UNIT 14 SEARCH THEORY AND UNEMPLOYMENT

Structure

14.0 OBJECTIVES

After going through this unit you should be in a position to

- explain the basic difference between Walrasian and non-Walrasian theories of unemployment;
- appreciate that the search and matching models are an extension of the neoclassical/monetarist theories of employment and unemployment;
- appreciate the context in which the search theory of unemployment was developed;
- explain the use of a specific search and matching model to determine unemployment and its variation over time; and
- explain some alternative search and matching models.

14.1 INTRODUCTION

Traditional theories of aggregate employment and output can broadly be classified into two categories:

a) Neoclassical/ Monetarist theories

b) Keynesian theories

The neoclassical/ monetarist theories are elegant, but have the drawback that they are unable to explain prolonged periods of involuntary unemployment that characterise the real world. In these theories the prevailing unemployment is always voluntary unemployment. Keynesian theories, on the other hand, explain the real world phenomenon of unemployment as involuntary unemployment by invoking the idea of deficiency of aggregate demand, but these theories lack the elegance of the neoclassical/monetarist models of employment and output. In particular, the models do not provide microeconomic foundations for the

rigidities in prices and wages that are postulated to show the existence of involuntary unemployment in the economy.

In this and the next two units of this block we will examine further developments of these traditional theories. The main difference between the developments based on the neoclassical theories and the developments springing from the Keynesian theories is that the former are based on the Walrasian general equilibrium model of perfectly competitive markets, whereas the latter are based on some non-Walrasian features introduced into the analysis, e.g., imperfect competition. In a Walrasian general equilibrium model, labour market is, like all other markets in the economy is a perfectly competitive one and there is no reason why the market should not clear. Involuntary unemployment is inconsistent with a Walrasian setting, so that if unemployment exists, it must be due to some non-Walrasian characteristics of the labour market.

The search theory that we are going to study in this unit becomes important because it shows that unemployment can exist as an equilibrium phenomenon even in a Walrasian setting of perfectly competitive labour markets. We begin, in Section 14.2, placing the search theory in the context of other theories of unemployment that you have studied, or are going to study in this block.

14.2 SEARCH THEORY AND THEORIES OF UNEMPLOYMENT

You must understand the search and matching theories of unemployment in the context of other theories of unemployment. With this objective in view, we classify, in this section, the theories of unemployment that we are studying into four kinds. The classification is based on Chapter 9, Section 9.1, of Romer (2001).

If there is unemployment in a Walrasian labour market, unemployed workers would immediately bid down wages until supply and demand for labour are again in balance. If this process of bidding down wages is not working freely, there must be distinct reasons for it. We classify the theories of unemployment according to whether the process of wage adjustment is working or not, and according to the reason why it is not working in cases where it does not work. In particular, consider an unemployed worker, who claims to be identical to a firm's current workers, and who offers to work for the firm at a marginally lower wage than the one the firm is currently paying to its workers. There are four possible responses of the firm, giving us four kinds of theories of unemployment. These responses are:

i) If the firm accepts the worker's offer, we can conclude that the market for labour is Walrasian. In this view all observed unemployment is voluntary unemployment – unemployment of people moving between jobs and of those who are ready to work only at wages higher than the prevalent wage rate. This is really the *neoclassical model* of unemployment referred to above.

ii) Secondly, the firm can respond to the unemployed worker's offer by saying that it does not accept the premise that the unemployed worker is identical to the firm's current employees. In this view, the labour market is not a market for a homogenous commodity, but is characterised by heterogeneity. Each job is unique and requires the unique skills that are embodied in an individual. The unemployed workers are matched with existing vacancies not through the market, but through a complex process of search and match. The models of unemployment that postulate such a process are called *search and matching models.*

iii) Thirdly, the firm can respond by saying that, even though it would like to cut the wages and employ the additional worker, it cannot do this because it is bound by implicit and explicit agreements with its workers, arrived at through collective bargaining, regarding the wages that have to be paid. Wages are thus institutionally determined in these models known as *contracting models.*

iv) Lastly, the firm may respond by saying that it does not want to reduce real wages – it believes that the benefits accruing to it from higher wages are more than the costs of maintaining wages high. Theories that build up on this idea are called *efficiency-wage theories* in an obvious reference to the fact that higher wages impart benefits to the employing firm by improving the efficiency of labour.

