Macroeconomic Theory and Policy

Lecture 20

Role of Expectation

Role of Expectation in An Economy

- Future is unknown and uncertain.
- Some consumers and investors are more optimistic and confident about the future the economy (about income, output and prices that affect their decision to work and invest) than others.
- These perceptions about the future affect all types of economic activities. How do these expectations affect macroeconomic behaviour? It is obvious from what we see in the markets.
- Prosperity follows from good expectations. Recession arises with dim expectations.
- Confidence of consumers and producers, which itself is based in a set of leading indicators of the economy, signals about the health of the economy as is discussed almost every hour in the media, particularly in case of highly integrated stocks and bonds markets around the globe.
- There are three different ways of forming expectations about unknown variables:
- Perfect foresight;
- Adaptive expectation and partial adjustment;
- Rational expectation.

Perfect Foresight

Nothing is uncertain; Steady State; Present value models

$$V = R_t + \frac{1}{1+r}R_{t+1} + \frac{1}{(1+r)^2}R_{t+2} + \frac{1}{(1+r)^3}R_{t+3} + \ldots\ldots\ldots + \frac{1}{(1+r)^n}R_{t+n}$$

$$A_t = A_0(1+r) + A_0(1+r)^2 + .. + A_0(1+r)^n$$

$$A_t = \sum_{i=0}^{\infty} A_0(1+r)^i$$

Adaptive Expectation: Learning from Past Mistakes

The rational expectation method ${}_{t-1}\pi_t^e = E\left(\pi_t \mid I_{t-1}\right)$ where ${}_{t-1}\pi_t^e$ is the price in period t as expected in period t-1, where I_{t-1} is the information set which includes past values of all endogenous variables and parameters.

Adaptive expectation (learning from past mistakes)

$$\pi_t^e = \rho\left(\pi_{t-1} - \pi_{t-1}^e\right) + \pi_{t-1}^e \quad (4)$$

Past mistake $\left(\pi_{t-1} - \pi_{t-1}^e\right)$ and learning occurs because $0 < \rho < 1$. Notice $\pi_t^e = \pi_{t-1}$ if $\rho = 1$ this is a completely backward looking expectation.

Rational Expectation

Conditional expectation about a variable X at time t+1
using all available information existing at time t

