now that the best response output gap $(y_t - y_e)$ is chosen, the CB "sets" the real interest rate to achieve its target Y on the IS curve:

$$y = k(c_0 + a_0 + G) - ka_1 r$$
$$= A - ar,$$

(IS curve, see Ch. 1)

In practice, CBs can't set real interest rates, so will set nominal rate in an effort to achieve target real interest rate (*Taylor Rule*)

To incorporate the lag with which interest rates affect output, the standard 3-equation model assumes a "dynamic" IS curve:

$$y_t = A_t - ar_{t-1}$$

EXAMPLE 1: ADJUSTMENT TO A TEMPORARY AD SHOCK

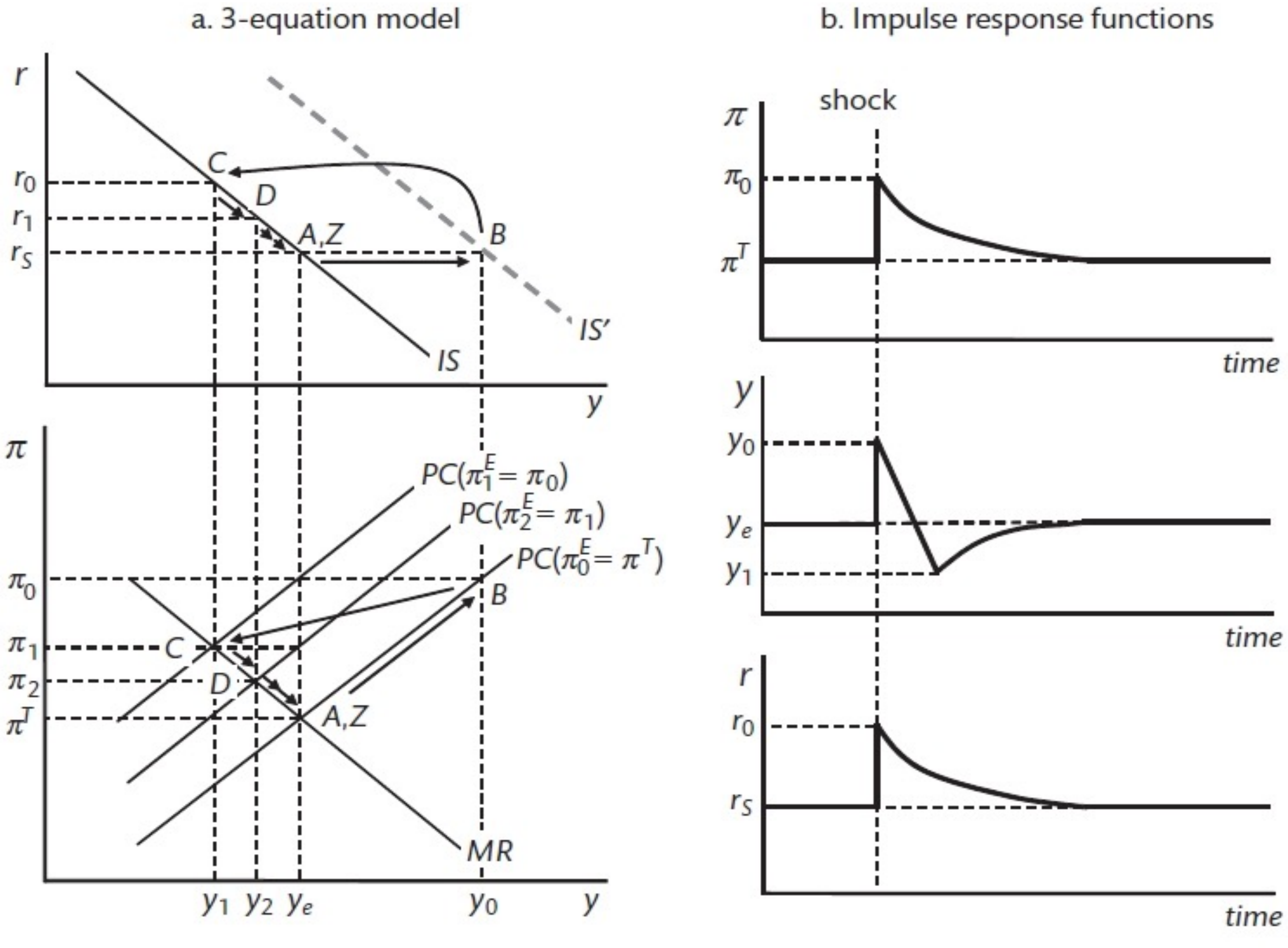


Figure 3.10 Adjustment of the economy to a temporary positive aggregate demand shock.

CONTINUED

Period 0:

- Temporary AD shock: IS shifts to IS', but stays at IS' *for 1 period only*.
- The economy shifts from initial point 'A' to point 'B'
- The CB forecasts the PC for period 1, which is PC ($\pi_1^E = \pi_0$)