In this unit, you will study in detail one of the search and matching models of unemployment referred to in (ii) above. You will study the contracting models and the efficiency-wage theories of unemployment, referred to respectively in (iii) and (iv) above, under the rubric of the New Keynesian Theories of Unemployment in Unit 16.

Check Your Progress 1

1) Why is a Walrasian general equilibrium model inconsistent with unemployment?

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2) Suggest a classification of theories of unemployment based on the postulated responses of a firm to an offer by an unemployed worker to work for it at a slightly lower wage.

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14.3 SEARCH THEORIES – A BRIEF HISTORICAL OVERVIEW

A search theory of unemployment is found even in the writings of A. C. Pigou in the inter-war period. To explain the high unemployment prevalent at that time Pigou used an idea you are very familiar with – that workers are unemployed because wages are too high. Keynes contested this idea in the development of his *General Theory of Employment, Interest and Money.* But initially Pigou had tried to explain the high unemployment of the inter-war period with reference to another idea – the idea of frictional unemployment, where unemployment arises as workers shift between jobs, moving to jobs where their productivity is higher. Search and matching unemployment is actually a form of frictional unemployment – unemployment which arises because of the frictions in shifting between jobs generated by the fact that skills are to be matched with vacancies in the job 'market'. Pigou himself was aware

though that jobs were not shifting around too much in the 1920s, so that he ultimately banked more on 'workers pricing themselves out of the market through trade union activities' as an explanation for the inter-war unemployment.

The idea of search unemployment was subsequently formalised in the 1970s and 1980s to make the neoclassical Walrasian model accord with the reality of the empirically observed and varying unemployment in the labour market, as has been indicated to you in the introductory section. The importance of search in decentralised markets was first emphasized in an influential book edited by Edmund Phelps in 1970 (*Microeconomic Foundations of Employment and Inflation Theory*, Norton, New York). This book contains some of the first formal models using search theory to explain unemployment as an equilibrium phenomenon. Lucas and Prescott presented in 1974 a general equilibrium model of unemployment. In this model stochastic sectoral shocks induce workers to move between sectors, but there is a one-period lag by workers in moving between sectors, brought about through search and matching kind of considerations. Unemployment is generated in the model by this lag.

In the 1980s, search models were built up as continuous time general equilibrium models, in the tradition of the models built under the real business cycle theory. Noteworthy amongst these are the models by Peter Diamond: the paper titled "Mobility Costs, Frictional Unemployment, and Efficiency" published in the *Journal of Political Economy* in 1981, and by Christopher Pissarides: the paper titled "Short-Run Equilibrium Dynamics of Unemployment, Vacancies, and Real Wages" published in the *American Economic Review* in 1985. We have reproduced the titles of the papers for you because they provide a flavour of the concepts and mechanisms used to rationalize unemployment as an equilibrium phenomenon in a Walrasian model. We will examine, very briefly, the model by Pissarides in Section 14.5. Before that, however, let us develop a more complete model of search unemployment in the next section.

Check Your Progress 2

1) Why was it necessary to augment the neoclassical/ monetarist theory of employment through search and matching kind of models?

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2) What is frictional unemployment?

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14.4 A SEARCH AND MATCHING MODEL

It should be clear to you from the earlier section that there are a variety of models under the rubric of search theory. In this section we examine one such

model at close quarters. Peter Howitt originally developed the model as "Business Cycles with Costly Search and Recruiting" in the *Quarterly Journal of Econometrics* in 1988. The exposition here is based on Blanchard and Fischer (2000). Unlike in other sections of this unit, the exposition in this section is necessarily more technical. It is important to follow it through, perhaps with the help of the book, in order to get a flavour of the kind of analysis that you will find in the literature today. The approach is descriptive and the use of equations is minimised. Going through equations, however, can add to the understanding of the expounded ideas and you are advised to follow the equations-based exposition of the model in Blanchard and Fischer (2000).

14.4.1 Model Specification

We proceed with the model specification in the following steps.