$$\left({}_{E_t}\, X_{t+1} \middle/ \Omega_t \right) = \tilde{X}_t$$

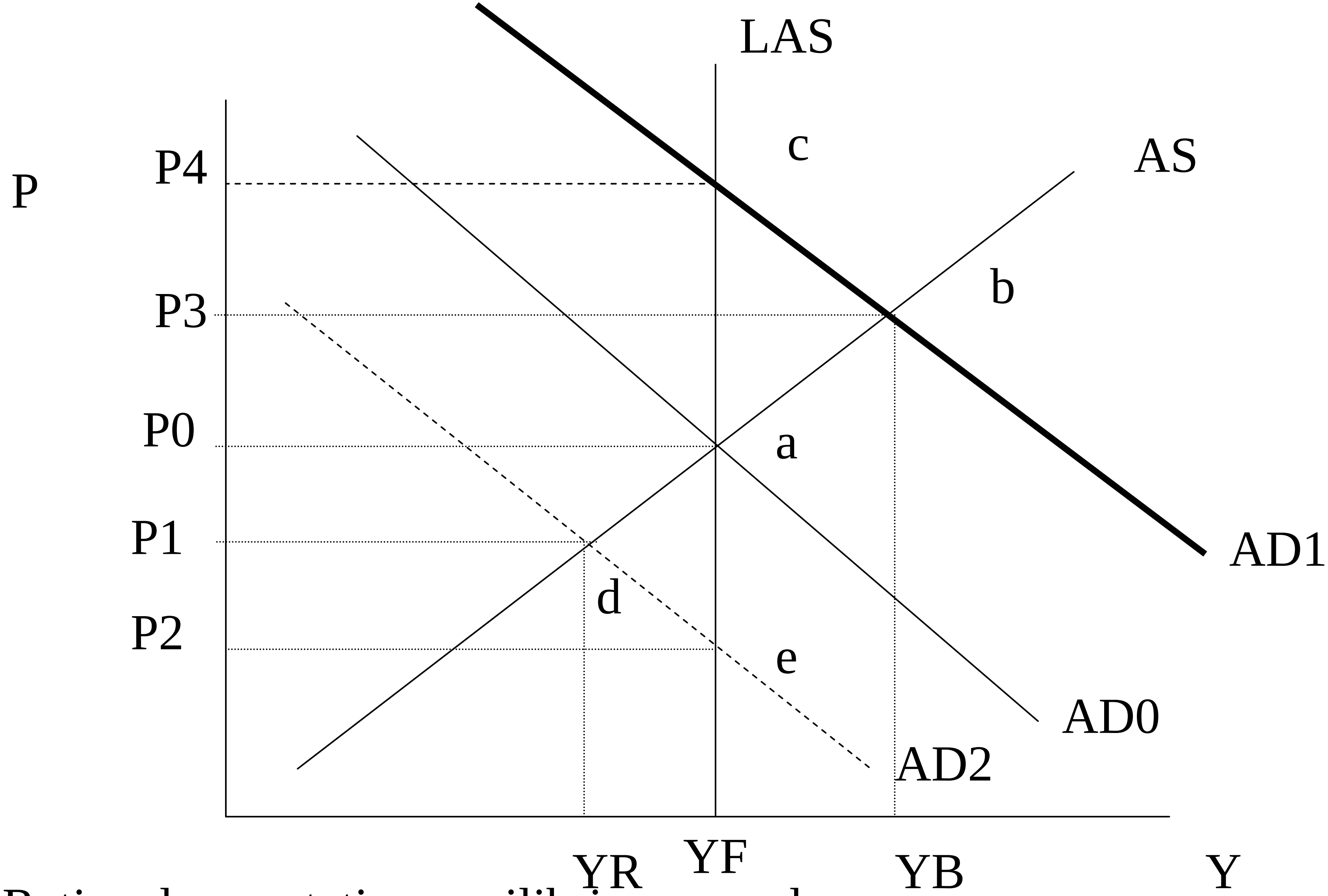
Information set Ω_t

It contains past values of endogenous and policy variables
and future predicted values of exogenous variables.

Three methods of forming rational expectation

1. Survey of opinion –asking people, economist, CEOs, consumers, about the their opinion about a variable.
2. Using current value of variable as the best predictor of future.
3. Extrapolative model based forecasts (Lucas (1976), Wallis (1977), Lee et.a. (2000)).

