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Abstract

In this study we examine whether moves of workers between sectors, sectoral shifts, influence the level of the unemployment of United Kingdom and its regions. Using as basic variables the proxy for the sectoral shifts and the unemployment rate and applying OLS and panel data methods we can understand in which way these moves affect the unemployment rate. We find that the sectoral shifts have a significant and positive impact on UK regional unemployment.

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1. INTRODUCTION

In our world, economic and working conditions change continuously. Because of the significance of these changes, people and more specifically, workers change their preferences and desires. As a consequence, workers are motivated to search another job in order to be more satisfied with what they have being offered. For a worker, finding a new job is not an easy task, even for a person who is at the beginning of his job career and tries to get a job that is related to his knowledge. It is a time-consuming process and the delay in finding a new job results in fluctuations of the unemployment rate.

In this study we examine the sectoral shifts for the economy of United Kingdom and for its regions also, i.e. we examine how moves of workers between sectors influence the unemployment rate of the United Kingdom and its regions. Our analysis is based on the variable that represents the sectoral shifts and is defined in the same way as Lilien's previous work. Lilien was the first author that studied the sectoral shifts hypothesis and found that the sectoral shifts are an important factor in determining the unemployment.

The models that will be used for our study, apart from the sectoral shift variable, include variables that represent the fiscal and the monetary policy, as well exogenous variables. The variables will be tested for stationarity and tests for autocorrelation, heteroscedasticity and specification will be applied on models. What we expect to find is for the sectoral shifts to play a significant role in the explanation of the UK unemployment rate. As we shall see, the findings are in contrast to the majority of existing literature.

In the remainder of this study, review of the papers that have examined the sectoral shifts is presented in section 2. Section 3 describes the data that are used for the estimation of the models. Section 4 presents the methodology that is applied on the models. In the section 5, the empirical results that arose from the estimation of the models and finally section 6 where the concluding remarks are provided.

2. LITERATURE REVIEW

There are many papers in the literature that examine the sectoral shift hypothesis. But what exactly is the sectoral shift hypothesis? This approach describes how the sectoral shifts affect the unemployment rate, i.e. how moves of workers from one sector to another affect the unemployment rate. Unemployment rate is the rate of the labor workforce that is not working either by choice or by layoff. The level of the unemployment rate, either higher or lower, depends on how quickly these workers

will find a job. In a world where technology is constantly evolving and is vulnerable to shocks i. e. economic crisis, workers prefer to move from traditional sectors, like construction, to more dynamic sectors, like communication. Because of the evolution and the slow adjustment of the workers to sectors there can be a positive natural rate of unemployment.

Since the sectoral shifts could have an impact on the unemployment rate, the literature could be beneficial in the sense of reducing unemployment. One of the findings is that the best period to move from a more sensitive sector to a less sensitive is during recession and from a less sensitive to a more sensitive sector is during recovery.

The unemployment and what can cause it, is a controversial theme since there are studies that support that unemployment is caused by sectoral shifts only or by aggregate demand shocks only or both of them. Until today there is not a final statement of what can cause unemployment in free market economies.

Next we will discuss the paper that examined the sectoral shifts hypothesis for the first time. Lilien (1982) examines the sectoral shifts and how these influence unemployment for the U. S. economy. The analysis starts with the equations for layoffs and unemployment. For the layoff equation, the dependent variable is the manufacturing layoff rate and the independent are the aggregate net hiring rate, the rate of change of employment, the quit rate, a time trend and a proxy of the variance of the net hiring rate. The data employed are monthly and quarterly for the period 1958-1977 for 21 two-digit manufacturing industries. The different combinations of regressions of the variables show a statistical significance of the proxy that indicates a strong positive relationship between the hiring conditions and the layoff rate. Another result of the regressions is that the aggregate employment growth alone cannot explain the layoff rate, so the unemployment equation is examined to see how employment demand influences the aggregate unemployment. For the regressions, the dependent variable is the unemployment rate and as independent the proxy of sectoral shifts, the unanticipated monetary policy, lags of them, a time trend and lags of unemployment are used. The data are annually for the period 1948-1980 for 11 industry decomposition for a non agricultural economy. The results of different combinations of the variables in the equations of the regressions support the hypothesis of the sectoral shifts since the coefficient of the sectoral shift is statistical

important and positive. Finally a measure of the natural rate of unemployment is made and the result is that factors that have an impact on the natural rate are a significant source of the cyclical unemployment. The conclusion is that even with monetary policy the unemployment is unavoidable due to sectoral shifts, and non-monetary factors are determinants for the cyclical unemployment.