- The CB knows that IS' returns to IS at the beginning of period 1, and thus sets r_0 to achieve y_1 and π_1 in period 1.

Period 1:

- The higher r_0 reduces π, and y *below equilibrium* y_e (Point 'C').
- The CB forecasts PC for period 2 to be PC ($\pi_2^E = \pi_1$), so now, the optimal point is 'D'; To achieve this, r_0 is reduced to r_1.

Period 2 onwards:

- The economy moves to point 'D' as demand increases from lower r.
- The same process repeats and r is gradually reduced until the economy reaches its equilibrium 'Z', given by π^T, y_e and r_S.

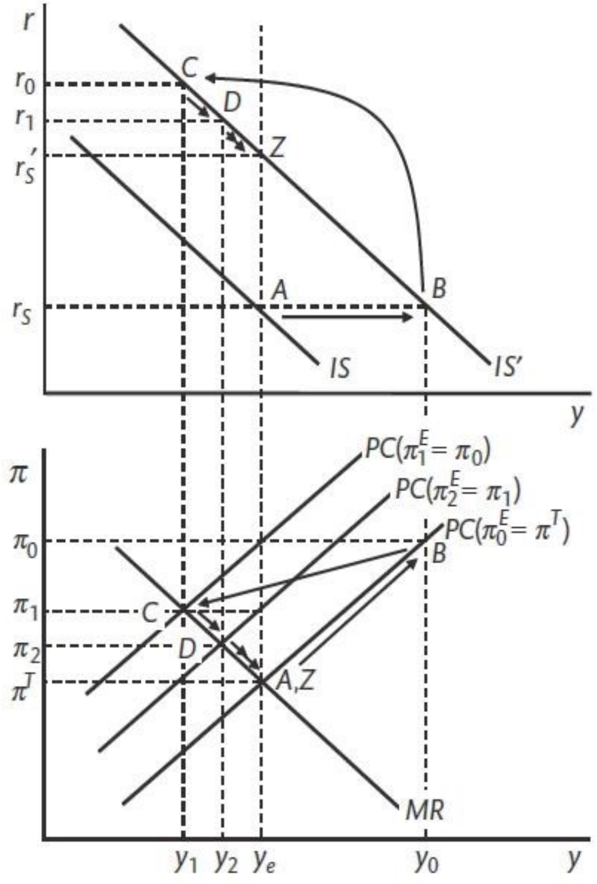
IMPLICATION: CB MUST PREDICT BOTH PC AND IS

Forecasting the IS curve:

- Is the AD shock temporary or permanent?
- Vital since the persistence of shocks affects the CB's optimal response.

Permanent shock: IS' does not shift back to IS

- A larger increase in r is needed compared to a temporary shock.
- The new equilibrium r_S' is higher.



Adjustment of the economy to a permanent positive aggregate demand shock.