

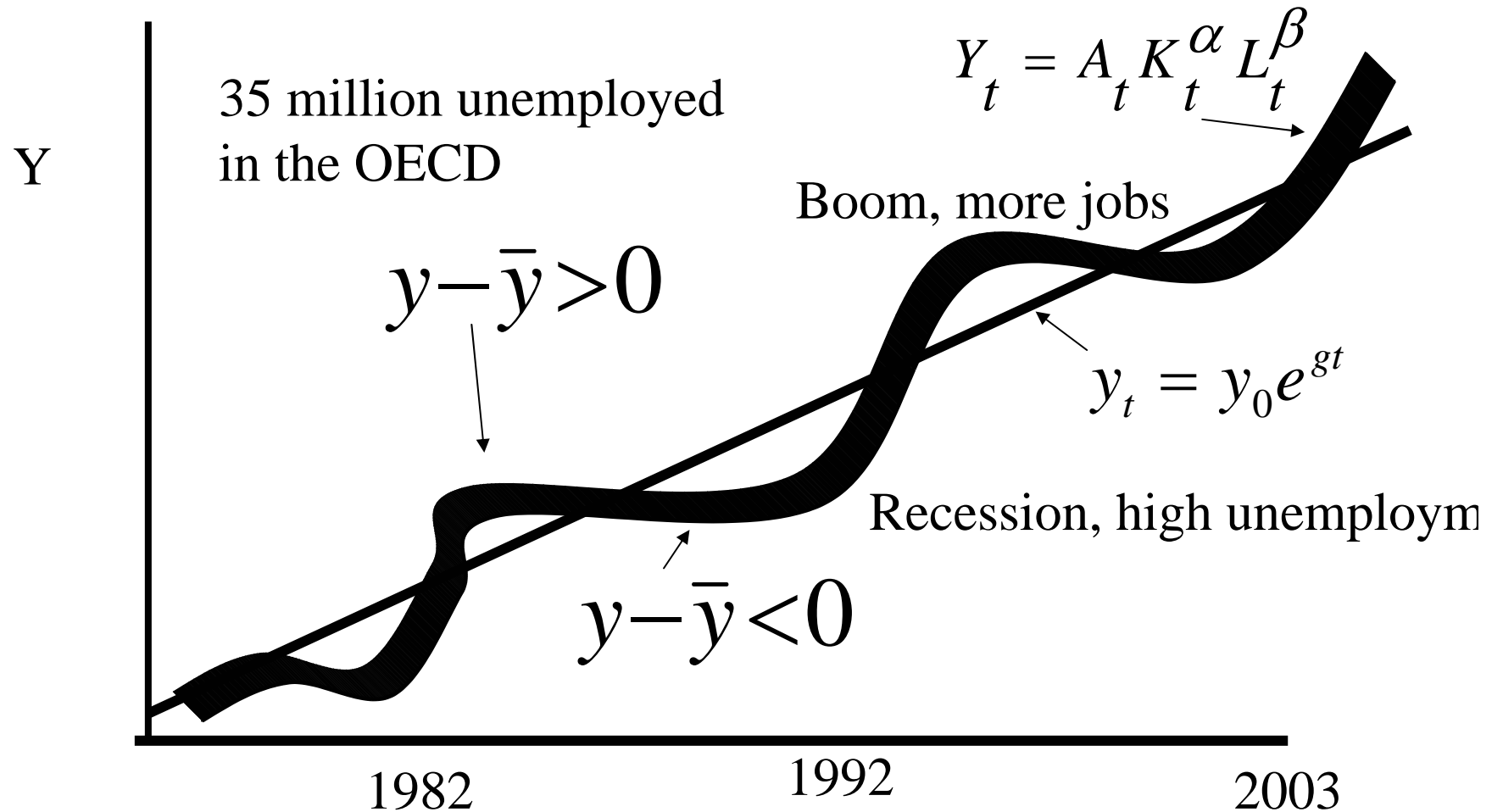
# Economic Modelling

## Lecture 6

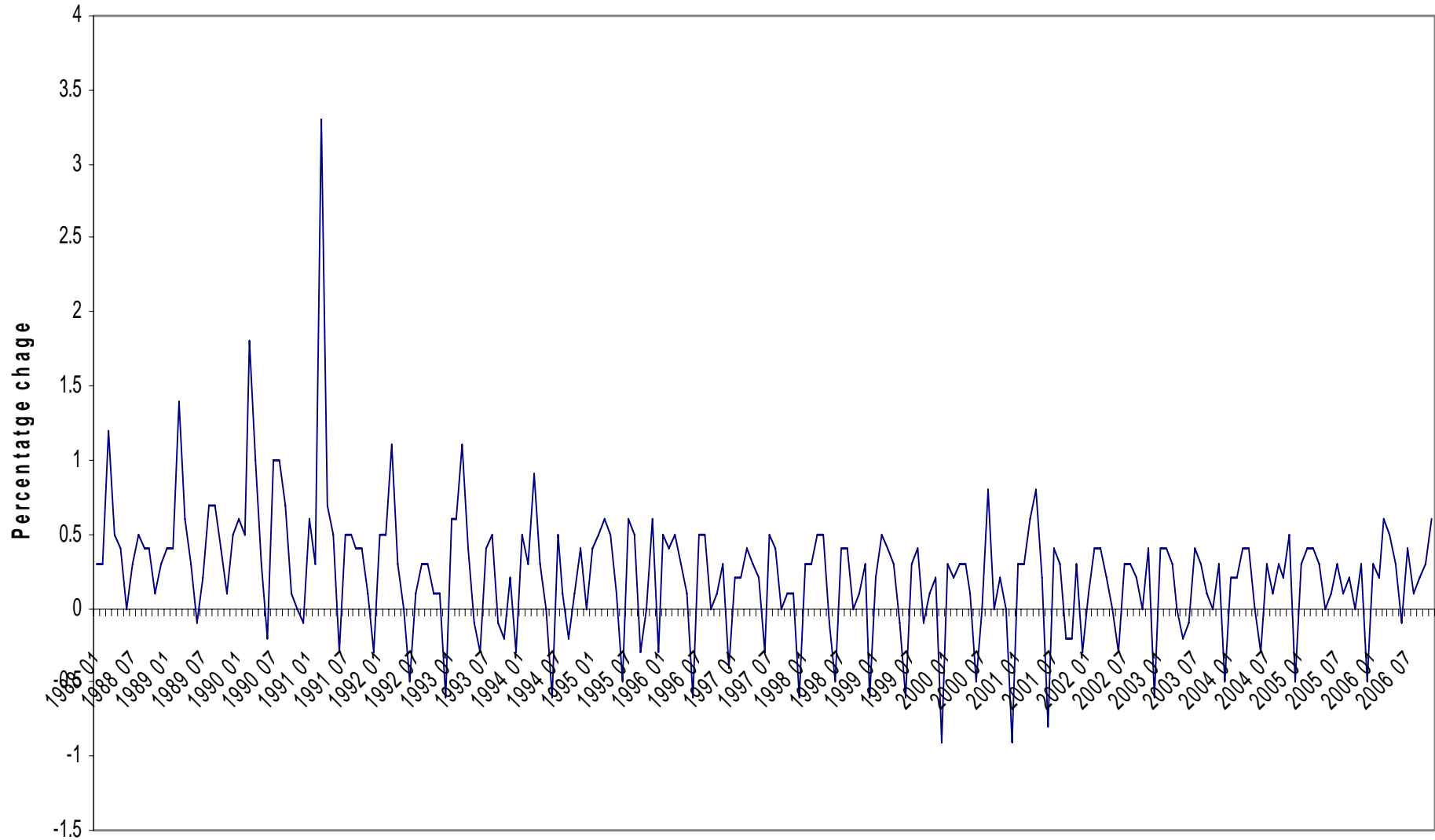
Unemployment-inflation Trade-offs in  
OECD Countries: Lessons from Panel  
data and Theories of Unemployment