Subsequent studies examine the sectoral shifts hypothesis and criticize the results. Abraham and Katz (1986) are the first that strongly criticize Lilien's paper and using the same method and some additional indexes argue that aggregate demand shocks and not the sectoral shifts are responsible for the unemployment. Neelin (1987) using some different indexes concludes that the exogenous shifts in sectoral employment demand are not important for the rise of the unemployment. Palley (1992) argues that a small fraction of the unemployment is accounted by sectoral shifts. Caporale et al (1996) examine the sectoral hypothesis thinking of the reliability of the variables of Lilien and using different variables and method conclude that the demand shocks are more important for the rise of the unemployment than the sectoral shocks. Finally, Fortin and Araar (1997) testing the sectoral shifts hypothesis and using stock price index find the opposite result from Lilien, aggregate shocks are more important for the unemployment rate and only a small fraction is accounted to the sectoral shifts.

2.1. Evidence for USA and Canada

Below we discuss the literature that examines the sectoral shifts hypothesis and its impact on the unemployment for U.S. and Canada.

Abraham and Katz (1986) as the first authors that criticize Lilien's paper, argue that sectoral shifts are not responsible for the unemployment. A distinction between a pure sectoral shift explanation and a pure aggregate demand explanation for unemployment rate fluctuations is made. They argue that when they do not take account the aggregate demand disturbances, sectoral shifts produce a positive impact on the unemployment rate. The used data are annual observations for the period 1949-80 and OLS is employed for estimating the regression. In case of sectoral shifts, an existence of a positive correlation between the dispersion of employment growth rates (σ) and vacancies is predicted and in the case of aggregate demand disturbances this

correlation is negative. Using the normalized help wanted index as a proxy for vacancies it is proved that the aggregate demand disturbances are responsible for the positive correlation between σ and unemployment. Empirically, the proxy is regressed on σ, a lag of it, unanticipated money growth, two lags of it, a lag of normalized help wanted index and a time trend. The results prove that the sectoral shifts are not the major reason for the unemployment. The results are the same and for the UK data. Overall the conclusion is that the aggregate demand disturbances rather the labor reallocation across sectors can explain the unemployment fluctuations.

Loungani and Rogerson (1989) examine the impact of the permanent sectoral shifts on the unemployment. The period that is tested in order to see the labor reallocation is 1974-1984. The analysis starts with a comparison between panel and aggregate data. Undertaking 26 2-digit decomposition of industries and dividing them in three categories, the durable goods-producing, the other goods-producing and the service-producing industries, three results arise from this comparison. First, in the panel data there is a higher employment rate in the durable goods-producing and other goods-producing industries and a smaller in the service-producing industries. Second, there are the same peaks in the unemployment rate in both panel and aggregate data. And third, there is a high correlation between the measure of the sectoral shifts and the unemployment in the panel data. The next step is to construct two fixed groups of all heads and males over 25 years of age and it is shown that there is sectoral reallocation even there is strong labor force attachments and during recessions respectively. For the estimation of an equation, eight overlapping time periods are constructed, with duration of four years and the first year is the base year. A discrimination is made between the individuals, to switchers and stayers. The equation takes the proportion of the switchers in a one industry in the base year, as the dependent variable. Independent consists of: the proportion of individuals in three skill-intensive occupations in an industry, average of real GNP growth and the growth rate of real GNP in the following year of the initial switch (GNP is the variables that captures the conditions of the economy). This equation describes the relationship between the reallocation and the business cycle. The result is that the sign of this correlation depends on the direction of the movement. Lastly, a closer look is taken to

the results about the labor reallocation and aggregate unemployment. The unemployment among switchers and stayers increases during recessions.