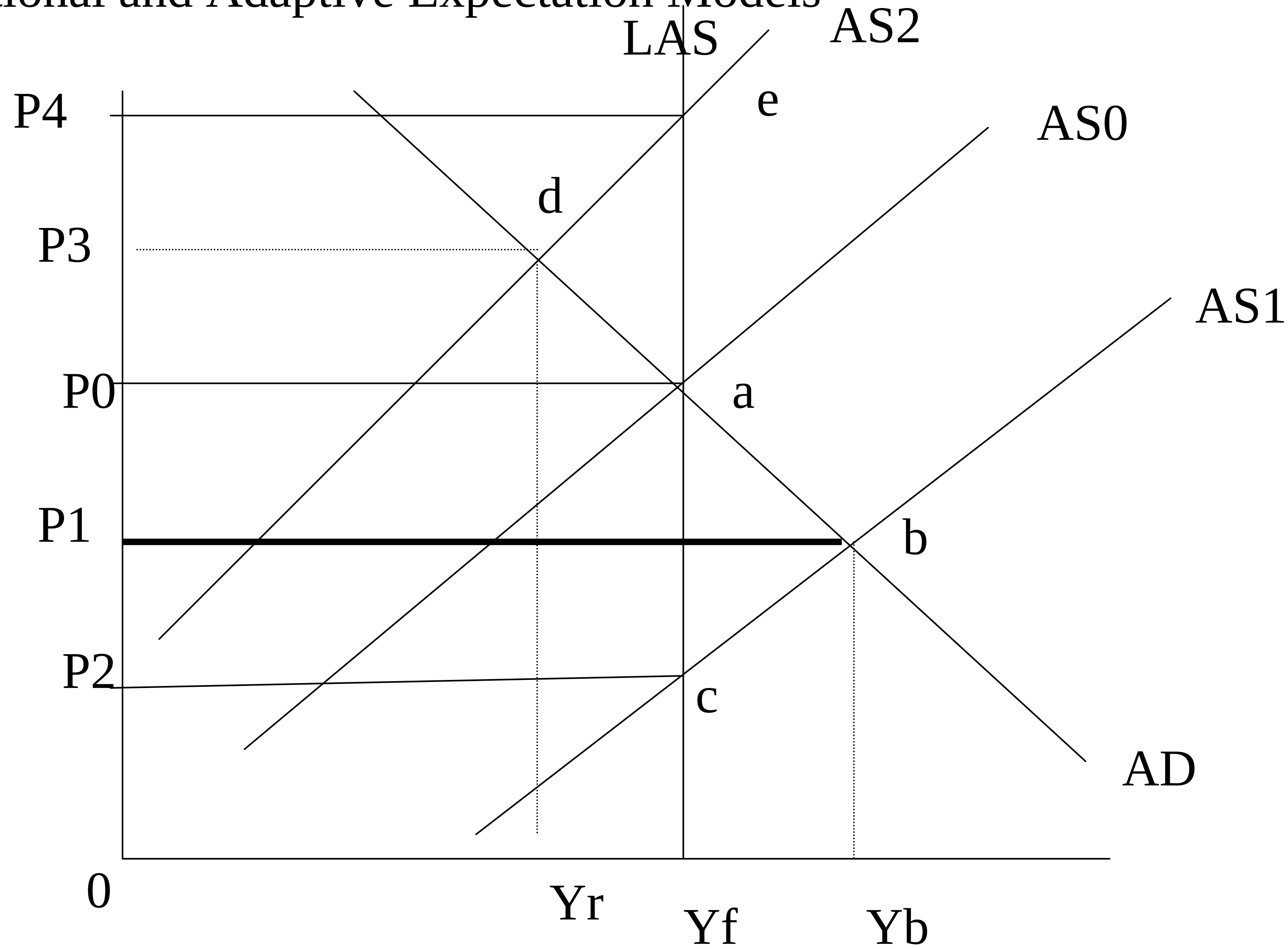
Impact of Demand Positive and Negative Demand Shock under Rational and Adaptive Expectation Models



Rational expectation equilibrium: c and e

Adaptive expectation equilibrium a-b-c or a -d- e

Impact of Demand Positive and Negative Supply Shocks under Rational and Adaptive Expectation Models



Lucas Critique of the IS-LM Model

Consumption: $C = a + bY^d$ (1)

Disposable income: $Y^d = Y - T$ (2)

Investment: $I(r) = I_0 - q \cdot r$ (3)

Demand for real balances: $\frac{M}{P} = kY - \eta \cdot r$ (4) or $r = \frac{1}{\eta}\left(kY - \frac{M}{P}\right)$

National income identity: $Y = C + I + G$ (5)

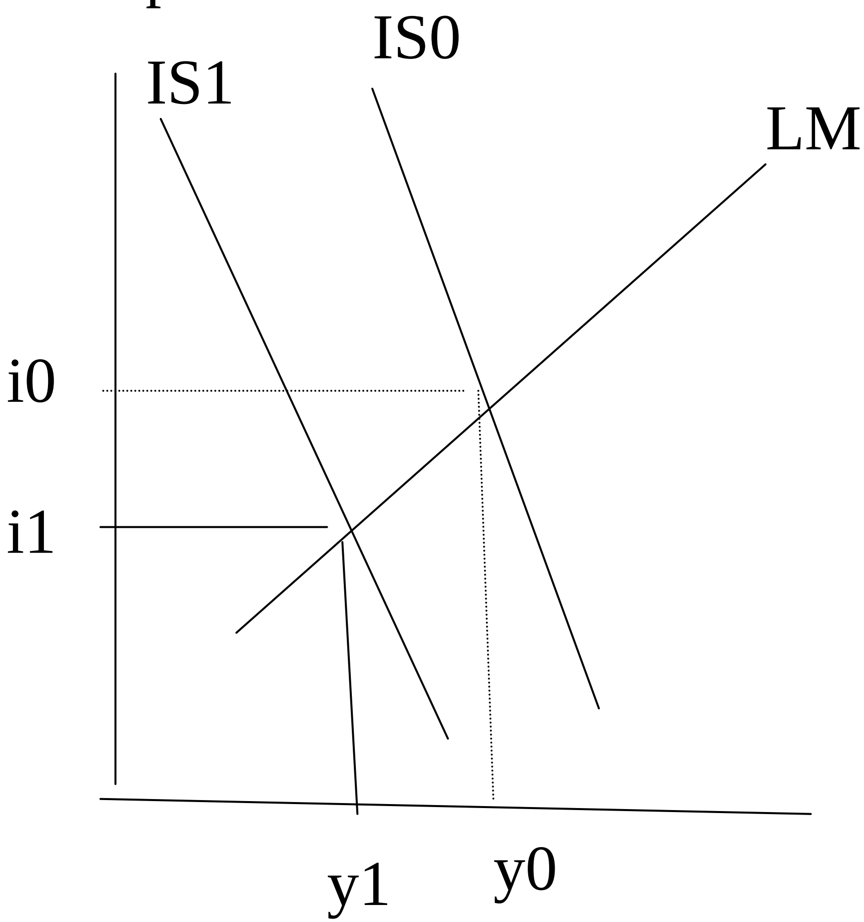
Model I: IS curve: $Y = \frac{a - bT + I_0 - qr + G}{1 - b}$ (6) $r = \frac{-(1-b)Y + a - bT + I_0 + G}{q}$