Keshab Raj Bhattarai  
Business School  
University of Hull, UK

# Movement of Economy Around the Trend: A Reminder

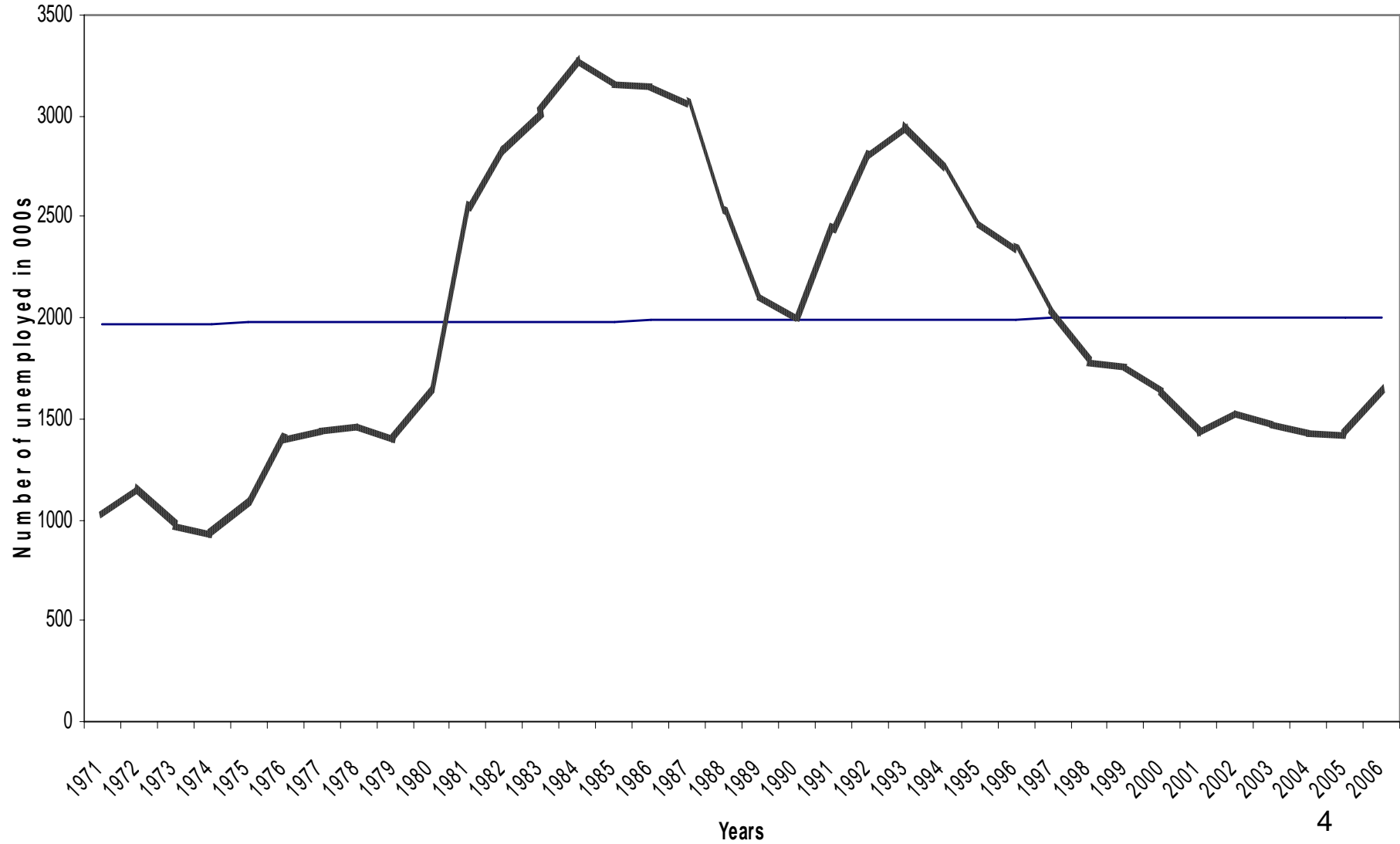


### Quarterly Changes in CPI (ONS)

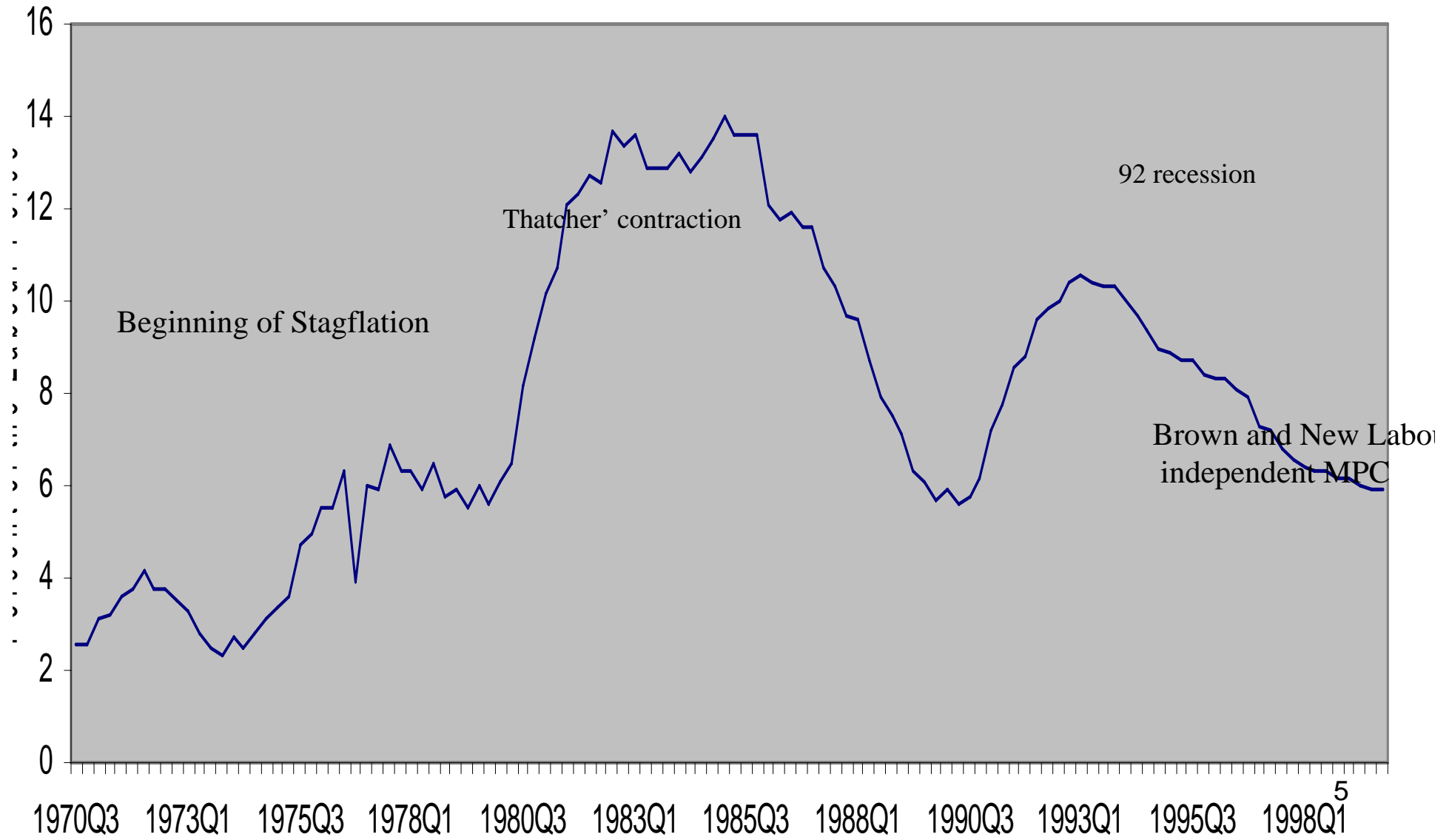


Quarters

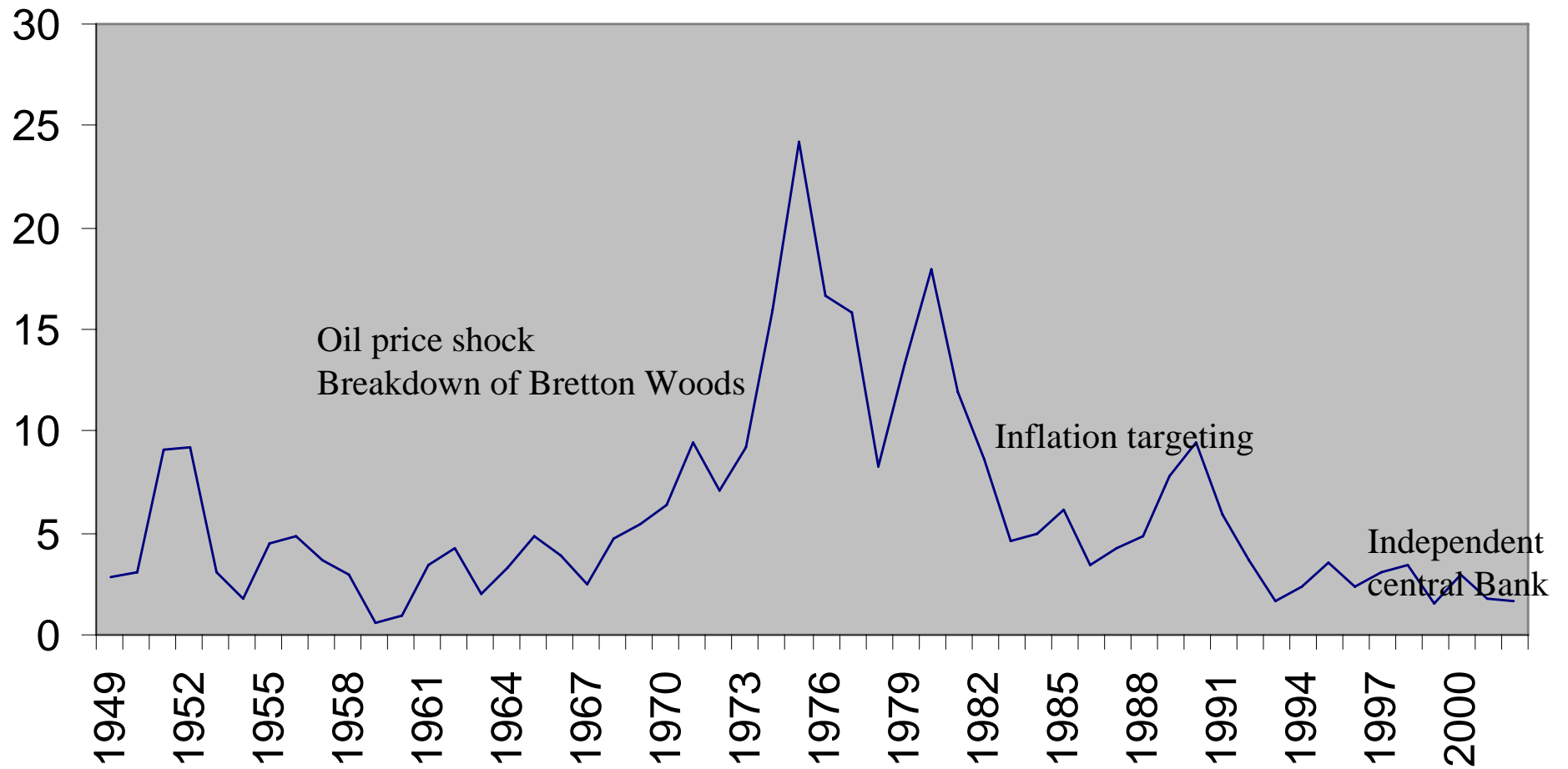
Number of Unemployed 16+ above



# Unemployment rate in the UK



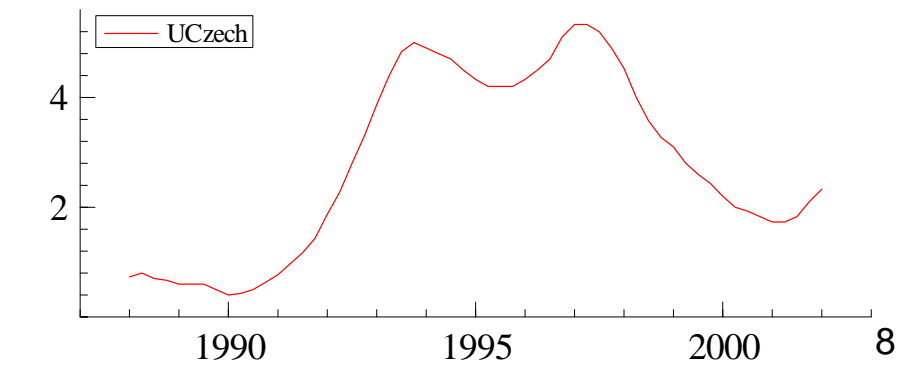
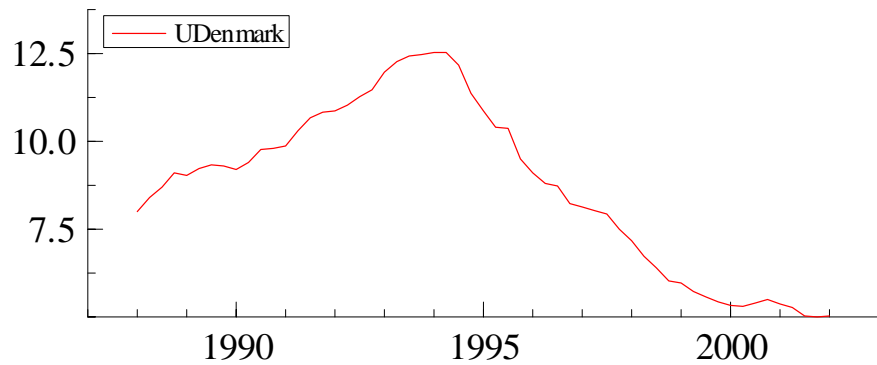
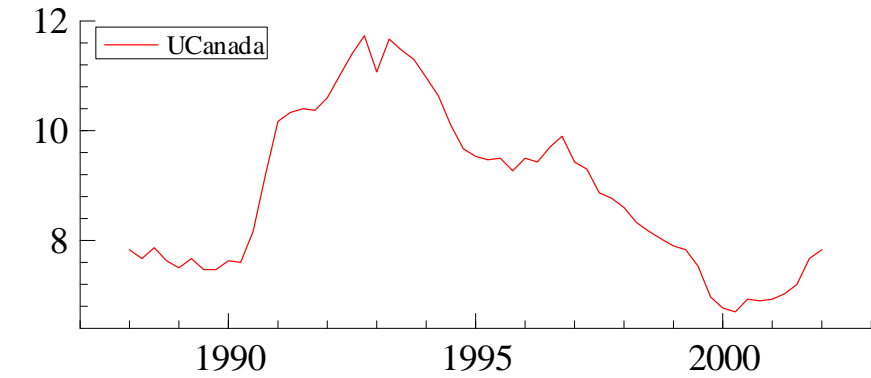
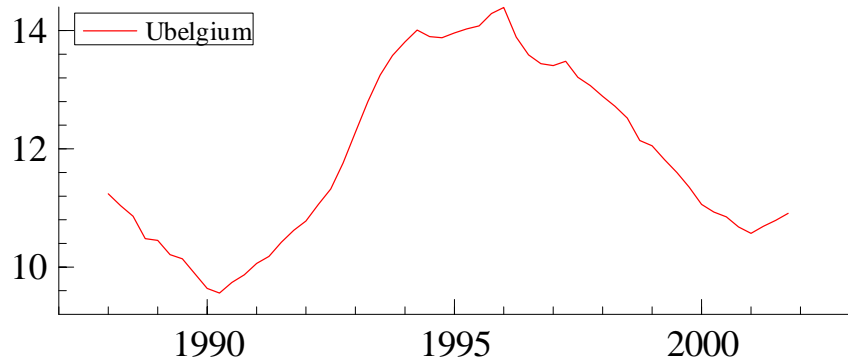
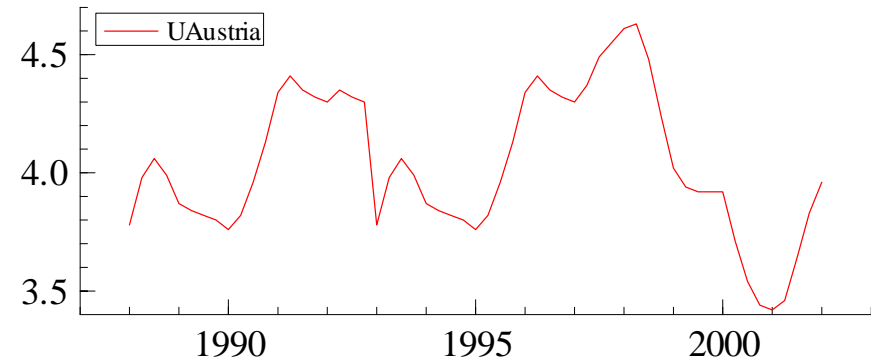
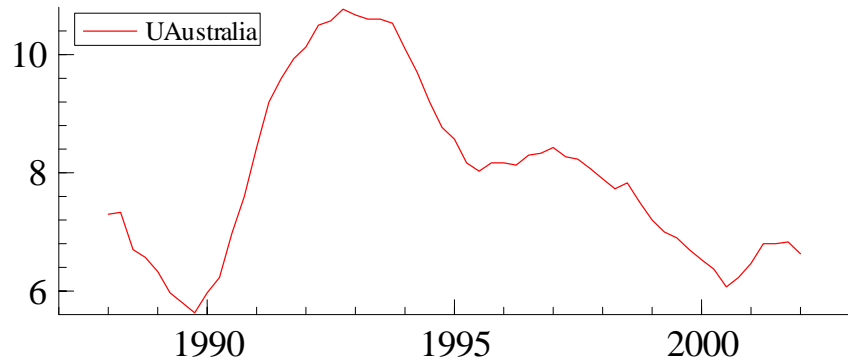
# Retail Price Index in the UK 1948-2000



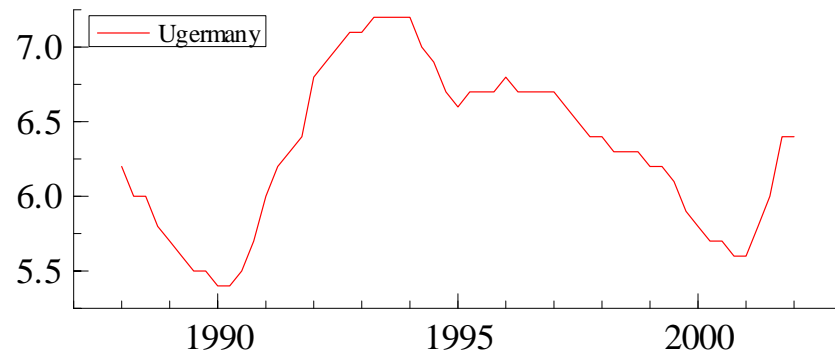
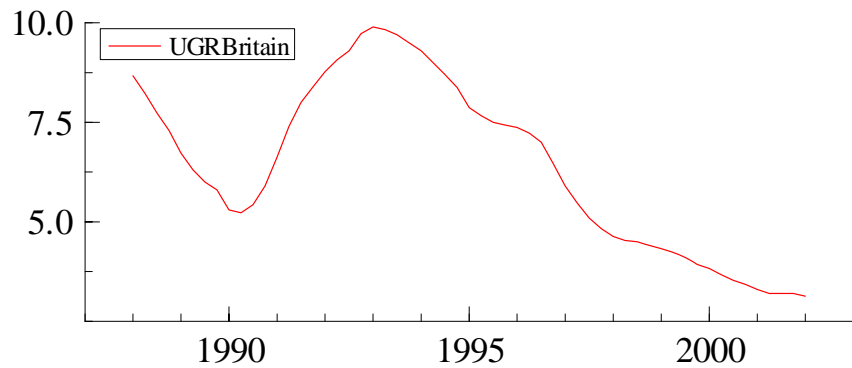
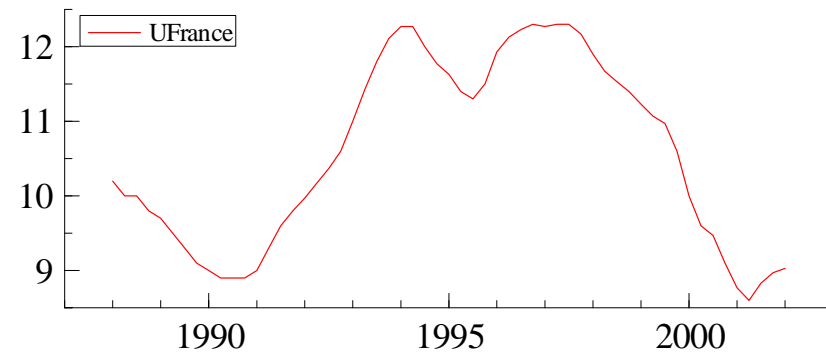
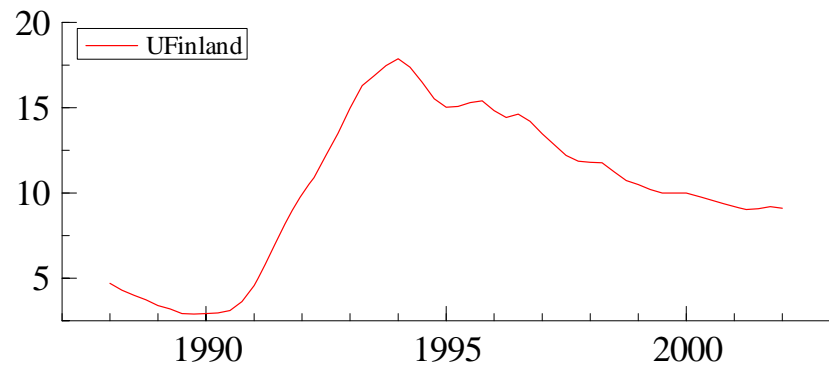
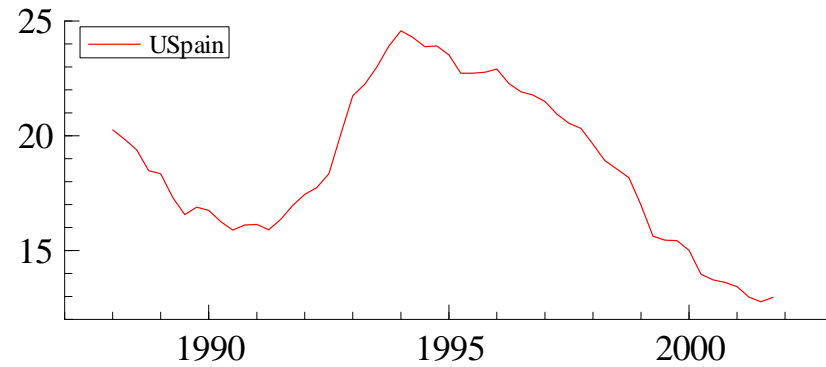
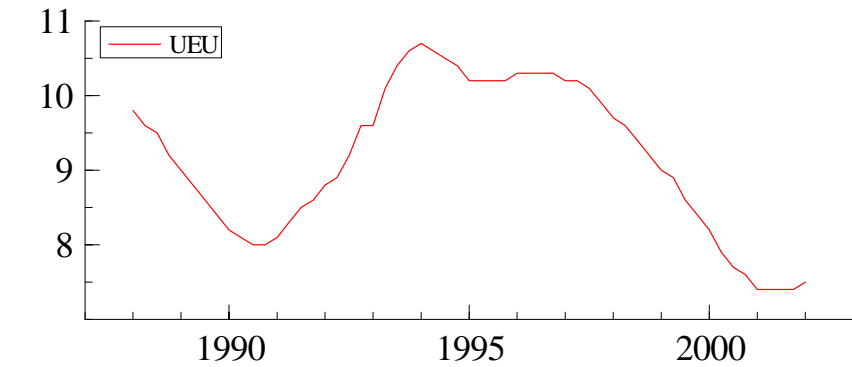
## Literature on Unemployment and Inflation

- Keynes (1936), Hicks (1937)
- Phillips (1958) studies 1861-1957, Lipsey (1960)
- Phelps (1968) Friedman's (1968)
- Lucas and Rapping (1969), Lucas (1976) Brunner et. al. (1976)
- Layard and Nickell (1986, 1990) and Blanchflower and Oswald (1994), Cross (1988), Hoon (2001) Manning (1995) Mankiw (1985), Dixon (1988), Ball and Romer (1990), Blanchard. and Summers (1986)
- McDonal and Solow (1981), Dixon (1988), Lockwood and Manning (1989), Lockwood, Miller and Zhang (1998), Nickell (1993, 1998)).
- Kydland and Prescott (1982) Summers (1988)
- Caballero and Hammour (1994) and Pissarides (2000)
- Bianchi and Zoega (1998)
- Hutchinson and Walsh (1998)
- Nickell (1998), Phelps and Zoega (1998), Madsen (1998), Cross (1988) King (2004)
- Yellen (1984) Nickell and Quintini (2003) Lindebeck and Snower. (1988)