Palley (1992) examines the cyclical unemployment and what factors influence unemployment. The difference from other papers is that a decomposition of factors is used, factors due to sectoral shocks and factors due to aggregate shocks. Starting with the econometric model and equations that are used to be estimated, quarterly data for the period 1948:3-1988:2 for eleven different sectors are used to compute the evolution of the employment rate. Then these results are taken into accountfor the estimation of the dispersion in sectoral employment due to sectoral and aggregate influences. Finally, all previous are incorporated to estimate the unemployment equation that includes the dispersion and lags of them, a time trend and lag of unemployment. For this purpose, Maximum likelihood procedure is employed. The results show that positive aggregate disturbances widen the dispersion of sectoral employment growth and the sectoral shifts raises the unemployment. Also an equation about vacancies is constructed and the impact of sectoral shifts on it is investigated. The result is that the sectoral shifts have a small and negative effect on aggregate vacancies. As a conclusion, the sectoral shifts cannot explain the cyclical fluctuations of aggregate unemployment.

Brainard and Cutler (1993) examine the sectoral shifts from a different aspect. By constructing a measure of reallocation shocks using stock market excess returns which is called, the cross-section volatility measure. For this measure a weighted variance of one-quarter excess returns is calculated. Data are quarterly observations for the period 1948:1 to 1991:2. From the characteristics of the data it is obvious that the cross-section volatility has a moderate and positive correlation with unemployment. The two equations that are regressed in order to see how important the cross-section volatility on unemployment is, are the unemployment on lags of cross-section volatility and unemployment on lags of cross-section volatility and lags of unemployment. The results show that changes in the cross-section volatility cause changes in unemployment in the same direction. Moreover the reallocation shocks can explain a substantial fraction of unemployment when the latter has a longer duration.

Hosios (1994) examines the unemployment and vacancies with sectoral shifts. An equilibrium matching model is developed where reallocation shocks can induce a negative short term relationship between the unemployment and vacancies. Assumptions are made concerning preferences, technologies, prices and output. What is more allocative disturbances are modeled both as changes in the separation rate and changes in relative price dispersion among firms. The implied unemployment-vacancies co movements will depend upon the type of sectoral shock experienced. A change in the separation rate will bring about the usual positive unemployment-vacancies co movement, but a temporary relative price shock will induce unemployment and vacancy to move in opposite directions. The driving force in the model is an externality, the negative impact of temporarily laid off workers on job openings. This result implies that aggregate unemployment-vacancy data, in isolation, are unable to resolve the question of whether sectoral or aggregate shocks are the primary factors responsible for aggregate unemployment fluctuations.

Mills et al (1995) re-examine the sectoral shifts hypothesis for the period 1960-1991 and different method and measures are employed. The estimated equation has the unemployment as dependent variable and as independent: the anticipated and unanticipated money growth, the short run interest rate, the ratio exports to GNP (Gross National Product) and lags of unemployment. The results show that the expected and unexpected money growth and exports have a negative effect on unemployment and the interest rate have a positive effect on unemployment. What is done next, is a construction of a purged measure of dispersion and a re-estimation of an equation and the result is that when a purged measure is used, unemployment can be explained better in comparison to an unpurged. The inclusion of a measure of the stage of a business cycle in the equation proves that has an important impact on intersectoral labor reallocation and the unemployment. Adding more variables in the equation, the results do not change and there is a clear evidence of the robustness of the model. On summary, the results show that money growth, interest rates and exports have an important effect on the US unemployment.

Coporale et al (1996) examine whether the sectoral shifts or the demand shocks can explain the largest part of unemployment. The data used are quarterly for the US economy for the period 1948:2 to 1991:2. Two VAR (Vector AutoRegressive) models

are employed. The first includes the following variables: the unemployment rate, the cross-section volatility, the inflation uncertainty, the monetary base growth rate, the consumer price index and the 3month t-bill rate. The second includes the same variables except the unemployment rate which is replaced with the change in the unemployment rate. In both models the results are the same: the unemployment rate is explained at most part by the demand shocks like changes in the t-bill rate, changes in the monetary base and changes in the consumer price index and just a little fraction can be explained by the sectoral shocks.