Model II: ISLM $Y = \frac{a - bT + I_0 - q\left[\frac{1}{\eta}\left(kY - \frac{M}{P}\right)\right] + G}{1 - b}$, $Y = \frac{a - bT + I_0 + \frac{q}{\eta}\frac{M}{P} + G}{1 - b + \frac{q}{\eta}k}$

Households and firms already know the parameters like a, b, q, I0, k. They fully anticipate and adjust their behaviour when G, T or M change. Anticipated fiscal and monetary policies do no have any impacts in Y, I or employment but only on prices and wages.

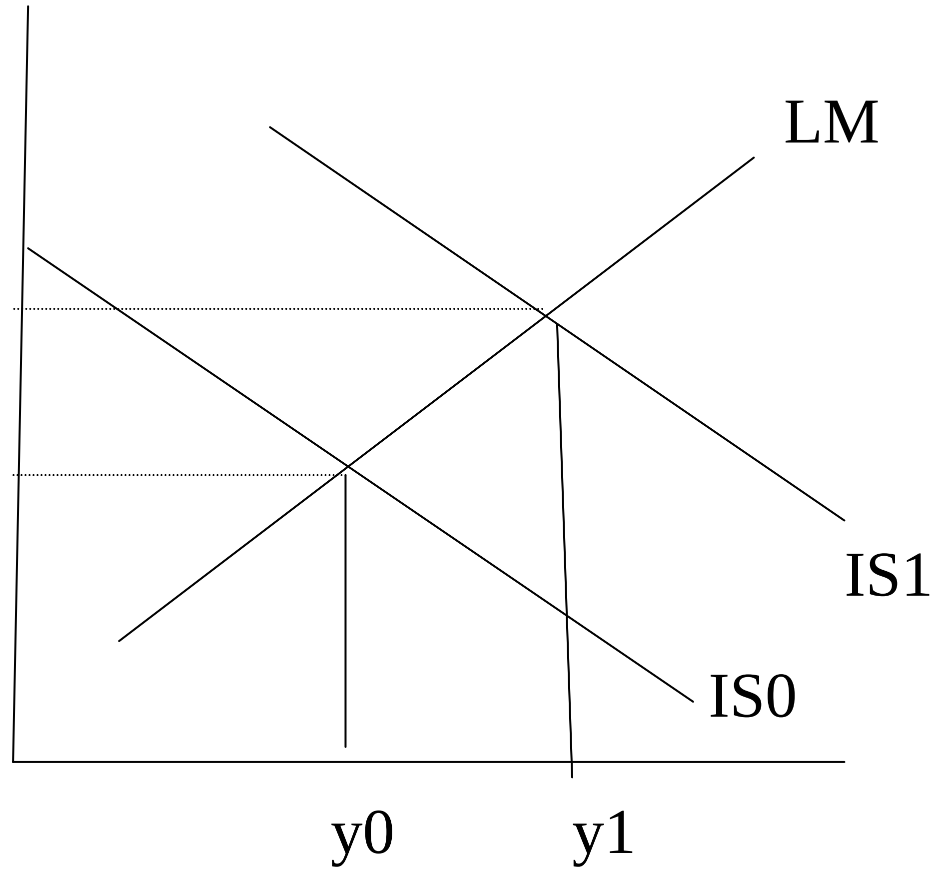
Role of Expectation in an IS-LM Model

Impact without change
Expectations



Deficit reduction without
Change in expectation

Impact with changes in expectation



Impact of deficit reduction
With change in expectation

Rational Expectation in the Labour Market

Labour supply depends on expected real wage rate $\frac{w}{p^e}$. $\frac{w}{p^e} > \frac{w}{p}$ if $p^e < p$. Workers know their wage rate but they do not know the current price level. They have expectation about the current price level conditional upon information available up to period t-1.