1) The economy is composed of competitive firms (F in number) and identical workers (N in number). In each discrete time period a fraction δ of the employed is laid off and joins the unemployment pool. The fraction δ is called the 'rate of separation' in the literature. Firms hire workers from the pool, not directly from other firms.

2) The marginal cost of hiring for each firm is an increasing function of its level of hiring. This captures the idea that a high rate of hiring may force firms to increase their search intensity or, in a more general model with heterogeneous workers, to accept poor matches between workers and jobs. The marginal cost is also a decreasing function of aggregate unemployment – high aggregate unemployment makes it easier and cheaper for the firm to find willing and competent workers.

3) Since each firm chooses the rate of hiring by equating the marginal cost of hiring to the net marginal benefit of hiring, it is important to determine, in the model, the marginal benefit of hiring to the firm. Assuming a firm to be risk neutral, the marginal value to the firm of a worker hired in this period is the expected present value of his marginal product so long as he works with the firm. The marginal value, denoted by q_t, is therefore an infinite sum of discounted marginal productivities from the present period onwards to infinity. Two discounting factors are used on each term: one, as usual, to take account of time and the other to take account of the probability that a given worker will have left the job by time $(t + i)$.

4) The net marginal benefit of hiring is equal to this marginal value *minus* the discounted present value of wages to be paid to the worker who is newly hired. It is in the spirit of search and matching models to assume that there is no labour market in which the wage is set – job matches require an explicit search process. The wage is set through bargaining so as to divide the surplus from the job between the worker and the firm. To simplify matters, it is assumed in the present model that the worker experiences neither costs nor benefits from unemployment, so that the total surplus from the job is just the marginal value determined in paragraph 3 above. It is assumed that the worker obtains a share ξ of the surplus and the firm gets $(1 - \xi)$ with the size of ξ reflecting the bargaining power of the worker. Thus the marginal benefit of hiring to the firm is given as a fraction of the marginal value q_t:

$$\lambda_t = (1 - \xi).\, q_t$$

5) Each firm chooses the rate of hiring, h_t, by equating the marginal benefit of hiring specified in paragraph 4 above with the marginal cost of hiring determined in paragraph 2 above

14.4.2 Model Solution and the Equilibrium Rate of Unemployment

Given the above specification, the model can be solved for the marginal benefit of hiring, λ_t, and the hiring rate, h_t. If the employment in the firm is denoted by n_t, it follows that $n_t = (1 - \delta).n_{t-1} + h_t$, since employment in period t is given by employment in period (t – 1), as adjusted for the rate of separation and the rate of hiring. Assuming that there are F identical firms in the economy, the unemployment rate, denoted by u_t, is given by $1 - (F.n_t)/N$, where N is the total number of workers in the economy. These four equations for λ_t, h_t, n_t and u_t can be solved to obtain the equation characterising the dynamics of the equilibrium unemployment rate:

$$u_t = \delta + \{1 - \delta - (F/G)\lambda_t\}.u_{t-1}$$

In the above equation, G is a parameter in the cost of hiring function, such that a larger parameter value denotes higher difficulty of locating workers. The equation clearly shows that the unemployment rate depends on its own lagged value and the constant rate of separation, δ. It also depends on the state of technology via its dependence on the net marginal benefit of hiring, λ_t, since the latter depends on the marginal product of worker.

When the marginal productivity of labour is postulated to have zero variance, the natural rate of unemployment is given by

$$u^* = \delta/\{\delta + (F/G).k\}$$

A clear result emerges from this equation: the larger the separation rate, δ, and the larger the parameter G (reflecting the difficulty of locating workers), the higher is the rate of unemployment.

14.4.3 Optimality of the Equilibrium Unemployment Rate

The above model rigorously rationalizes the existence of unemployment. As we will see below, shocks to productivity can also be used to explain the variability of the equilibrium rate of unemployment over time. You should, however appreciate that the equilibrium rate of unemployment obtained in the above model is unlikely to be socially optimal. This is so for two reasons:

1) Hiring decision by a firm is beneficial to it to the extent that the net marginal benefit of hiring is positive, but it imposes a cost on other firms, an externality that is not taken into account by the hiring firm. By hiring an extra worker, the firm decreases unemployment, and since the marginal cost of hiring is a decreasing function of aggregate unemployment, the marginal cost of hiring to other firms is increased. This effect leads to too much hiring compared to the social optimum, and thus to too low an equilibrium rate of unemployment.