Fortin and Araar (1997) attempt to estimate the importance of sectoral shifts in explaining short term fluctuations in unemployment. Two indexes are constructed in order to measure the sectoral shocks, the dispersion index and the cross-section volatility. It is proved that the cross-section volatility index is better in measuring the sectoral shifts. The period that is tested is 1970-1993 using quarterly data for 13 sectors. A reduced form equation for the unemployment is estimated using the following variables: the cross-section volatility index, lags of unemployment, the unpredictable growth rate, the US unemployment, the terms of trend and an index of generosity. As a first result is the strong impact of unanticipated money growth on unemployment. Secondly, a large fraction of unemployment in periods of recessions is attributed to monetary shocks. The analysis of the covariance between the unemployment and an index of the vacancy rate is presented. It is showed that reallocation shocks produce a positive correlation between them. Overall, the results show that the dispersion index and the terms of trend have a significant impact on the unemployment rate. Finally, the activity shocks as opposed to sectoral shocks have no impact on short term fluctuations of the Canadian unemployment.

Shin (1997) examines the effects of intersectoral and intrasectoral shocks on aggregate unemployment. Two indices are constructed that represent the two shocks using two data series of different periods, 1972-91 and 1961-91. Three different equations are regressed, the first unemployment on current and lagged indices, the second like before plus current and lagged growth rates of the money supply and the economy wide mean return and the third is like the second plus lagged dependent variables. The regression results are: first, the intersectoral shock explains the aggregate unemployment significantly better than the intrasectoral shock. Second, the

effects of the intersectoral shock are more stable. Third, extending the period examined (1961-91), the results are the same but not as strong as the first period sample (1972-91). Finally, what is suggested by the estimates and the response functions is that intersectoral shocks explain about 70% in the first period, and 50% in the second period, of the variance of the aggregate unemployment rate**.**

Samson (1985) examines the impact of sectoral shifts on aggregate unemployment in Canada and the targets to provide an answer whether the sectoral shifts in employment can predict fluctuations in the aggregate unemployment rate only in U.S or it happens in other countries as well. Natural rate of unemployment is defined according to Lilien and the same measure of dispersion of unemployment is adopted. An equation that describes the monetary policy of Canada for the 1954-1983 period is constructed which depends on past values of rate of growth of money. The residuals of this estimated equation describes the unexpected monetary policy and they will be used to the estimation of the unemployment equation. The main result of the estimation is that a rise in the amount of reallocation between sectors will lead to a rise in the aggregate unemployment rate. Versions of this equation show that the measure of the dispersion is important in explaining movements in the aggregate unemployment rate and that US unemployment rate influences unemployment in Canada and specifically real shocks rather than monetary shocks are the most important cause of variations in Canadian unemployment rate.

Neelin (1987) examines the Lilien's hypothesis using Canadian data. Motivated by Lilien's work, Neelin takes the opportunity to extend it. The data used are quarterly for the period 1961:2-1983:1. The shift measure of Lilien is taken, decomposed in explained and unexplained parts by aggregate activity and included in an equation. This methodology is followed in order to see if there is negative or positive relationship between sectoral shocks and unemployment. In the equation money shocks, unobservable aggregate shocks, time trend and sector-specific shock are included and using the last one a measure similar to that of Lilien's is made in order to prove that the sectoral shifts influence the unemployment. Finally, two indices are constructed: the weighted standard deviation of the predicted and the unpredicted growth rates. They are included in the equation with the unemployment as the dependent variable. If the index of the unpredicted growth rates is positive and

significant then it follows that sectoral shifts influence unemployment with no effect of aggregate activity. The sector is defined in three different ways, the industry, the region and the industry-region and at each one estimate three indices, the observed, the predicted and the residual employment growth rate. The equation that is estimated includes unemployment rate, unanticipated money growth, shift variable and lags of them and seasonal dummies. The results of the estimations show that at the first and third sector-category, industry and industry-region, the sectoral shifts have an impact on Canadian unemployment and at the second sector-category, region, exogenous shifts influence the unemployment.