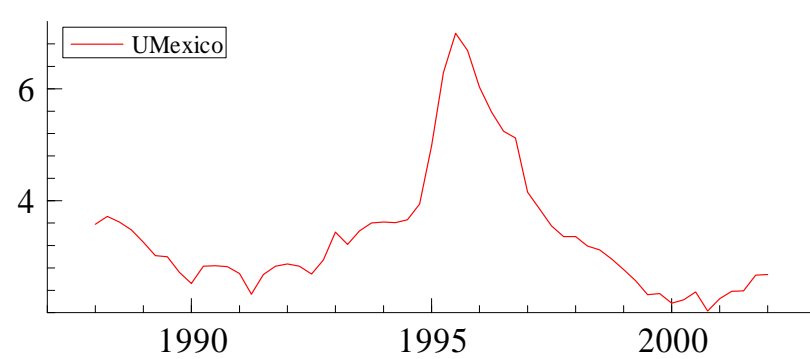
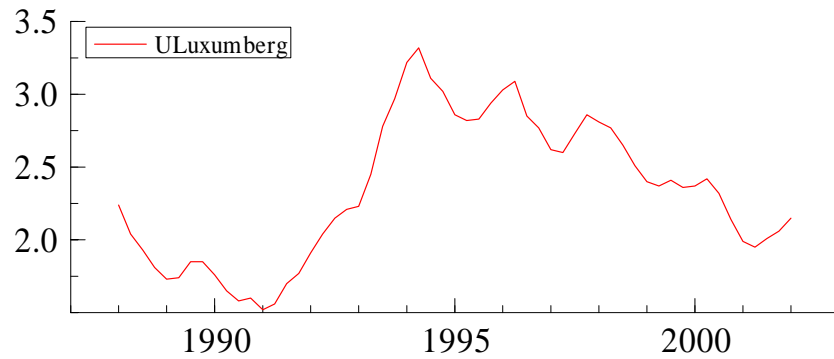
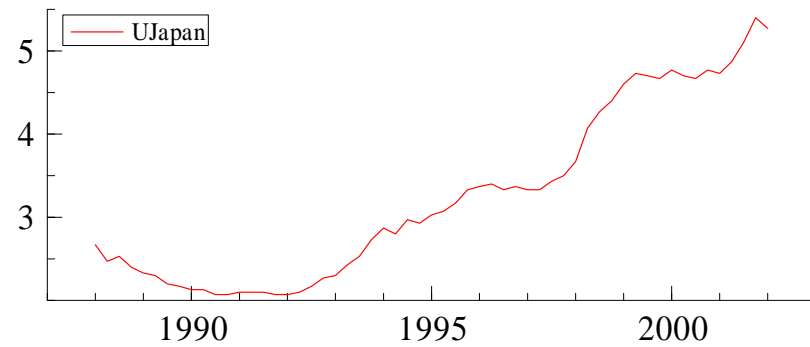
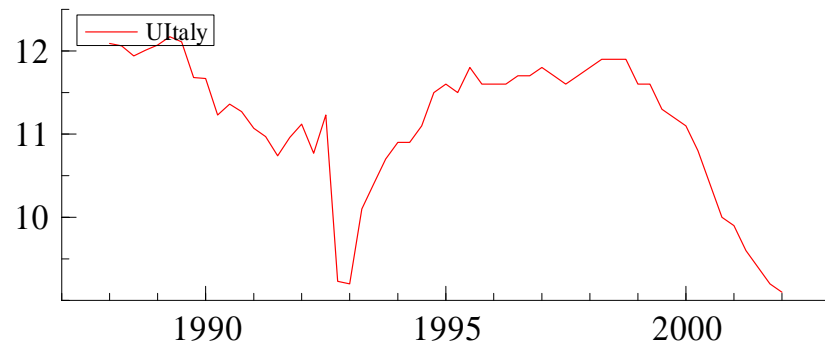
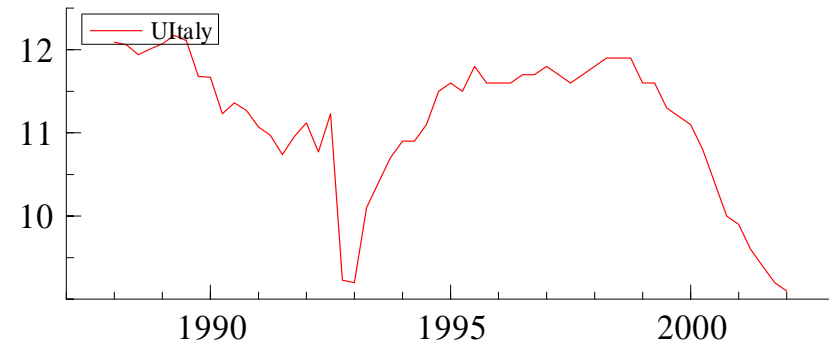
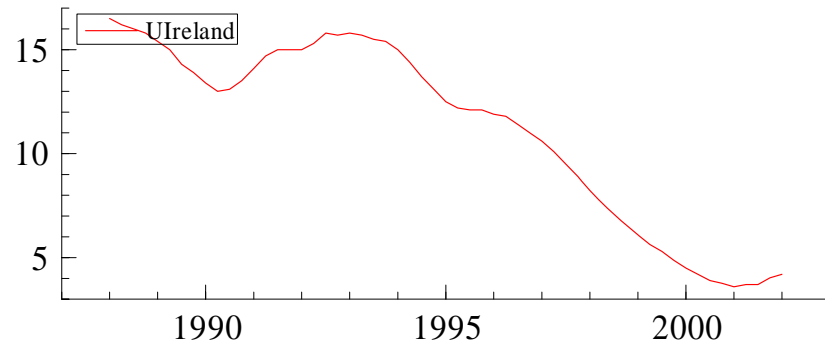
# Unemployment Rates in OECD Economies: 1988:1-2002:1



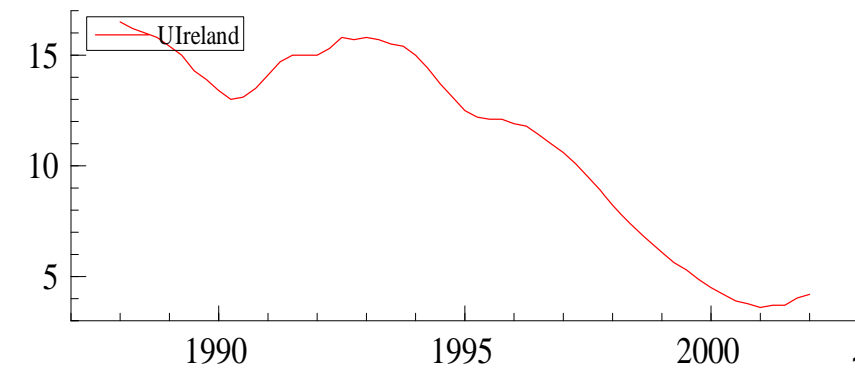
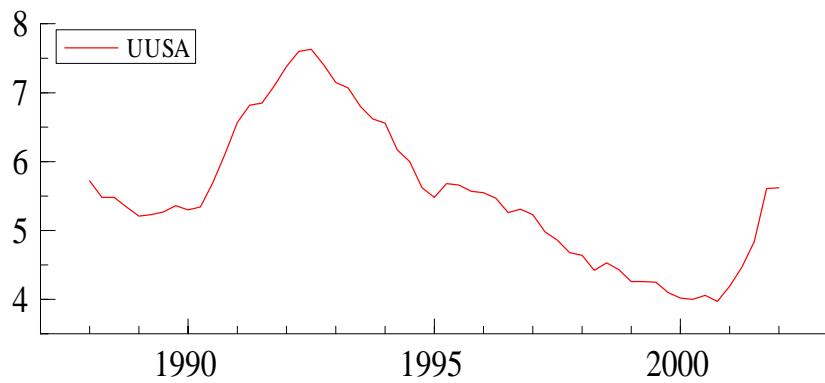
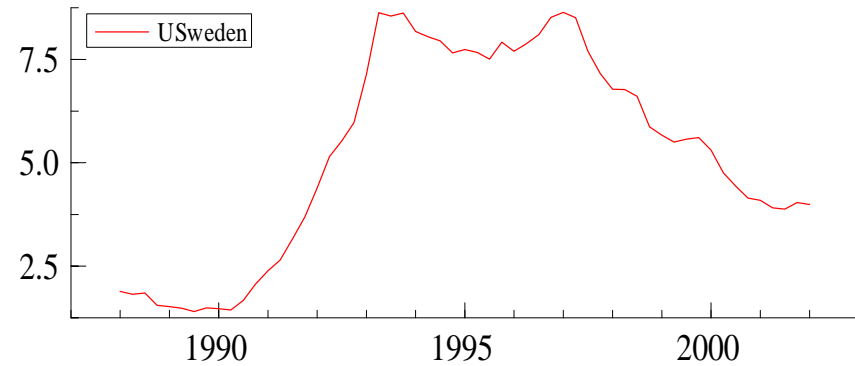
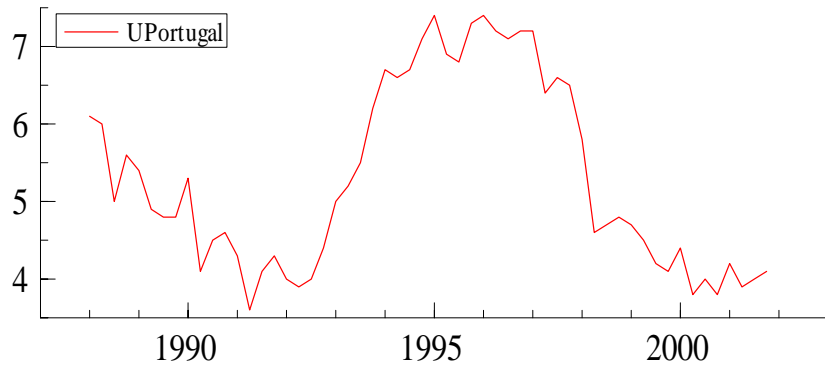
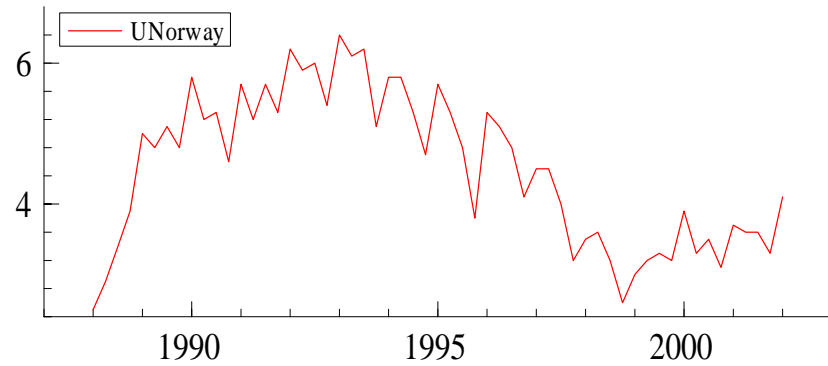
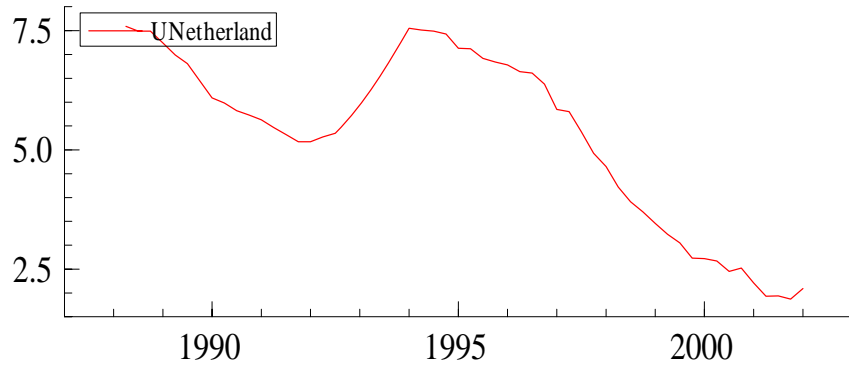
# Unemployment Rates in OECD Economies: 1988:1-2002:1



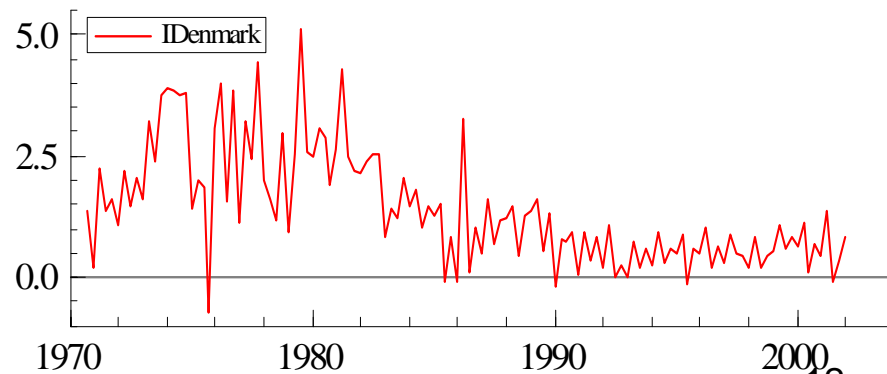
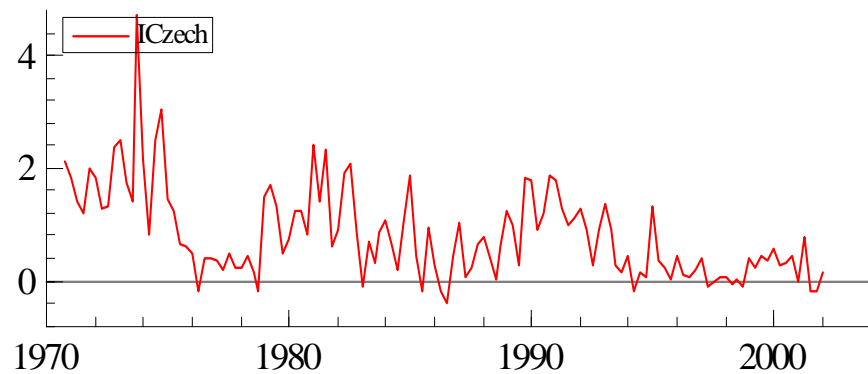
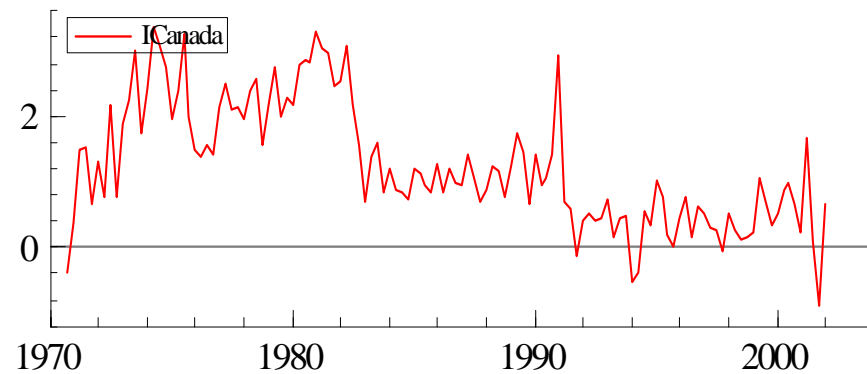
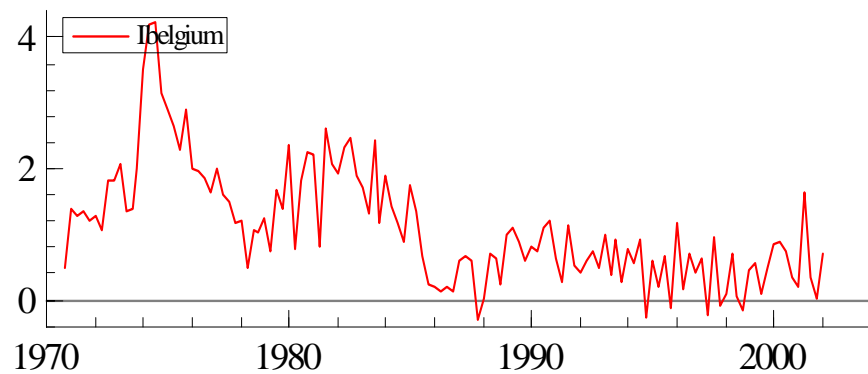
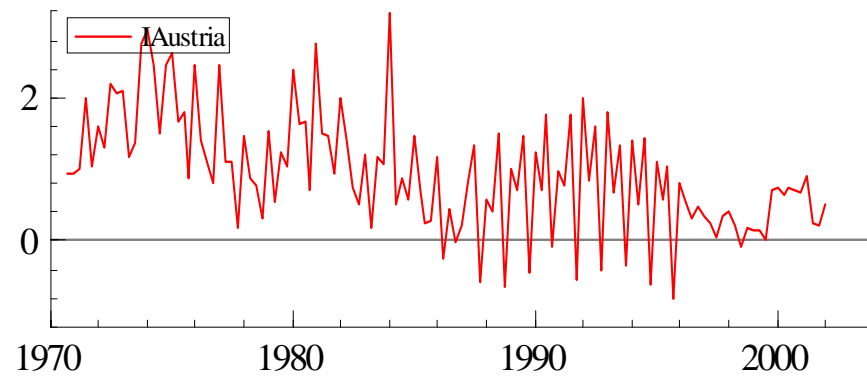
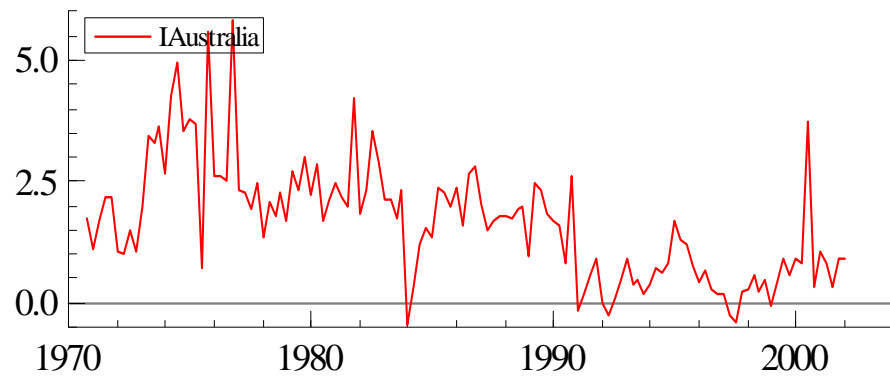
# Unemployment Rates in OECD Economies: 1988:1-2002:1