2) There is also a divergence between the social and private marginal benefit of hiring: the former is given by q_t, whereas the latter (the private benefit to the hiring firm) is given by a fraction $(1 - \xi)$ of q_t, depending on the bargaining power of the worker *vis-à-vis* the hiring firm. Since the private benefit is less than the social benefit ($\xi > 0$), there is too little hiring and thus too high an equilibrium rate of unemployment.

The two effects, in (1) and (2) above, work in opposite directions, one tending to increase the equilibrium rate above the socially optimum rate and the other tending to keep it below the social optimum. The net effect on the equilibrium rate of unemployment *vis-à-vis* the socially optimum rate is ambiguous in the model.

14.4.4 Dynamics of Unemployment and Real Wages through Productivity Shocks

The model that you are studying here is in the tradition of the real business cycle theory that you have studied in earlier units. As you know, this kind of a model works out the implications of shocks to productivity. The model has the following implications to employment and wages.

1) A temporary adverse shock to productivity decreases hiring (as it decreases the marginal productivity of labour and hence the benefit of hiring the marginal unit of labour) and increases unemployment. As the shock is, by definition, temporary, productivity and the net marginal value of labour return to their original level, but, it can be shown that the unemployment rate only slowly returns to normal through increased hiring. Moreover, since it is cheaper for the firm to hire when there are more unemployed, a productivity shock has greater effect on unemployment when it is high than when it is low. This is, of course, implicit in the non-linearity of the equation explaining u^*, the natural rate of unemployment.

2) The model explains why fluctuations in employment may be associated with smaller fluctuations in real wages. This will happen if ξ, the share obtained by workers, is constant, as is assumed in the model, and small. Real wages vary in the model with productivity and high rates of hiring are åssociated with high real wages. The model thus explains the observed empirical fact of a pro-cyclical increase in real wages, but to a smaller extent than the increase in employment, if the share obtained by workers is small in relation to that obtained by the hiring firms.

Check Your Progress 3

1) Explain why introduction of search and matching introduces equilibrium unemployment in a Walrasian model.

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3) Why is the equilibrium unemployment rate obtained in the Howitt (1988) model unlikely to be socially optimal?

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4) How does the Howitt (1988) model explain

   a) An increase in unemployment

   b) A smaller pro-cyclical response of real wages in relation to employment?

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14.5 SOME ALTERNATIVE SEARCH MODELS

In this section we look, briefly, at two more papers emphasizing frictions arising due to search and matching considerations: one by Pissarides that has been already referred to and another by David Lilien. The exposition here is again based on Blanchard and Fischer (2000).

The model developed in Section 14.4 is just one of the many search and matching models developed in the literature. In this section we examine, briefly, some alternative search and matching models. One of the shortcomings of the Howitt (1988) model that was discussed in Section 14.4 is that it simply postulates that search and matching is undertaken by workers and firms, but does not specify the search technology and the matching process used by workers and firms. Also the Howitt model takes the share of workers parameter, ξ, as given. Pissarides developed a closely related model in 1985 wherein these shortcomings were addressed. The model clearly shows that unemployment emerges as an equilibrium phenomenon in an otherwise neoclassical model that is characterised by workers moving from one job to another and remaining unemployed in the interim during their search for the right kind of job as a replacement for the job they have discarded. The approach shows explicitly the dependence of the rate of hiring on the characteristics of the labour markets. Moreover, unlike in the Howitt model, the Pissarides model helps in thinking about what determines the share of workers parameter ξ in the bargaining process between the workers and the firms – the parameter value depends on the option that the workers have in turning down the match and looking for another match.