Byun and Hwang (2012) examine the sectoral shift hypothesis using additional tests. A test of skewness is used, i.e. a joint test of the dispersion of sectoral shocks and skewness. The data are quarterly for the period 1955Q1-2003Q1 for a 30-industry employment and 1990Q1-2011Q1 for a 36-industry employment. The variables that are used are unemployment, M1 money stock, 3-month Treasury bill, government expenditure, GDP deflator and the number of employees and the period tested for them is 1955Q1-2011Q1. Three equations are estimated, the unemployment, the money growth and the net employment growth in two different models, the first is the Lilien's and the second is the Abraham-Katz. The concluding remark is that in both models if the skewness is included, the sectoral shifts hypothesis is strongly supported, in other words, the sectoral shifts play a significant role in unemployment.

Reicher (2011) uses a stochastic volatility model to compare the impacts of sectoral shocks on unemployment growth rate between the US and Germany. The US data concern output, unemployment and employment for 5 big sectos for the period after 1960. The data for Germany concern GDP and employment for 5 major sectors for the period after 1991. The frequency of both is the quarter. The method that is applied is the Markov Chain Monte Carlo algorithm. It is shown that the sectoral reallocation shocks are not the key factor for the rise of the unemployment after the decay of 60's for both US and Germany.

The most recent paper about the job reallocation is Liu's (2013) that examines how the nature of the excess job reallocation is changed over time in US economy. The factor that represents the reallocation fluctuations is decomposed to national,

regional and state-specific factor and this paper attempts to explore which of the three accounts more for the excess job reallocation changes. A dynamic latent factor model is applied using Bayesian techniques for estimations. The data are annual for the period 1977-2009. What is found is that the national allocation factor and the state-specific allocation factor account almost 57% and 29% respectively, for the excess job reallocation.

2.2. Evidence for the UK

In this study, the sectoral shift hypothesis for the U.K. country is examined, not only as a whole, but also for the twelve regions of it. The studies that have examined the UK sectoral shifts hypothesis are presented below.

Mills et al (1995) examine the Lilien's hypothesis making further tests for the UK. In their paper the used data are quarterly for the period 1976-1991 for 25 sectors for the sectoral shifts hypothesis using the analysis of the extreme bounds. Furthermore, the implications of the stage-of-business-cycle and the past sectoral shocks on unemployment behavior are examined. The same proxy with Lilien is used as long as a restricted model that includes the following variables: a purged dispersion index, seasonal dummies, unemployment, expected and unexpected money growth, the logarithm of the short interest rate and lags of the last three variables. The results of the regression show a significant positive effect of sectoral shifts on UK unemployment. Examining the stage-of-business-cycle effect, is stated that the labor reallocation will be less is expansion and more in recession and there is a positive correlation between the past sectoral shocks and unemployment. After all, it is concluded that there is a strongly positive impact of sectoral shifts on unemployment of the UK economy.

Samson (1990) gives rise to a paper examining the sectoral shifts and aggregate unemployment using additional empirical evidence. This is an attempt to estimate whether the impact of real and monetary shocks on unemployment fluctuations for several industrialized countries, Canada, France, Germany, Italy, Japan, United Kingdom and United States s important. Two equations are used, the unemployment equation that includes the dispersion index, the anticipated and unanticipated money growth, the lagged unemployment and a time trend and a money

equation that includes money growth and lags, government expenditures, lagged unemployment rate and net trade of the balance of payments. The data are annual for the period 1957-84 for Canada, 1958-81 for France and Germany, 1957-81 for Italy, 1960-82 for Japan, 1958-82 for United Kingdom and 1951-84 for United States. The method followed is OLS for the unemployment equation and GLS for the money equation for each country. For the most of the countries the results show that the sectoral shifts play a very important role in the unemployment rate as opposed to the money shocks.