$$n_t^s = \gamma\left[w_t - E_{t-1}^{*}\left(p_t\right)\right] \quad (9)$$

where ${}^{*}_{t-1}\left(p_t\right)$ is the psychological expectation of the period t price level held at time t-1.

Labour market clearing condition: $n_t^s = n_t^d$ (10)

An Illustrative Model of Rational Expectation Aggregate Supply and Demands

Aggregate Supply $Y_t = N_t^{\alpha}$ in logs $y_t = \alpha n_t$ (6)

Labour demand: $\frac{\partial Y_t}{\partial N_t} = \alpha N_t^{\alpha - 1} = \frac{w_t}{p_t}$ taking log it can be

written as $w_t - p_t = \ln(\alpha) + (\alpha - 1)\ln(n_t)$ (7)

Aggregate Demand : $\frac{M_t}{P_t} = k_t Y_t$ where k_t is a monetary policy

parameter $k_t = e^{\theta_t}$ where θ_t is a random variable. Now taking log of this demand $m_t - p_t = \ln(k) + y_t$ or

$m_t - p_t = \theta_t + y_t$ (8)

Labour Market Equilibrium and Aggregate Supply

Solve (4) for the wage rate w_t and substitute the result for the w_t term in (2).

$$w_t = \frac{1}{\gamma} n_t^s + E_{t-1}^*\left(p_t\right)$$

$$\frac{1}{\gamma} n_t^s + E_{t-1}^*\left(p_t\right) - p_t = \ln(\alpha) + \left(\alpha - 1\right)\left(n_t\right)$$

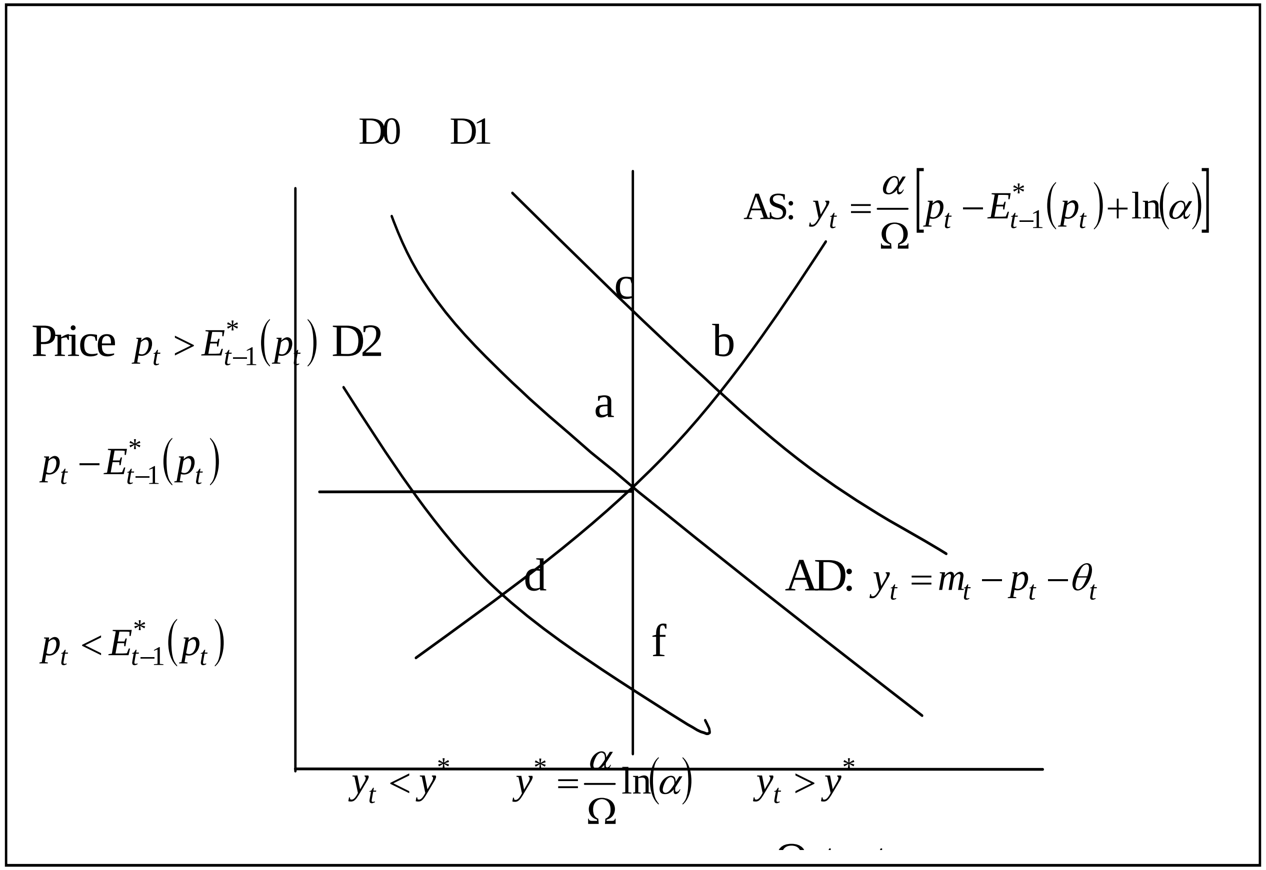
$$n_t\left[\frac{1}{\gamma} + \left(1-\alpha\right)\right] = p_t - E_{t-1}^*\left(p_t\right) + \ln(\alpha) \quad \text{let}\ \Omega = \left[\frac{1}{\gamma} + \left(1-\alpha\right)\right]$$