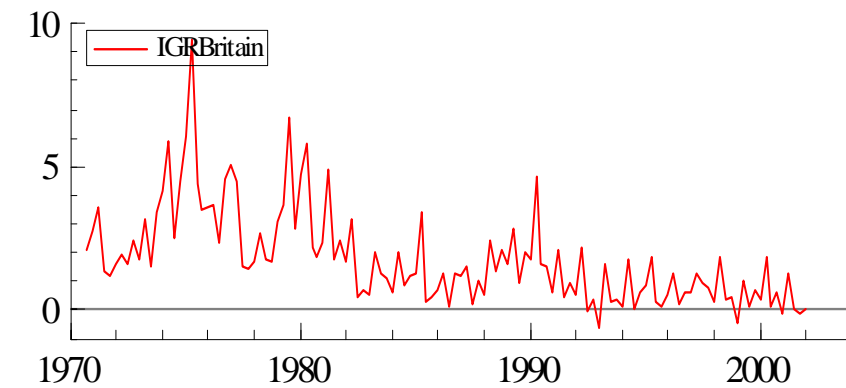
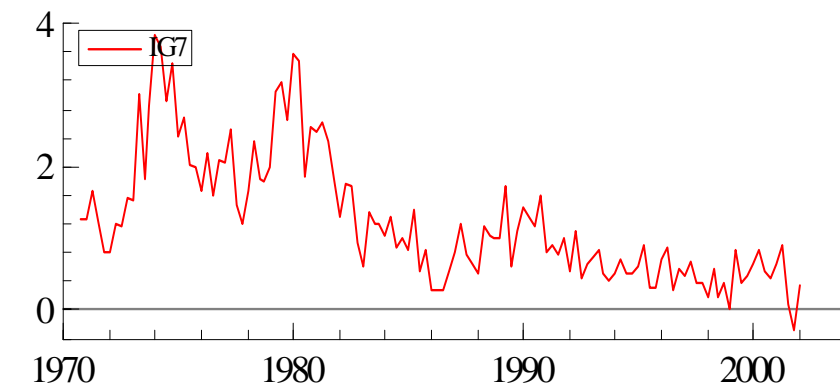
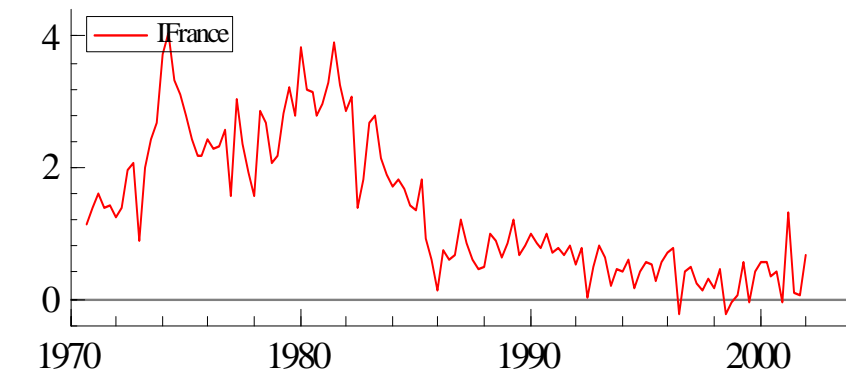
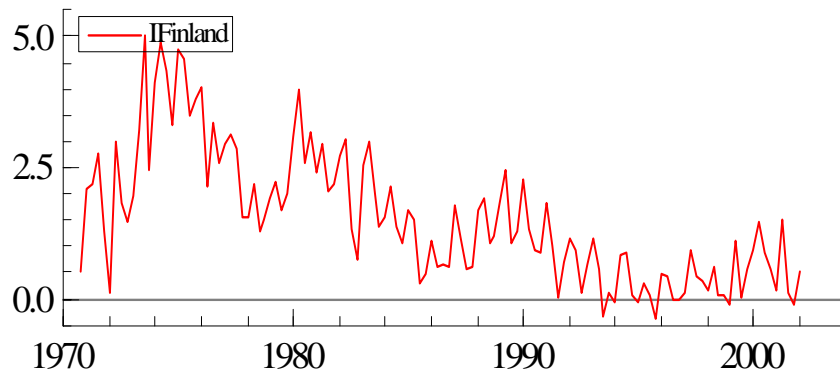
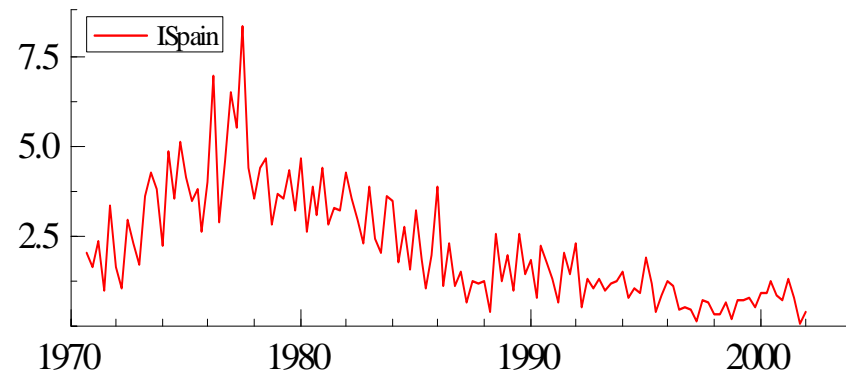
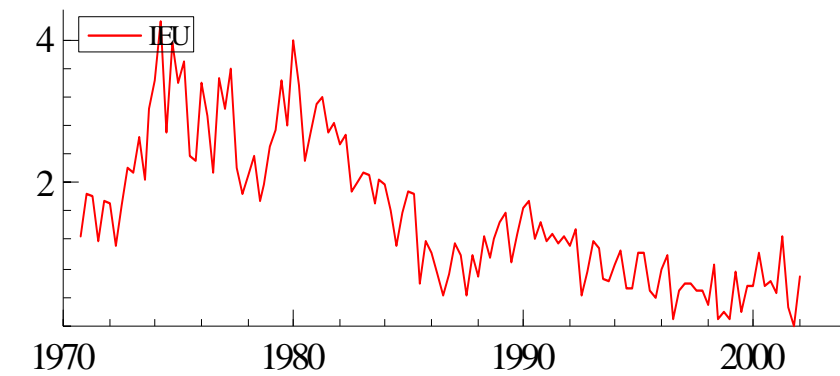
# Unemployment Rates in OECD Economies: 1988:1-2002:1



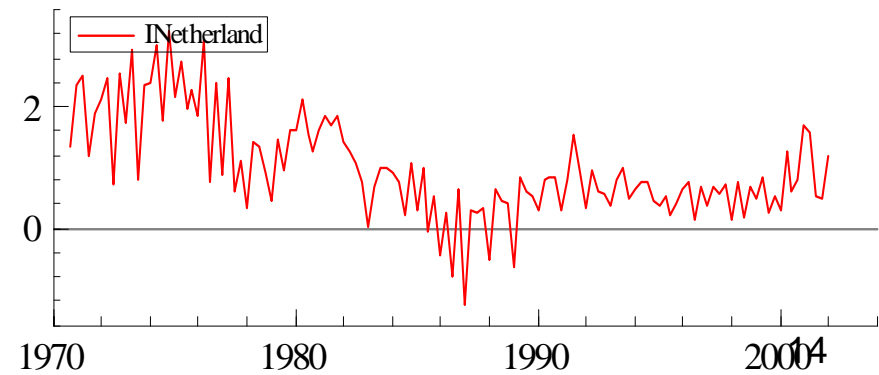
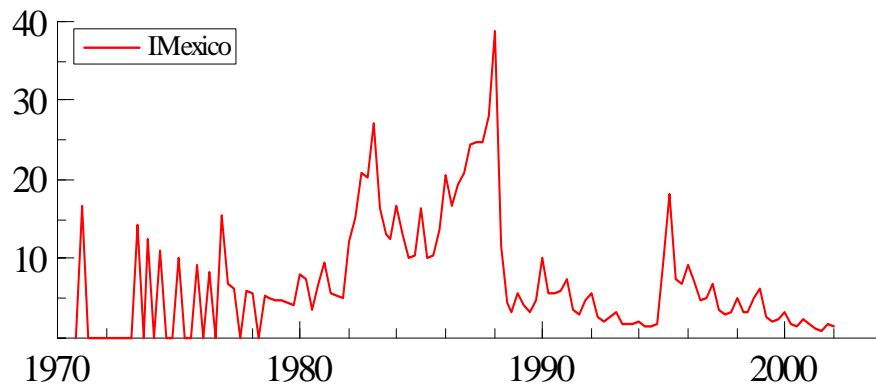
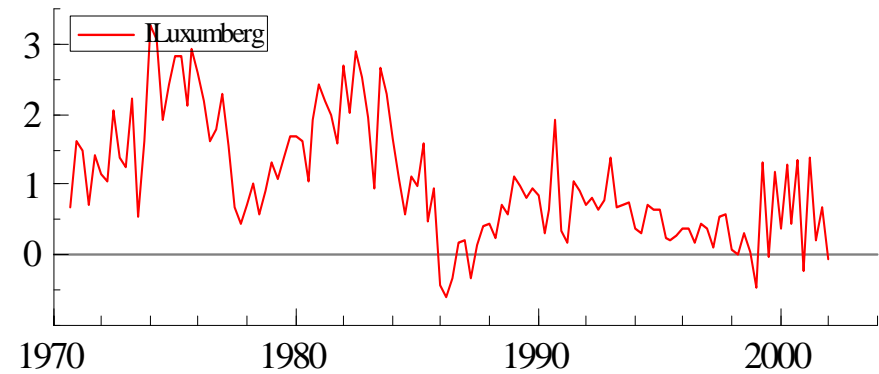
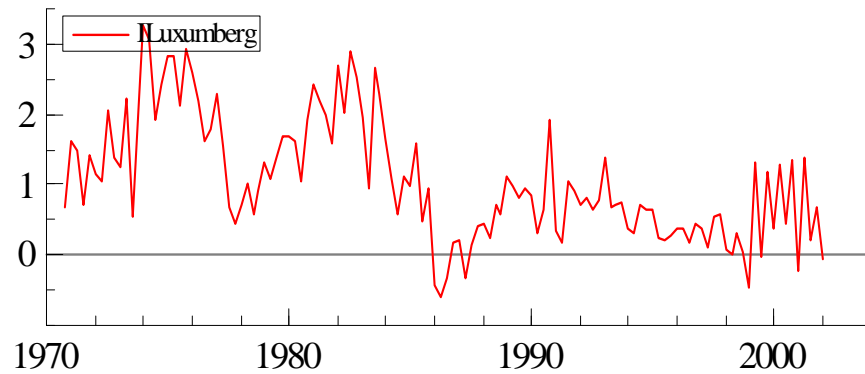
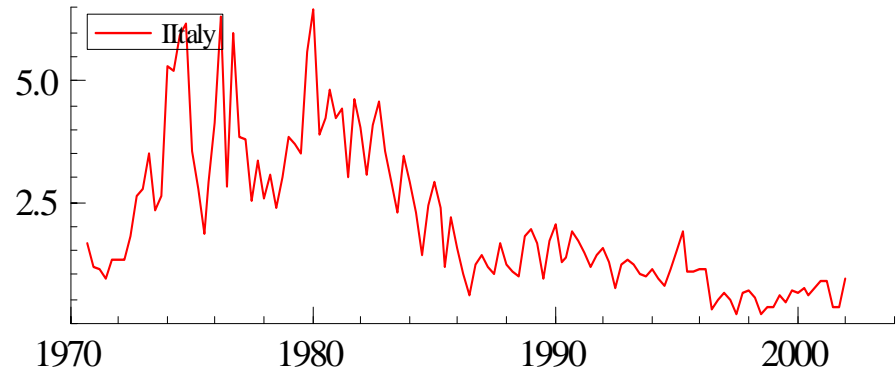
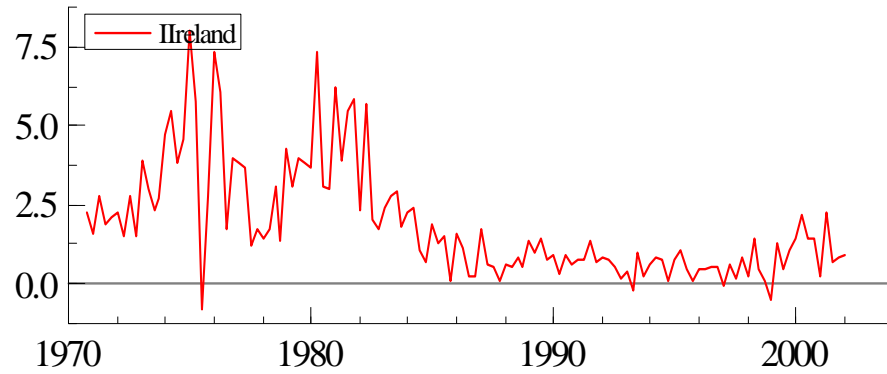
# Quarterly Inflation Rates in OECD Economies: 1970:1-2002:1