Pelloni and Polasek (2003) examine the macroeconomic effects of sectoral shocks and more specifically they investigate the relevance of shocks volatility, the amount of aggregate employment growth variation accounted for re-allocation shocks and the amount of aggregate innovation volatility explained by sectoral components. Data points are quarterly for U.S., U.K. and Germany for the period 1968-1998 and the used method is the Bayesian method. For U.S and U.K. data concern the natural logarithms of aggregate employment and the employment shares of the manufacturing, finance, trade and construction sectors and for Germany employment shares of manufacturing, communication and the "rest" sectors. The method preferred is VAR-GARCH-M (Vector AutoRegressive Garch in Mean) model. The results showed that there is no co integrating relation between the sectors for any country. The re-allocation shocks account for about 58%, 45% and 51% of the aggregate employment variability for U.S., U.K. and Germany respectively and finally the innovation analysis shows that about 44%, 54% and 52% of sectoral- shares innovations are counted for aggregate employment growth rate.

2.3. Evidence for other countries

Finally papers that examine the sectoral shift hypothesis for other countries, different from US, Canada and UK are presented below.

Ours and Tak (1991) analyze the relationship between the sectoral shifts, unemployment and vacancies for the Netherlands. The authors show that the fluctuations of unemployment are not caused by sectoral shifts but by changes in demand factors. For their estimation a matching function is used that includes unemployment, vacancies and the flow of filled vacancies. Before the estimations a

distinction between the intersectoral and intrasectoral matching process is made. The data are yearly for the period 1971-1987 for Dutch labor market and for 24 sector classification. From the estimations the results show that there is a positive correlation between the dispersion measure of employment and the unemployment, a negative correlation between the dispersion index and the vacancies and there is no correlation between the dispersion measure of employment and the matching process.

Chiarini and Piselli (1999) examine the effect of allocative disturbances by analyzing the effect of permanent sectoral shifts on unemployment and the wage formation process. The data are quarterly for the period 1975:1-1993:3 from the Italy economy and a Neumann-Topel's employment-based dispersion index is constructed. A VAR (3) (Vector AutoRegressive) model and Johansen's tests and ML (Maximum Likelihood) estimation method are applied using 10 industry sectors and the following variables: consumption real wage, labor productivity, price wedge, worked hours, unemployment rate and the sectoral shift variable. The results show that labor reallocation across sectors is a large component of long-run unemployment rate fluctuations. Moreover permanent shifts in employment result in permanent increases in unemployment. Finally it is proved that the significant factors for unemployment are the permanent sectoral shifts.

Sakata (2000) examines whether Lilien's sectoral shift hypothesis is valid for the case of Japan, and particularly for male and female unemployment. The data are quarterly data for a 13 sector decomposition and half-yearly data for a 33 sector decomposition and both of nonagricultural employment and both for period 1973-1999. After constructing two measures of the dispersion index, these are calculated for both 13 and 33 sector decomposition. It is proved that there is no long term relationship between sectoral shifts and unemployment. For the short term relationship, a VAR (Vector AutoRegressive) model for both 13 and 33 decomposition sector is applied and as independent variables, unemployment, imports, unanticipated and anticipated money growth, the two proxies and lags of each one variable are used. The results indicate a significance of the proxies that shows that there is a positive effect of sectoral shifts on aggregate unemployment. Undertaking the same tests for male and female unemployment, findings are impressive: in the case of the male unemployment the results are similar to that of

aggregate unemployment and in the case of female unemployment the results are different, the dispersion measures are not significant and that indicates that the sectoral shifts hypothesis is not valid for the female unemployment. Two important remarks are concluded, first, there is a positive relationship between sectoral shifts and unemployment and second, there are gender differences in labor market of Japan.