$$n_t = \frac{1}{\Omega}\left[p_t - E_{t-1}^*\left(p_t\right) + \ln(\alpha)\right] \text{ and } y_t = \frac{\alpha}{\Omega}\left[p_t - E_{t-1}^*\left(p_t\right) + \ln(\alpha)\right]$$

(11)

Impact of Monetary Policy in the Short and the Long Run

$$n_t = \frac{1}{\Omega}\left[p_t - E^*_{t-1}(p_t) + \ln(\alpha)\right] \qquad (7)$$



and output $$y_t = \frac{\alpha}{\Omega}\left[p_t - E^*_{t-1}(p_t) + \ln(\alpha)\right] \qquad (8)$$

Steps for Solving a Rational Expectation Model

Supply depends on wage rates relative to expected prices

$$y_t^s = w_t - {}_{E_{t-1}^*}p_t = p_t - {}_{E_{t-1}^*}p_t$$

Current wage rate is set conditional on information about current price:

$$w_t = {}_{E_{t-1}}p_t$$

Aggregate demand is given by the real money balances and monetary shock

$$y_t^d = m_t - p_t - \theta_t$$

$$\theta_t = \lambda\theta_{t-1} + \mu_t \qquad \mu_t \sim N\left(0, \sigma_\mu^2\right) \qquad E(\mu_t) = 0$$

Take conditional expectation of aggregate demand

$${}_{E_{t-1}}y_t = {}_{E_{t-1}}m_t - {}_{E_{t-1}}p_t - \lambda\theta_{t-1}$$

Anticipated Policy has no Impact on output

Demand and Supply are equal in equilibrium:

$$ {}_{E_{t-1}} p_t - {}_{E^*_{t-1}} p_t = {}_{E_{t-1}} m_t - {}_{E_{t-1}} p_t - \lambda\theta_{t-1} $$

This solves as:

$$ {}_{E_{t-1}} p_t = \frac{1}{2}\, {}_{E^*_{t-1}} p_t + \frac{1}{2}\, {}_{E_{t-1}} m_t - \frac{1}{2}\lambda\theta_{t-1} $$

Equating demand and supply:

$$ {}_{E^*_{t-1}} y_t = {}_{E_{t-1}} m_t - \left[\frac{1}{2}\, {}_{E^*_{t-1}} p_t + \frac{1}{2}\, {}_{E_{t-1}} m_t - \frac{1}{2}\lambda\theta_{t-1}\right] - \lambda\theta_{t-1} $$