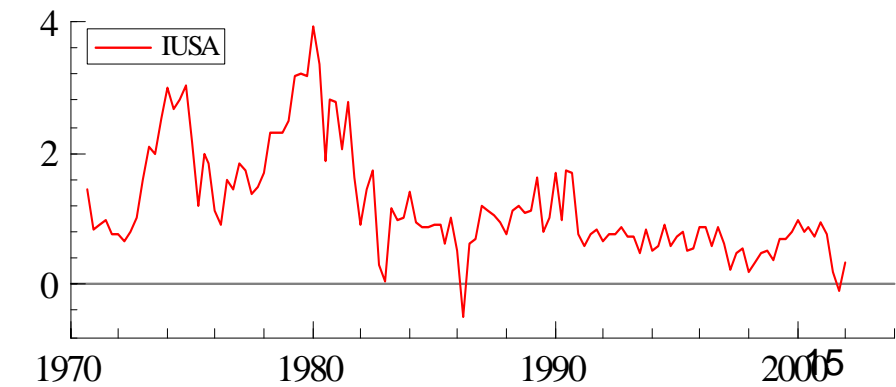
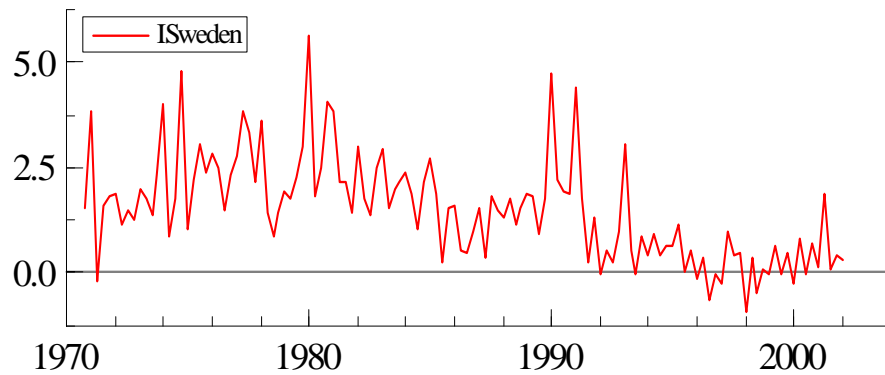
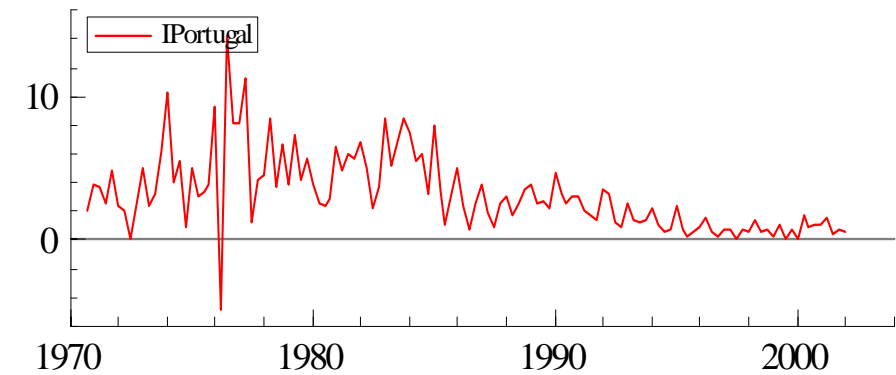
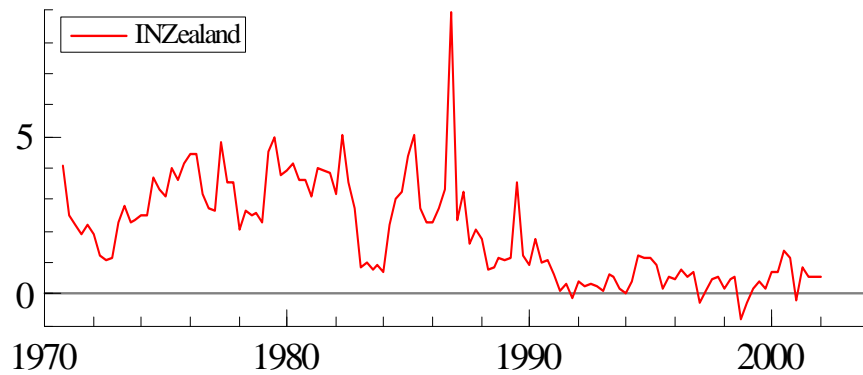
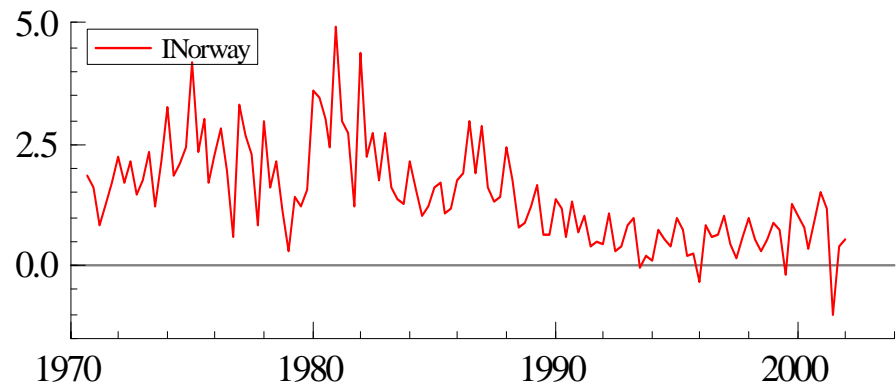
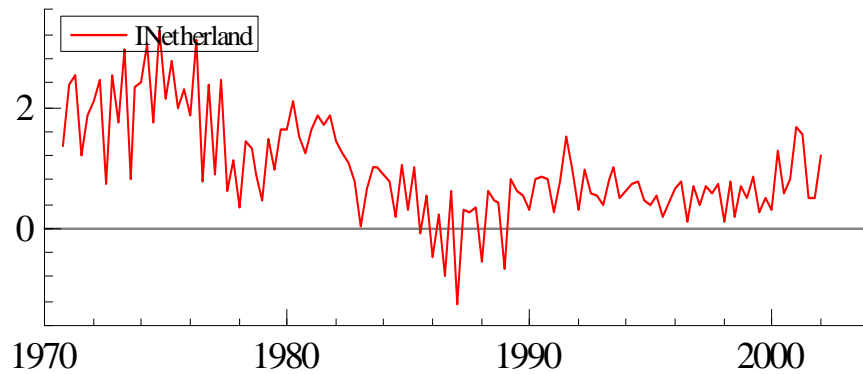
# Quarterly Inflation Rates in OECD Economies: 1970:1-2002:1



# Quarterly Inflation Rates in OECD Economies: 1970:1-2002:1



# Quarterly Inflation Rates in OECD Economies: 1970:1-2002:1



$$\mu, \gamma = 0.2$$

## Main cause of Inflation: Wage Price Spiral Modernisation or Negotiation?

Time	Wage	Price
1	1.00	1.00
2	1.20	1.20
3	1.44	1.44
4	1.73	1.73
5	2.07	2.07
6	2.49	2.49
7	2.99	2.99
8	3.58	3.58
9	4.30	4.30
10	5.16	5.16
11	6.19	6.19
12	7.43	7.43
13	8.92	8.92
14	10.70	10.70
15	12.84	12.84
16	15.41	15.41
17	18.49	18.49
18	22.19	22.19
19	26.62	26.62
20	31.95	31.95
21	38.34	38.34

**Price Mark up by firms:**

$$P_t = (1 + \mu)W_t \quad (1)$$

**Wage Mark up by unions**

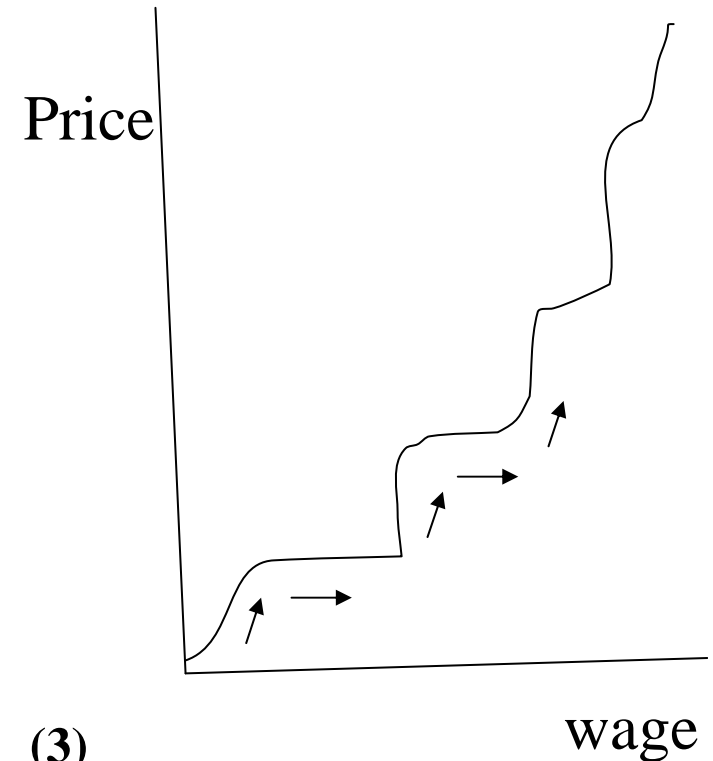
$$W_t = (1 + \gamma)P_t^e \quad (2)$$

**Price Wage Spiral**

$$P_t = (1 + \mu)(1 + \gamma)P_t^e \quad (3)$$

**Both mark-ups  $\mu$  and  $\gamma$  increase in the boom time and decrease in the slump.**

$$\mu + \gamma = a(y - \bar{y}) = -b(u - \bar{u}) \quad (4)$$



# Derivation of Expectation Augmented Phillips Curve from Aggregate Supply

AS: 
$$P_t = P_t^e + a(Y_t - Y_n) \quad (1)$$

Subtract  $P_{t-1}$  from both sides:

$$P_t - P_{t-1} = P_t^e - P_{t-1} + a(Y_t - Y_n) \quad (2)$$

$$\pi_t = \pi_t^e + a(Y_t - Y_n) \quad (3)$$

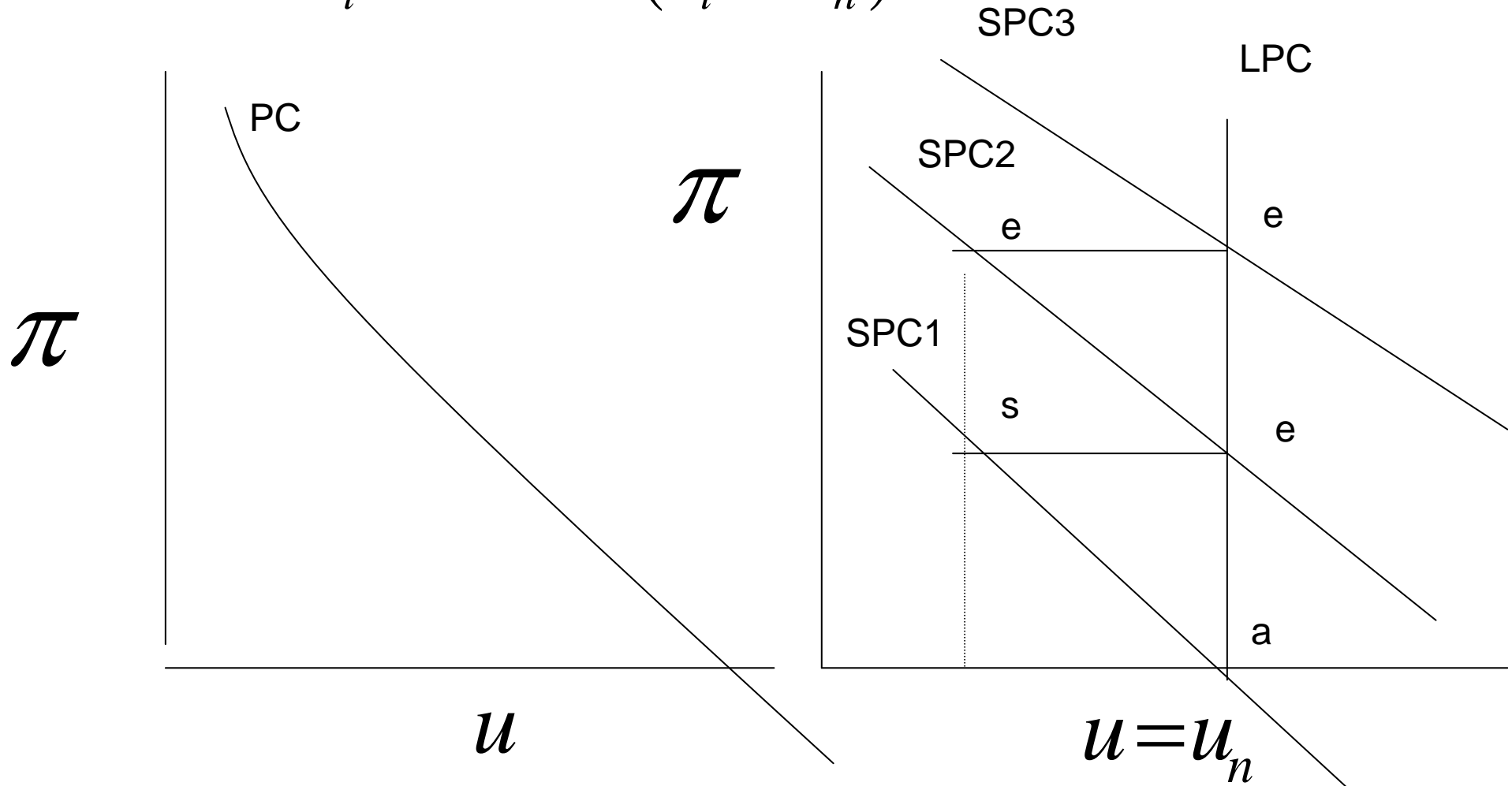
OKun's Curve: 
$$(Y_t - Y_n) = -k(u_t - u_n) \quad (4)$$

Expectation Augmented Phillips' Curve:

$$\pi_t = \pi_t^e - ak(u_t - u_n) \quad (5)$$

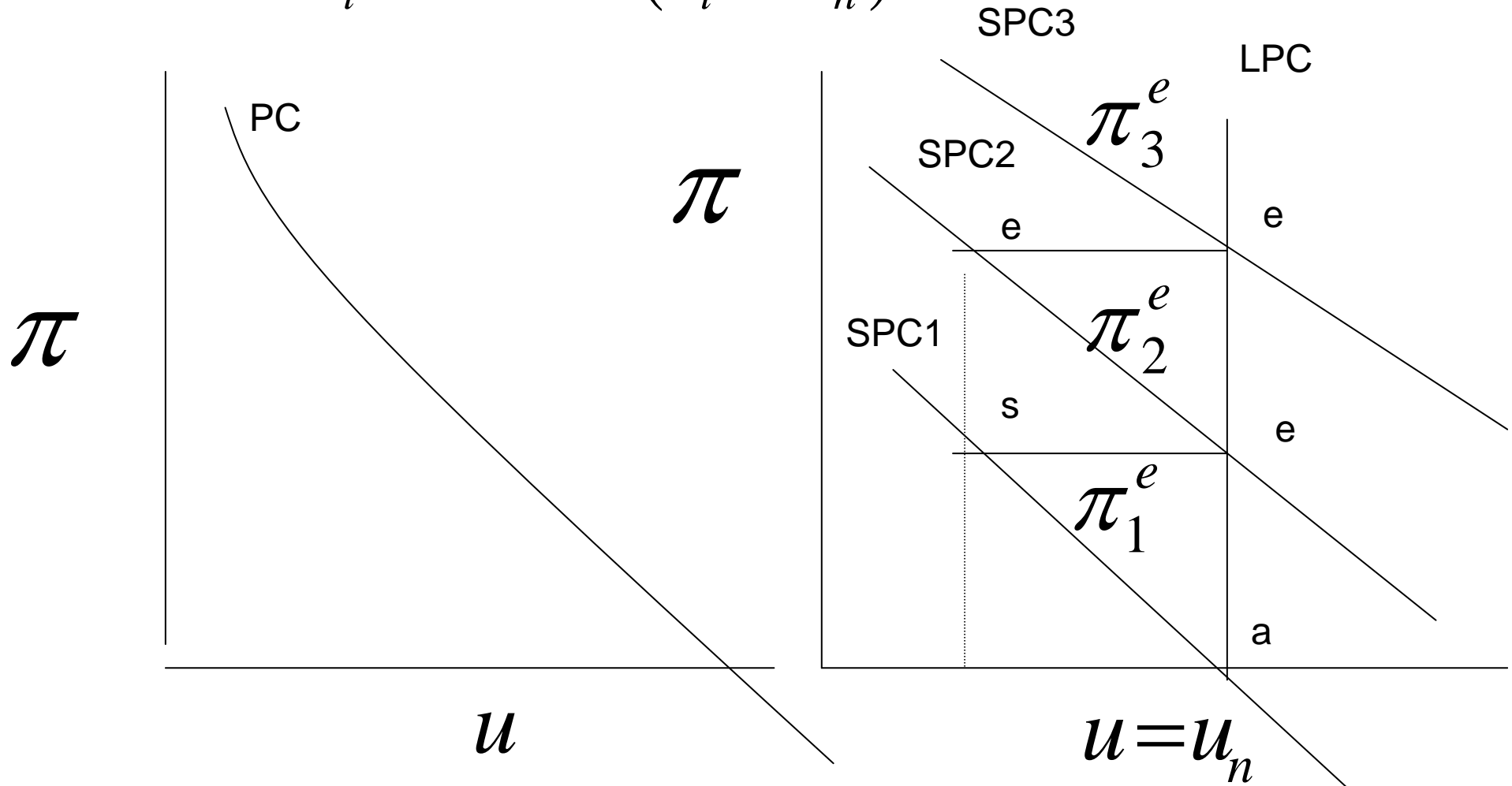
# Phillips Curve and Expectation Augmented PC (NAIRU)