Models have also been developed to capture the effects of sectoral shocks – changes in relative productivity or changes in relative demand for goods – on aggregate equilibrium unemployment. David Lilien emphasized frictions arising due to the inability of labour to relocate instantaneously and costlessly between sectors in a paper titled "Sectoral Shifts and Cyclical Unemployment" published in the *Journal of Political Economy* in 1982. Consider an economy with two sectors. Labour is immobile between sectors within periods but fully mobile across sectors over periods. Workers in each sector supply one unit of labour inelastically if the wage exceeds a reservation wage. Assume that the wage is sufficiently higher than the reservation wage in both sectors and that labour is fully employed between the two sectors. Assume further that labour demand shifts away from sector 1 toward sector 2, so that within the period wage increases in sector 2 and falls in sector 1. Since labour cannot shift from sector 1 to sector 2 within the period, employment cannot increase in sector 2, but falls in sector 1 due to the decrease in labour demand. The sectoral shift hence increases unemployment in the current period. In the following period labour reallocates itself and aggregate employment returns to normal.

14.6 SIGNIFICANCE OF THE CONCEPT AND THEORY OF SEARCH UNEMPLOYMENT

From what has been said earlier, you understand the significance of the theory of search unemployment as an attempt to endow realism to the elegant neoclassical model of employment and output. You should also understand the practical significance of the concept of search unemployment as it has worked itself out in the United States and in some of the countries of the European Union.

The idea of search unemployment gained importance in the US economy in the 1990s when the social security system was being restructured in that country. It

is easily understandable that the ability and desire of a person to keep looking for a better job and to remain unemployed in the mean time depends in part on the availability of unemployment benefits under such a system. The unemployment that arises when a person quits a job to have more time to look for a better job, or when an unemployed delays accepting a job in the hope of finding a better one, is of course the search unemployment that we have been discussing. If all jobs are the same, an unemployed person will take the first one offered. If some jobs are better than others, it is worthwhile searching and waiting for a good one. The higher the unemployment benefits, the more likely people are to keep searching for a better job, and the more likely they are to quit their current job to try to find a better one. It was consideration of these kinds that prompted the United States to restructure their unemployment benefits system in the 1990s. If unemployment rates in the European Union are by and large higher than those prevailing in the United States in recent years, part of the explanation is the fact that it is not as easy, as in the countries of the European Union, to obtain unemployment benefits in the United States after the revamping of their unemployment benefits system.

Check Your Progress 4

1) Explain briefly the ways in which the search model of Pissarides goes beyond the Howitt model.

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2) Why should a sectoral shift in labour demand generate higher aggregate unemployment?

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3) How will you use the concept of search unemployment to explain the differences between the United States and the European Union vis-à-vis their unemployment rates?

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14.7 LET US SUM UP

The neoclassical theory of employment and output is theoretically elegant, but does not accord with the empirically observed fact of prolonged periods of high unemployment. The search theory of unemployment attempts to remedy this drawback of the neoclassical theory. The existence of unemployed workers in the context of the neoclassical model would imply a fall in wages in the market for labour. In the context of search and matching models, though, the labour market is not a market for a homogenous commodity, but is characterised by heterogeneity. Each job is unique and requires the unique skills that are embodied in an individual worker. Unemployed workers are matched with existing vacancies not through the market, but through a complex process of

search and match. This generates a frictional kind of unemployment. Indeed the origins of the search and matching models can be traced all the way back to Pigou's explanation of the inter-war unemployment as the unemployment of workers moving between jobs. More recent approaches to the theory involve construction of models wherein the unemployment emerges as an equilibrium phenomenon when, for example, firms decide on hiring by equating the marginal benefits and costs of hiring, where the costs include search costs. Such an equilibrium rate of unemployment is not a social optimum due to the divergence between, e.g., private and social benefits of hiring. Such models can be used to explain variation of unemployment over time by postulating shocks to productivity, as in the models of real business cycles. Unemployment can also emerge in models where sectoral, as versus aggregate, shocks are postulated to productivity/ demand, in the context of frictions in moving from one job to another.

14.8 KEY WORDS

Adverse Shock to Productivity: A decline in productivity

Equilibrium Unemployment: Unemployment that emerges in a model wherein agents (workers and firms) optimise in the context of a process of search and matching.

Frictional Unemployment: Unemployment of workers who are moving between jobs. Frictions in the job market, e.g., due to the process of matching the requirements of a vacancy with the skills of an unemployed, imply that those who give up a job do not find a new job instantaneously and are unemployed in the interim. Such unemployment is frictional unemployment.

Natural Rate of Unemployment: Equilibrium unemployment (as defined above) as a percentage of the labour force.