Rationally expected deviation of output from mean:

$$ {}_{E^*_{t-1}} y_t = \frac{1}{2}\, {}_{E_{t-1}} m_t - \frac{1}{2}\, {}_{E^*_{t-1}} p_t - \frac{1}{2}\lambda\theta_{t-1} $$

$$ {}_{E^*_{t-1}} y_t = 0 $$

This give the money supply rule: $ {}_{E_{t-1}} m_t = {}_{E^*_{t-1}} p_t + \lambda\theta_{t-1} $

Unanticipated Policy has Affects the Variance of Output

$$p_t - {}_{E^*_{t-1}}p_t = m_t - p_t - \lambda\theta_{t-1} - \mu_t$$

$$p_t = \frac{1}{2}\,{}_{E^*_{t-1}}p_t + \frac{1}{2}m_t - \frac{1}{2}\lambda\theta_{t-1} - \frac{1}{2}\mu_t$$

$$y^s = w_t - {}_{E^*_{t-1}}p_t = p_t - {}_{E^*_{t-1}}p_t$$

$$\text{var}(y_t) = \text{var}\left(p_t - {}_{E^*_{t-1}}p_t\right) = E\left[\frac{1}{2}\,{}_{E^*_{t-1}}p_t + \frac{1}{2}m_t - \frac{1}{2}\lambda\theta_{t-1} - \frac{1}{2}\mu_t - {}_{E^*_{t-1}}p_t\right]^2$$

$${}_{E_{t-1}}m_t = {}_{E^*_{t-1}}p_t + \lambda\theta_{t-1} + \mu_t$$

$$\text{var}(y_t) = \text{var}\left(p_t - {}_{E^*_{t-1}}p_t\right) = E\left[\frac{1}{2}\,{}_{E^*_{t-1}}p_t + \frac{1}{2}\left({}_{E^*_{t-1}}p_t + \lambda\theta_{t-1} + \mu_t\right) - \frac{1}{2}\lambda\theta_{t-1} - {}_{E^*_{t-1}}p_t\right.$$

$$\text{var}(y_t) = \text{var}\left(p_t - {}_{E^*_{t-1}}p_t\right) = E\left[\frac{1}{2}\lambda\theta_{t-1} + \frac{1}{2}\mu_t - \frac{1}{2}\lambda\theta_{t-1}\right]^2 = \frac{1}{4}\sigma^2_\mu$$

Adaptive Expectation

People learn by mistake and adjust their expectations accordingly

$$P_t^e - P_{t-1}^e = \mu\left(P_{t-1} - P_{t-1}^e\right) \qquad (1)$$

Here P_t^e is the expected price and μ is the adjustment parameter between zero and 1, $0<\mu<1$. There is no observation available about the expected price, P_t^e. How can it be used in a model? . The trick is to solve (1) for P_t^e and eliminate it using observed variables. First (1) can be written as

$$P_t^e = \mu P_{t-1} + \left(1-\mu\right)P_{t-1}^e \qquad (2)$$

Adaptive Expectation

By one step backward iterations (2) can be written as

$$P^e_{t-1} = \mu P_{t-2} + (1-\mu) P^e_{t-2} \qquad (3)$$

Now use (3) into (2)

$$P^e_t = \mu P_{t-1} + (1-\mu)\left[\mu P_{t-2} + (1-\mu) P^e_{t-2}\right] =$$

$$\mu P_{t-1} + (1-\mu)\mu P_{t-2} + (1-\mu)^2 P^e_{t-2} \qquad (4)$$

Now further iterate (3) and substitute the result back in (4)

$$P^e_t = \mu P_{t-1} + (1-\mu)\mu P_{t-2} + \mu(1-\mu)^2 P_{t-3} + (1-\mu)^3 P^e_{t-3}$$

(5)

Adaptive Expectation

If this process continues (5) can be written as

$$P_t^e = \mu P_{t-1} + (1-\mu)\mu P_{t-2} + \mu(1-\mu)^2 P_{t-3} + .+..+(1-\mu)^n \quad (6)$$

Since $0 < \mu < 1$, $\underset{n \to \infty}{Lim} (1-\mu)^n P_{t-n}^e = 0$. Therefore (6) can be written only in terns of the observed values of the actual price, P_{t-i}.

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