$$\pi_t = \pi^e - b(u_t - u_n)$$

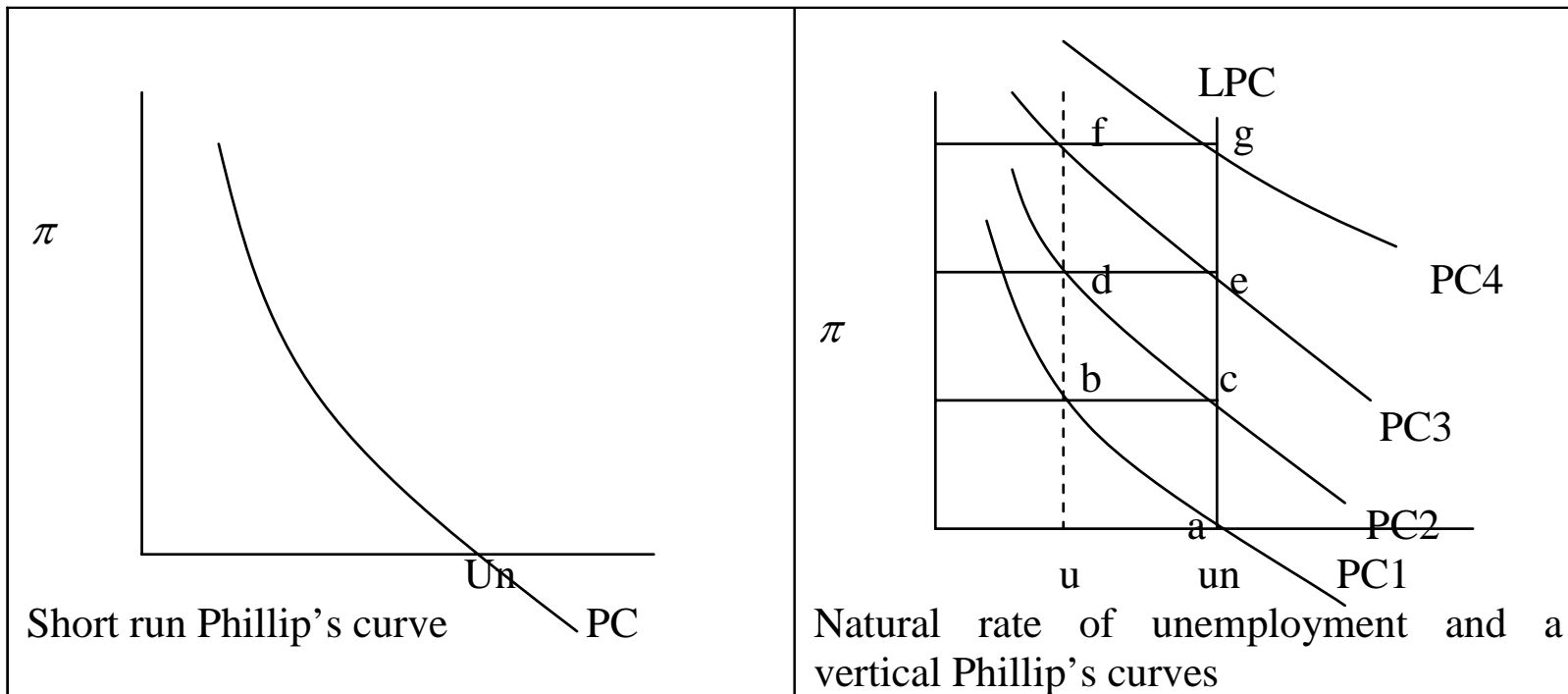


# Phillips Curve and Expectation Augmented PC (NAIRU)

$$\pi_t = \pi^e - b(u_t - u_n)$$



# Phillips Curve and Expectation Augmented PC (NAIRU)



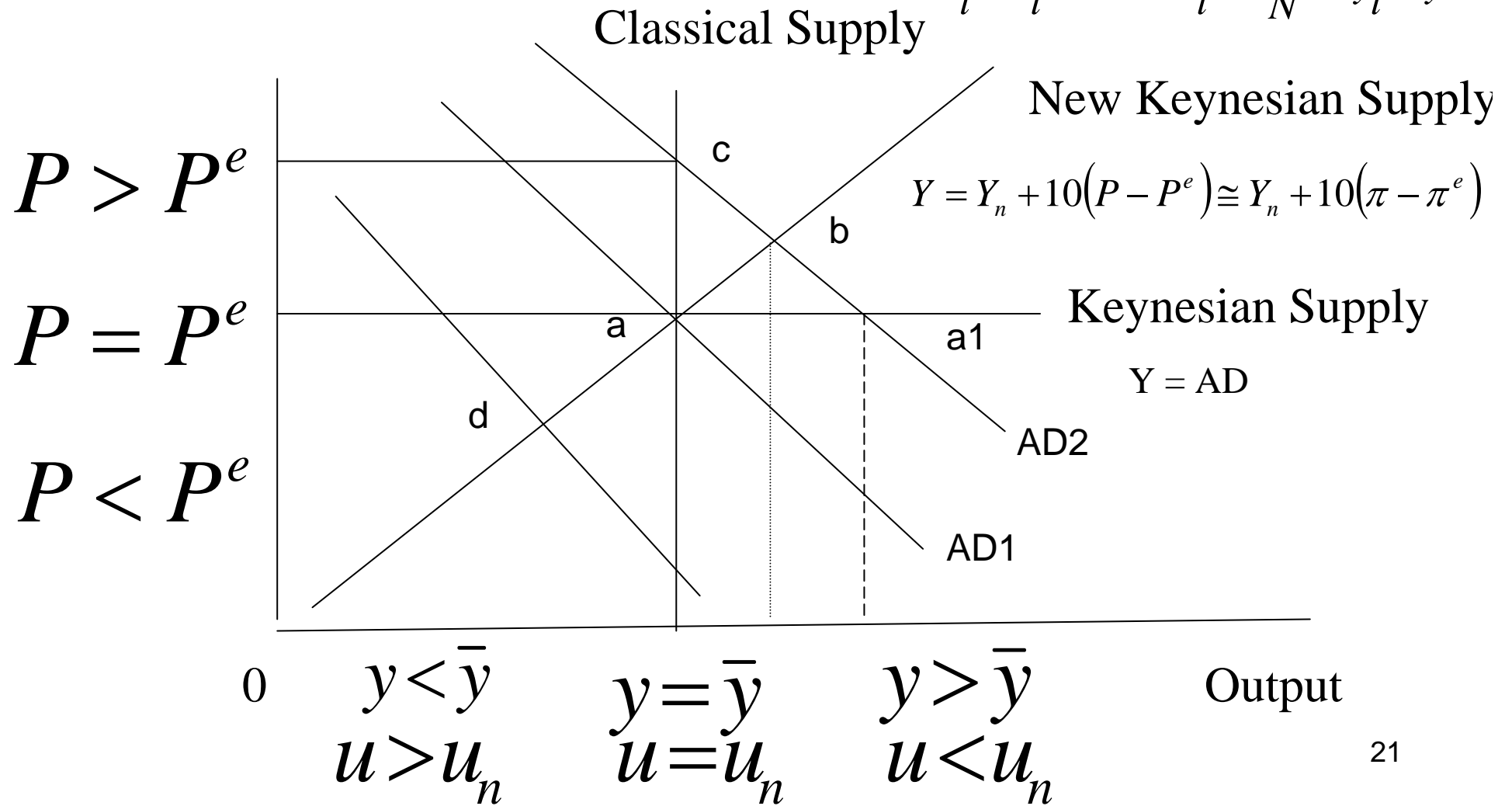
# Classical, Keynesian and New Keynesian Aggregate Supply curves

Supply curves

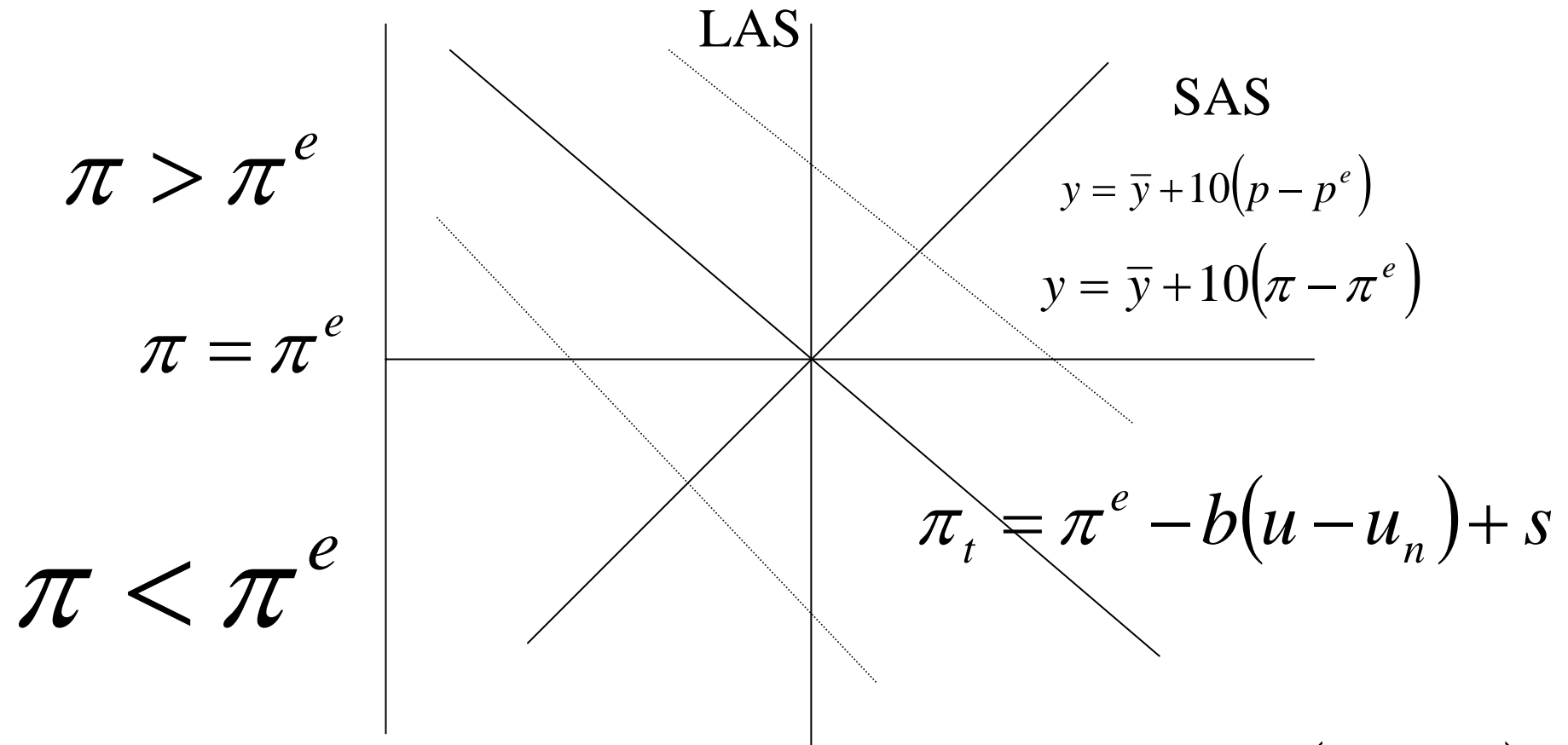
$$P_t > P_t^e \Rightarrow u_t < u_N \Rightarrow y_t > \bar{y}$$

$$P_t < P_t^e \Rightarrow u_t > u_N \Rightarrow y_t < \bar{y}$$

$$P_t = P_t^e \Rightarrow u_t = u_N \Rightarrow y_t = \bar{y}$$



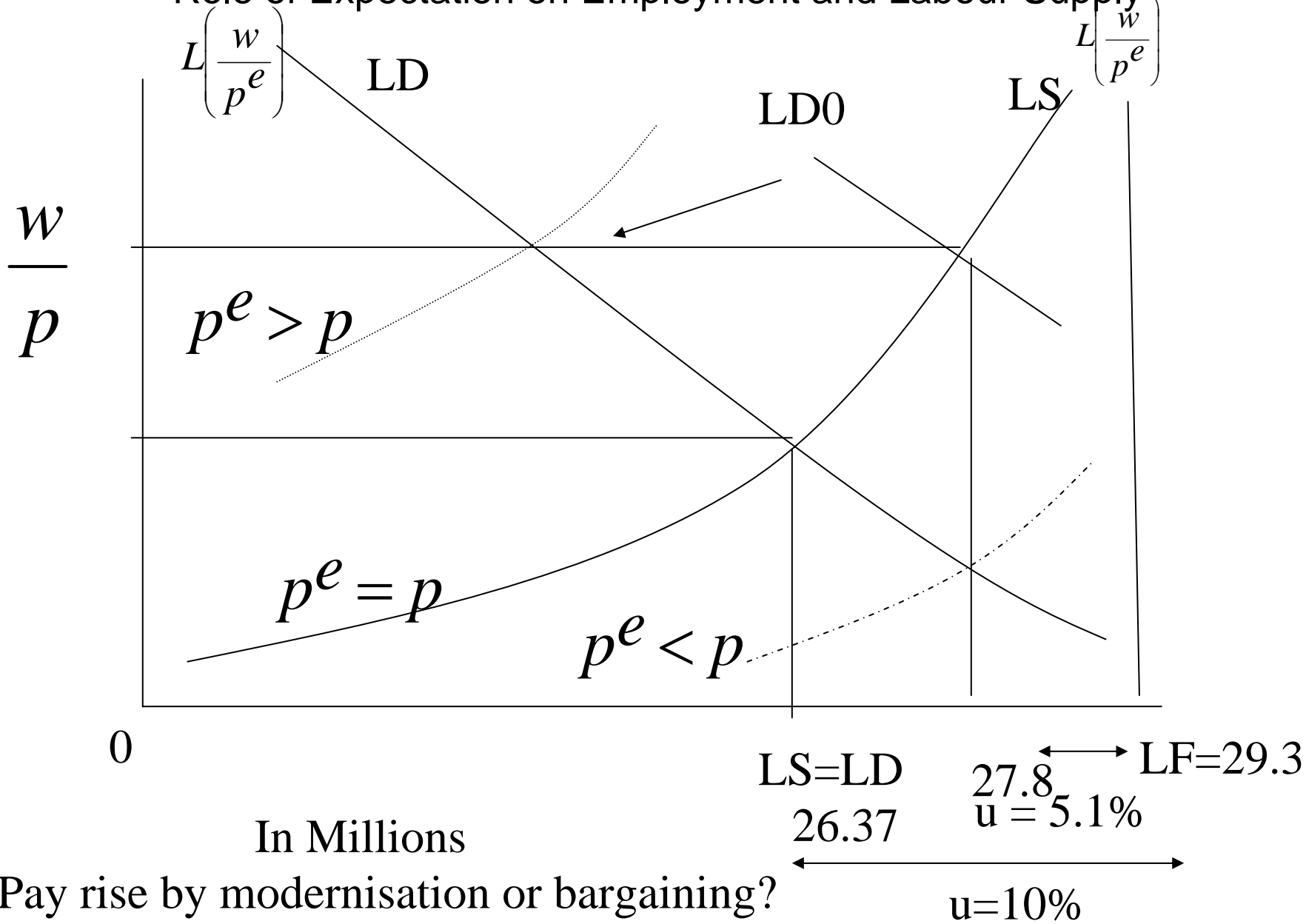
# Aggregate Supply, Inflation and natural rate of unemployment hypothesis



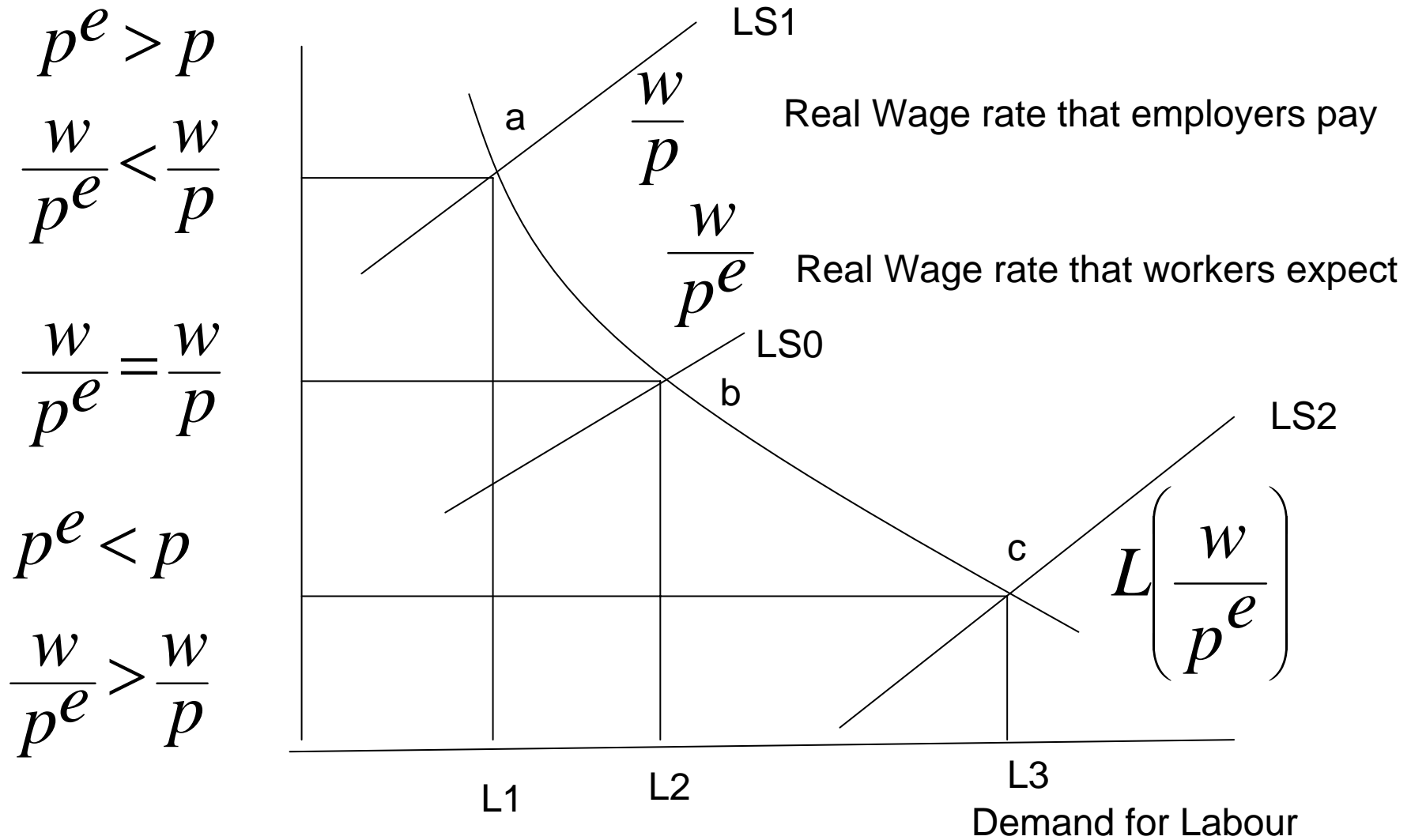
Summary:

	o					
$\pi_t > \pi_t^e$	$\Rightarrow$	$u_t < u_N \Rightarrow y_t > \bar{y}$	$y < \bar{y}$	$y = \bar{y}$	$y > \bar{y}$	$(u - u_n)$
$\pi_t < \pi_t^e$	$\Rightarrow$	$u_t > u_N \Rightarrow y_t < \bar{y}$	$u > u_n$	$u = u_n$	$u < u_n$	
$\pi_t = \pi_t^e$	$\Rightarrow$	$u_t = u_N \Rightarrow y_t = \bar{y}$				