Neoclassical/Monetarist theory of Employment/Output: Theory of employment/ aggregate output in the Walrasian general equilibrium set-up wherein markets clear through price adjustments.

Pro-cyclical Increase in Real Wages: Real wage increase accompanying the upward phase of a business cycle.

Search Theory: Theory of unemployment wherein each vacancy has unique features and requires unique skills that are embodied in individual workers. The frictions in the process of matching vacancies with the unemployed generate unemployment.

Voluntary Unemployment: Unemployment of workers who are not ready to work at the going wage for a similar job.

14.9 SOME USEFUL BOOKS

Blanchard, O.J. and S. Fischer, 2000, *Lectures on Macroeconomics*, Prentice-Hall of India, New Delhi

Dornbusch, R., S. Fischer and R. Startz, 2004, *Macroeconomics*, Ninth Edition, Tata McGraw-Hill, New Delhi.

Romer, D., 2001, *Advanced Macroeconomics*, Second Edition, McGraw-Hill International, New Delhi

14.10 ANSWERS/ HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Walrasian general equilibrium model is inconsistent with involuntary unemployment. Labour market in this model is assumed to be competitive and it always clears through wage adjustments at a point where labour demand is equal to labour supply. Any unemployment in the model is hence voluntary, i.e., of those who do not want to supply labour at the going wage rate.

2) Your answer to this question should be based on Section 14.2. If the firm accepts the offer of the outside worker and employs him/her at a lower wage, you are in the realm of the neoclassical model. If the firm believes that the outsider-workers do not necessarily possess the skills of the insider-workers you are postulating a search and matching model. If the firm is unable to lower the wage fixed through collective bargaining, in spite of the firm wanting to accept the outsider worker's offer to work at the lower wage, you are subscribing to a contracting theory of unemployment. Finally, if you postulate that the firm does not reduce wage because it believes that its benefits exceed the cost of paying a higher wage, then you are working in the realm of New Keynesian theories like the efficiency-wage theory.

Check Your Progress 2

1) The neoclassical model was theoretically elegant, but did not accord with the observed phenomenon of high and varying unemployment in the real world. It was hence necessary to augment the model to bring it more in tune with reality. The search theory attempts to do this by modelling unemployment as an equilibrium phenomenon.

2) Frictional unemployment is unemployment of workers moving between jobs. In the search models workers are unemployed because they do not take up the first job that is offered to them and keep searching to find the best job that matches their skills. The unemployment is frictional, in as much as workers and jobs are not continuously matched.

Check Your Progress 3

1) You will have to explain this by using the model expounded in Sub-sections 14.4. 1 and 14.4.2. Alternatively, you could use ideas from two or three different search models to explain why unemployment occurs as an equilibrium phenomenon in such models. You will be helped further in this by the alternative models in Section 14.5.

2) Answer to this question is in Sub-section 14.4.3. Hiring generates a private benefit, but imposes a social cost to other firms that is not accounted for by the hiring firm. There is also a divergence between the private and social benefits generated by hiring.

3) Refer to Sub-section 14.4.4 to be able to answer these questions. The variability in unemployment is explained by productivity shocks that change the benefit of hiring and hence generate more or less unemployment in equilibrium. The pro-cyclical response of real wages is explained by the fact that, in the model, workers obtain a constant share, and an increase in productivity leads to an increase in real wages. Real wages increase to a smaller extent if the share of the workers is smaller compared to the share of firms in output.

Check Your Progress 4

1) Unlike the Howitt model, the Pissarides model specifies the search technology used by the workers and firms. Further, the Pissarides model also helps in understanding the factors determining the share of workers in output.

2) In a frictionless world, a sectoral shift in demand cannot generate unemployment because a decrease in employment in the declining sector is made up for by an increase in employment in the expanding sector. However, if, for example, it takes time for labour to relocate perhaps due to search and matching considerations, labour released from the declining sector can be unemployed in the interim that it locates itself in the expanding sector firms.

3) You will have to explain the difference in the unemployment rates between the US and the EU with reference to the differences in the two regarding obtaining unemployment benefits. The more liberal scheme in the EU means that a larger number of workers can remain unemployed over longer period of time in search for a better job. However, this is not the full explanation of the observed differences in the unemployment rates.