# Role of Expectation on Employment and Labour Supply



# When Expected Price Level is Higher than Actual Price it Reduces the Supply of Labour



a: low employment equilibrium b: original equilibrium c: high employment equilibrium

## Specification of the Panel Data Model

$$u_{i,t} = \beta_{0,i,t} + \beta_{1,i,t} \pi_{i,t} + e_{i,t}$$

$$e_{i,t} \sim N(0, \sigma_i^2)$$

$$\beta_{1,OLS} = \frac{\sum_i \sum_t (\pi_{i,t} - \bar{\pi})(u_{i,t} - \bar{u})}{\sum_i \sum_t (\pi_{i,t} - \bar{\pi})^2} = \frac{t_{xy}}{t_{xx}}$$

$$t_{xy} = \sum_i \sum_t (\pi_{i,t} - \bar{\pi})(u_{i,t} - \bar{u}) = \sum_i \sum_t (\pi_{i,t} - \bar{\pi}_i + \bar{\pi}_i - \bar{\pi})(u_{i,t} - \bar{u}_i + \bar{u}_i - \bar{u})$$

$$\sum_i \sum_t ((\pi_{i,t} - \bar{\pi}_i)(u_{i,t} - \bar{u}_i)) + T \sum_i (\bar{\pi}_i - \bar{\pi})(\bar{u}_i - \bar{u}) = W_{xy} + b_{xy}$$

## Specification of the Panel Data Model

Between Group Effect

$$\hat{\beta}_b = \frac{\sum (\pi_{i,t} - \bar{\pi})(u_{i,t} - \bar{u})}{\sum (\pi_{i,t} - \bar{\pi})^2}$$

Within Group Effect

$$\hat{\beta}_W = \frac{\sum_i (\pi_{i,t} - \bar{\pi}_t)(u_{i,t}^t - \bar{u}_t)}{\sum_i (\pi_{i,t} - \bar{\pi}_t)^2}$$

$$t_{xx}\beta_{OLS} = t_{xy} = W_{xy} + b_{xy} = \hat{\beta}_W \frac{W_{xx}}{W_{xx} + b_{xx}} + \hat{\beta}_W \frac{b_{xx}}{W_{xx} + b_{xx}}$$

$$u_{i,t} = \alpha_{1,1}D_{1,i} + \alpha_{1,2}D_{2,i} + \dots + \alpha_{1,m}D_{m,i} + \alpha_{1,i}\pi_{i,t} + e_{i,t}$$

Dynamic Panel

$$u_{i,t} = \beta_{0,i,t} + \beta_{1,i,t}\pi_{i,t} + \gamma_{1,i}u_{i,t-1} + e_{i,t}$$

## Determinants of Unemployment in OECD economies: Results from a Static Panel Data Model (OLS Estimation)

	Coefficient	Std.Error	t-value	t-prob
CPI	-0.0259	0.0010	-25.2000	0.0000
Australia	0.2600	0.0063	41.1000	0.0000
Austria	-0.1519	0.0039	-38.6000	0.0000
Belgium	-0.0252	0.0033	-7.7400	0.0000
Canada	0.0238	0.0004	58.8000	0.0000
Check Rep.	-0.2657	0.0052	-51.4000	0.0000
Denmark	0.2006	0.0000	5525.0000	0.0000
EU	0.2218	0.0053	42.0000	0.0000
Spain	0.6856	0.0117	58.6000	0.0000
Finland	0.2310	0.0030	76.9000	0.0000
France	0.1317	0.0014	96.6000	0.0000
Germany	0.0372	0.0001	432.0000	0.0000
Great Britain	0.4365	0.0059	74.0000	0.0000
Ireland	0.5869	0.0037	157.0000	0.0000
Italy	0.5947	0.0114	52.2000	0.0000
Japan	-0.0560	0.0100	-5.6100	0.0000
Luxumberg	-0.0798	0.0031	-25.6000	0.0000
Mexico	5.3772	0.0162	332.0000	0.0000
Netherland	0.0019	0.0085	0.2280	0.8200
Norway	0.1489	0.0033	45.5000	0.0000
NewZealand	0.4810	0.0095	50.8000	0.0000
Portugal	1.3950	0.0201	69.3000	0.0000
Sweden	0.0697	0.0086	8.1100	0.0000
USA	0.0000			
Constant	3.0476	0.0728	41.9000	0.0000

Sigma	1.766	sigma^2	3.119479
R^2	0.427		
RSS	9105.759	TSS	15881.454959
no. of observations	2944	no. of parameters	25

Unemployment rate and inflation:  
 results from the Dynamic Panel Estimation from the OECD economies (GMM estimations)

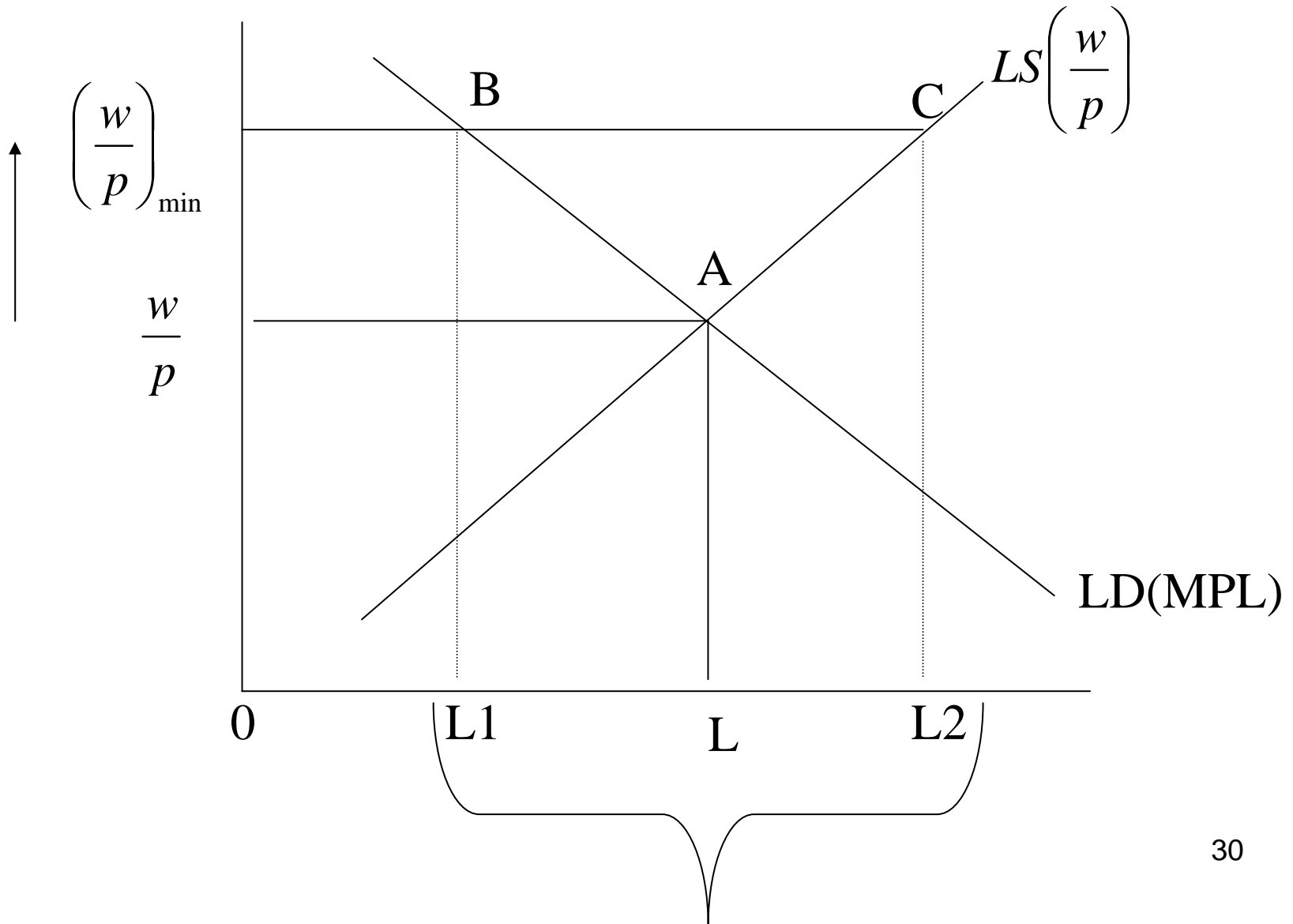
	Coefficient	Std.Error	t-value	t-prob
Unemp(-1)	0.3947	0.1049	3.7600	0.0000
Time(-1)	0.0334	0.0032	10.3000	0.0000
Australia	-0.1658	0.0112	-14.7000	0.0000
Austria	0.1740	0.0156	11.1000	0.0000
Belgium	0.1706	0.0171	9.9600	0.0000
Canada	0.0262	0.0045	5.7800	0.0000
Che	0.2357	0.0221	10.7000	0.0000
Denmark	0.0839	0.0143	5.8900	0.0000
EU	-0.1230	0.0079	-15.6000	0.0000
Spain	-0.1886	0.0178	-10.6000	0.0000
Finland	0.0036	0.0106	0.3380	0.7350
France	0.0451	0.0117	3.8600	0.0000
Germany	0.0368	0.0063	5.8300	0.0000
Great Britain	-0.0716	0.0132	-5.4100	0.0000
Ireland	0.0443	0.0254	1.7400	0.0820
Italy	-0.2162	0.0156	-13.9000	0.0000
Japan	0.5464	0.0612	8.9300	0.0000
Luxumberg	0.1478	0.0150	9.8400	0.0000
Mexico	1.2529	0.2865	4.3700	0.0000
Netherland	0.3800	0.0370	10.3000	0.0000
Norway	-0.0797	0.0051	-15.5000	0.0000
NewZealand	-0.1538	0.0144	-10.6000	0.0000
Portugal	-0.1331	0.0538	-2.4700	0.0130
Sweden	-0.2738	0.0216	-12.7000	0.0000
USA	0.0000			
CPI	1.0005	0.1682	5.9500	0.0000
CPI(-1)	-1.0557	0.1741	-6.0600	0.0000
Constant	1.7581	0.2570	6.8400	0.0000

Sigma	1.266	Singma <sup>^</sup> 2	1.603	
R <sup>^</sup> 2	0.7075527			
RSS	4638.684	TSS	15861.60 9	
no. of observations	2921 no.	No.of parameters		28

# Four Theories of Unemployment

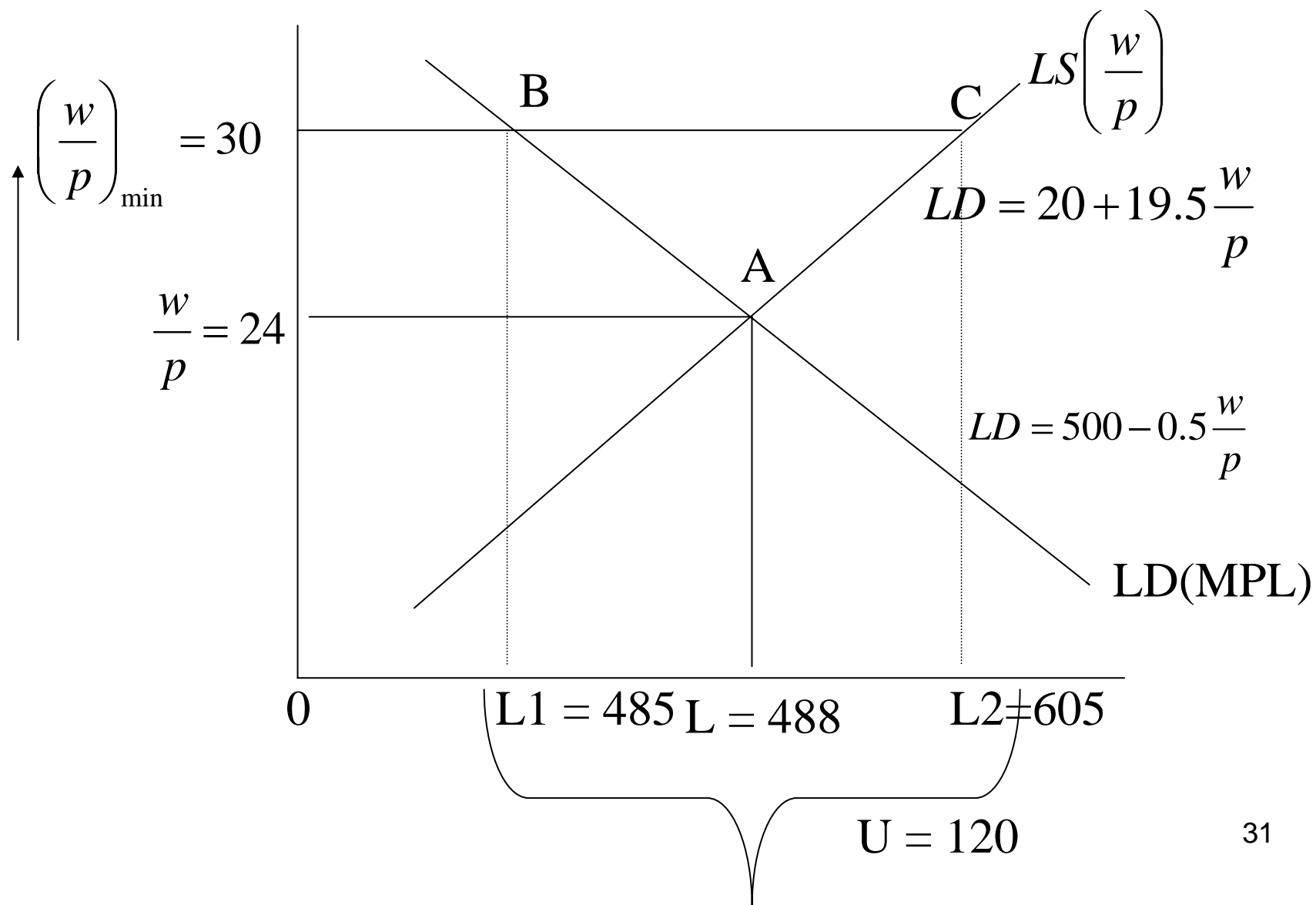
- Unemployment in the Classical Model
- Insider-outsider theory: Unions
  - individual and collective labour supply
  - wage setting and price setting
- Efficiency wage theory:
  - no shirking,
  - no turnover costs
  - nourishment
  - adverse selection
- Frictional and structural unemployment model: Search and Employer-Employee job matching theory
- Lottery theory
- Individual and collective labour supply model of involuntary unemployment
- Hysteresis, persistence or random walk theory of unemployment

# Unemployment in the Classical Model: Minimum wage and Labour Market Rigidity



# Unemployment in the Classical Model: A Numerical Example

## Minimum wage, Labour Market Rigidity and Involuntary unemployment



## Union-Employer Bargaining Model of the Natural Rate of Unemployment Model (Blanchard)

Price setting:  $P = (1 + \mu)W$

Wage setting:  $W = P^e N^s(u; z)$

Production function  $Y = N$

$P$  = price level,  $P^e$  expected price level,  $W$  = wage rate

$\mu$  = price mark up by firms  $u$ =unemployment rate,

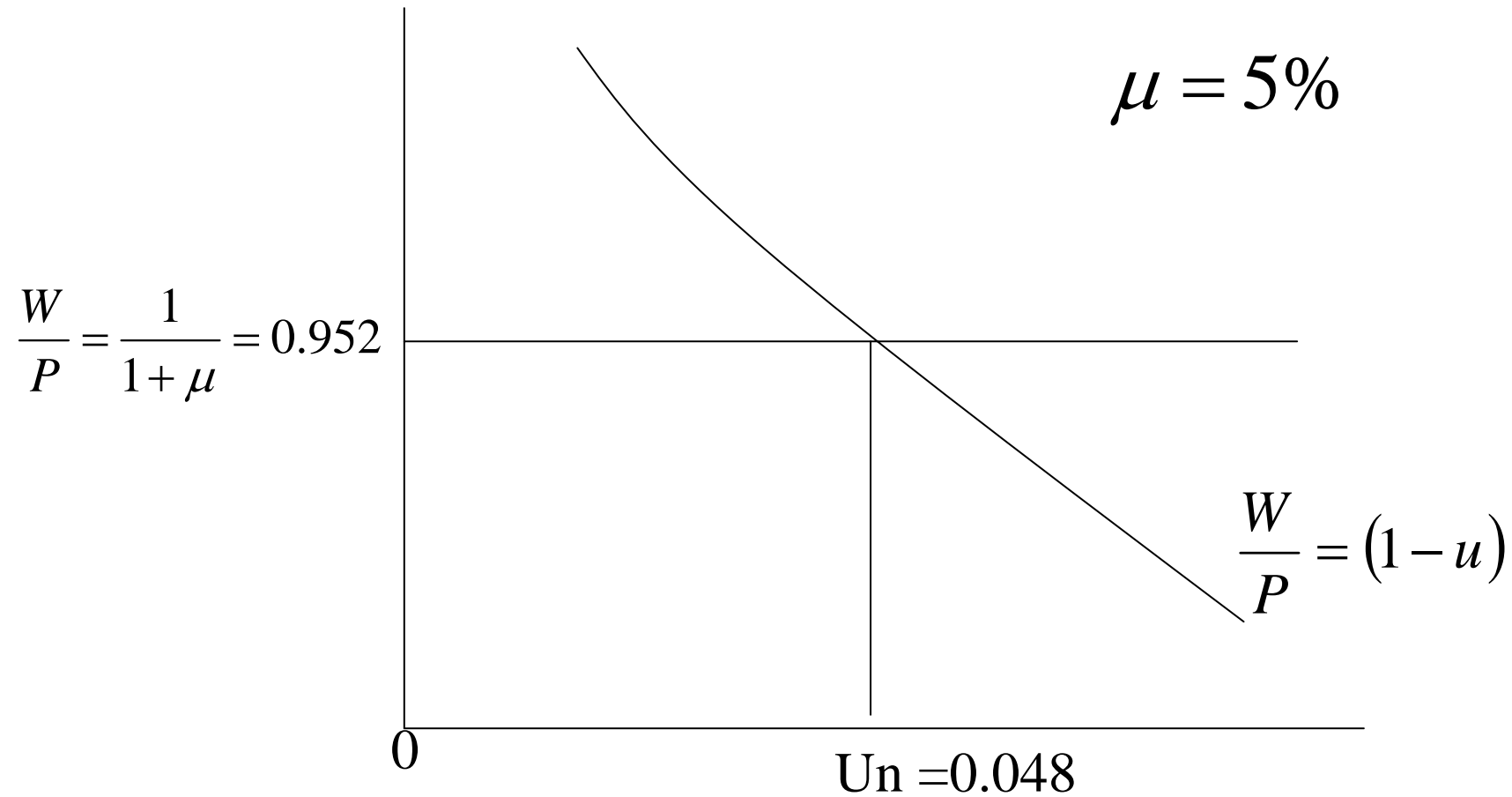
$L$  = labour force,  $N$ = number of employed people

$Z$  labour market factors such as

reservation wage, taxes, union bargaining power,  
upward pressure on wages by minimum wage laws,  
benefits and efficiency wage arguments, Structural  
change

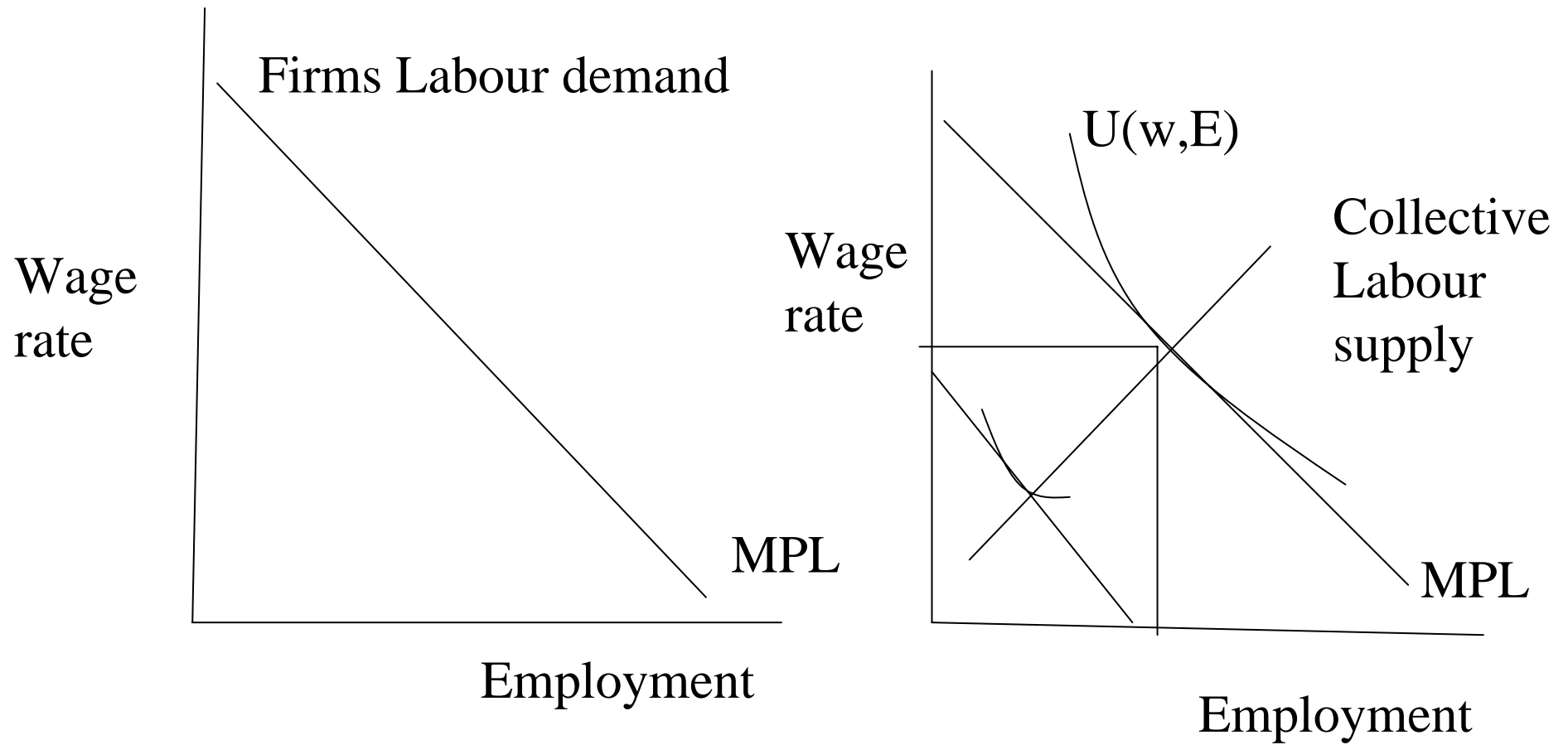
Firms set price with a mark up on wage rate. Union's demand for wage depends on labour market factors,  $Z$ . Natural rate of unemployment is outcome of the union-firm (employer) bargaining process.

# Real wage, Mark up and the Natural Rate of Unemployment

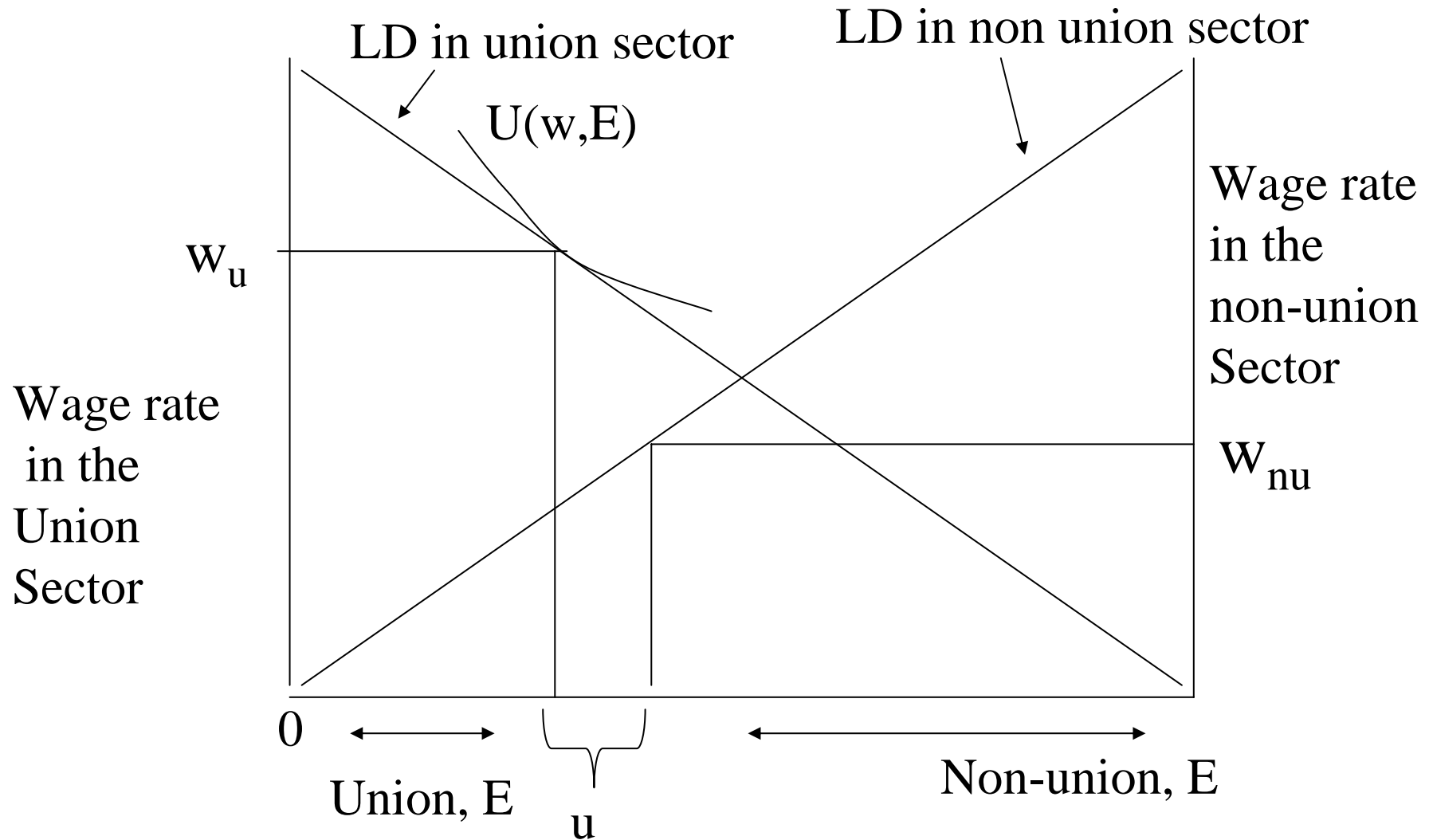


# Firms Demand for labour

## Unions wage employment preference



# Insider-Outsider Model of Unemployment with Wage rates and Employment in the Union and Non-union Sectors



# Frictional Unemployment

Labour force:  $L = E + U$

Unemployment:  $\Delta U = sE - fU$

Steady state

$$\left\{ \begin{array}{l} \Delta U = 0 \\ sE = fU \\ s(L - U) = fU \end{array} \right.$$

Frictional Unemployment rate:  $\frac{U}{L} = \frac{s}{s + f}$

## Frictional Unemployment Rate

Labour force:  $L = E + U$

$(\Delta U)$  Change in the number of people unemployed

$(sE)$  those who quite the job and

$(fU)$  those who find a new job:

$$\Delta U = sE - fU$$

Labor market balance in the steady state

$$\Delta U = 0$$

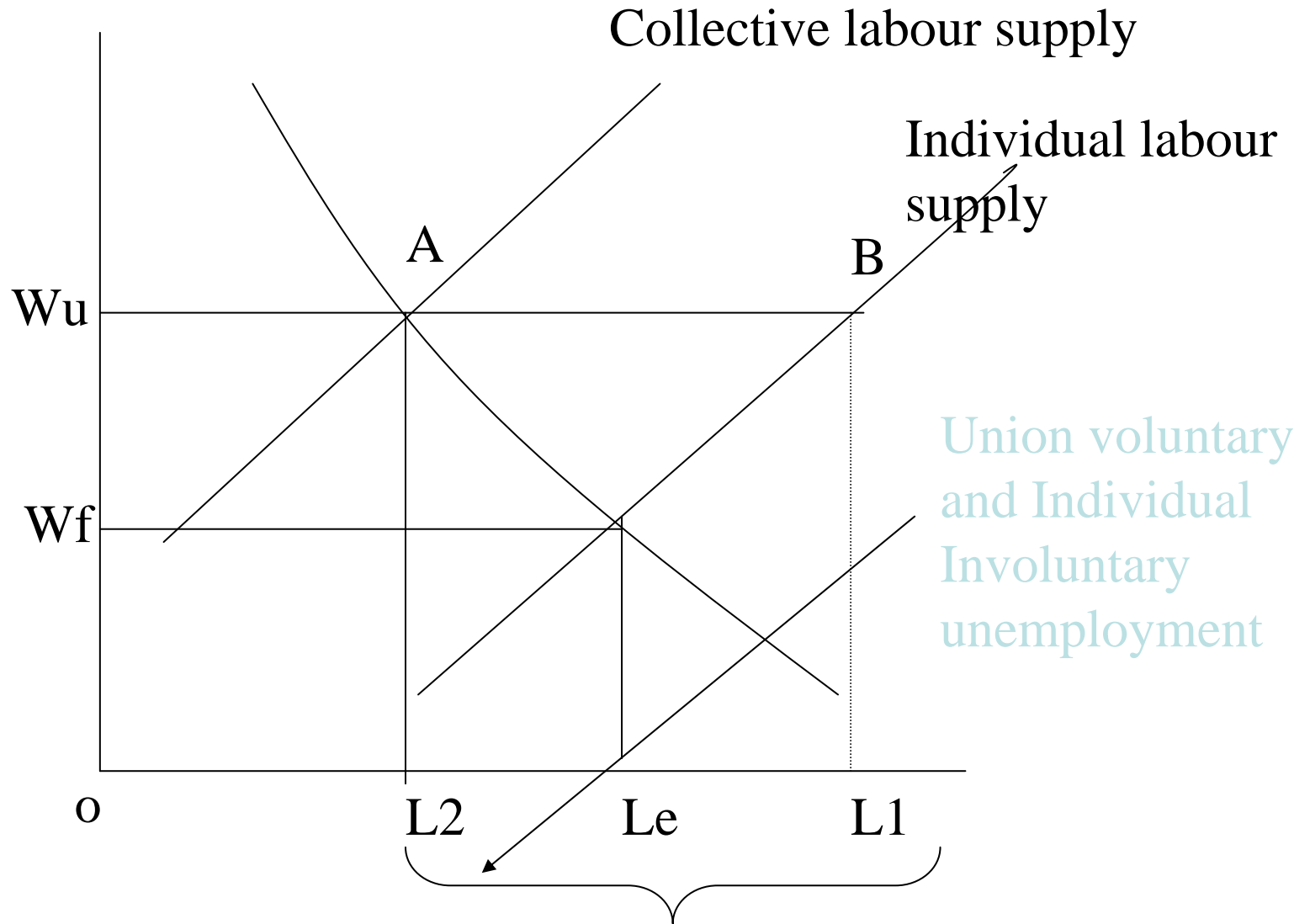
$$sE = fU \quad \text{or} \quad s(L - U) = fU$$

Unemployment rate:  $\frac{U}{L} = \frac{s}{s + f}$

unemployment rate is high if  $s$  is high.

$s$  = separation rate  $f$  = finding rate

# Involuntary Unemployment in the Collective Bargaining



# Structural unemployment: Labour Market Rigidity

- It occurs because of redundancies due to the structural change in the economy.
- Some skills become obsolete and people with these skills become unemployed.
- It happens when an old technology is replaced by new technology of production.
- Some sectors and regions experience outflow of capital resources, become less attractive place for investment, therefore experience less demand for labour and higher unemployment rate.

## Measures to reduce unemployment rate

- European governments have taken several steps to solve the problem. Structural unemployment is gradually declining in Europe in late 1990s for reasons such as:
- tighter benefit eligibility criteria
- “New Deal” type measure which makes work pay by carrot and stick policy
- use of information technology in creating vacancy databases which any job seeker can easily access using touch screens in local labour market offices
- CV data banks where employer can access CVs of job applicants
- One-stop shop concept which bring different services required by a job seeker into a single place e) strengthening of Public employment services
- Supply side: manpower planning approach to unemployment problem: skill formation, New Deal – unemployment to work programmes.

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