Tao and Li (2007) examine how the sectoral shifts influence the unemployment duration. Data points represent 1455 individuals, which finally come up to 8250 cross-sectional observations according to their unemployment duration for the period from 1998 to 2001. The authors consider as the sectoral shift rate, the proportion of new hires from other industries. The higher this rate is, the longer unemployment duration is expected. A log likelihood function is constructed that includes as variables unemployment, gender, financial support that are positive and significant, age, education, firm scale before unemployment that are negative and significant and marital status, number of household members and working for a public or private firm before unemployment that are not significant. The variable time is not significant, the variable that captures the sectoral shifts is significant in some models. The total effect of the sectoral shifts is divided to the overall effect referred to all industries and the specific effect referred to each industry. The first is negative which means that the more new hires from other industries the longer will be the unemployment duration and the second is positive which means that a downturn in the aggregate market will result in the unemployed in declining industries having less opportunities to find a job, lengthening the unemployment duration.

The table below summarizes the literature review:

Table 1: Summary of Literature Review

Author(s)	Data-Method	Results
Lilien (1982)	The data is annually for the period 1948-1980 for 11 industry decomposition OLS is employed. Unemployment U, the variable that captures the sectoral shift hypothesis σ, the unanticipated monetary policy DMR and lags of unemployment are the used variables. Country: Canada	From the estimations it is argued that the sectoral shifts and non monetary factors are determinants for the cyclical unemployment even with monetary policy.
Samson (1985)	The data is annually for the period 1954-1983. OLS is employed. Unemployment U, the variable that captures the sectoral shift hypothesis SIG, the unanticipated monetary policy DMR and lags of unemployment are the used variables. Country: Canada	The main result of the estimation is that a rise in the amount of reallocation between sectors will lead to a rise in the aggregate unemployment rate of Canada
Abraham and Katz (1986)	Annual data for the period 1949-1980 using OLS method. Unemployment U, the variable that captures the sectoral shift hypothesis σ, the unanticipated monetary policy DMR and lags of U and DMR are the used variables. Country: Canada and UK	For the estimation a pure sectoral and a pure demand variable is used to see which of the two affect more the unemployment and it is concluded that aggregate demand shocks account more for the aggregate unemployment
Neelin (1987)	Quarterly data are used for the period 1961:1-1983:2 and OLS is employed. Unemployment U, the variable that captures the sectoral shift hypothesis σ, the unanticipated monetary policy DMR, lags of U and DMR and dummies are the used variables. Country: Canada	Lilien's hypothesis is examined for Canada and from the estimations is supported, more particularly the sectoral shifts affect the unemployment in Canada

Table 2: Summary of Literature Review (cont'd)

Author(s)	Data-Method	Results
Loungani and Rogerson (1989)	The data are annual for the period 1974-1984. OLS method is employed. The variables that are used are: unemployment, the proportion of individuals in occupations, the real and the average GNP that captures the conditions in economy. Country: Canada	An attempt to find out if permanent sectoral shocks affect the unemployment and the result is that these shocks cause rise of the unemployment
Samson (1990)	The data are different for each country, 1957-84 for Canada, 1958-81 for France and Germany, 1957-81 for Italy, 1960-82 for Japan, 1958-82 for United Kingdom and 1951-84 for United States. OLS method is employed. Unemployment U, the variable that captures the sectoral shift hypothesis σ, the unanticipated monetary policy DMR, lags of unemployment and a time trend are the used variables. Country: UK,Canada,France,Germany,Italy,Japan,US.	The examination of the sectoral shifts hypothesis and aggregate unemployment for Canada, France, Germany, Italy, Japan, UK,US The result is that for the most of the countries the sectoral shifts play a significant role on aggregate unemployment rate.
van Ours and van der Tak (1991)	The data that they use are yearly for the period 1971-1987 for Dutch labor market and for 24 sector classification. OLS is employed. Used variables are: unemployment, expectation errors in wages or prices (monetary policy) and the variable σ of sectoral shift hypothesis. Country: Netherlands	The relationship between the sectoral shifts, unemployment and vacancies is examined for the Netherlands. They found that positive correlation between the dispersion measure of employment (sectoral shifts) and the unemployment, a negative correlation between the dispersion index and the vacancies.
Palley (1992)	The data are quarterly for the period 1948:3-1988:2 for 11 different sectors Maximum likelihood method is employed for the estimation. The variables are: unemployment, the dispersion for the sectoral shift hypothesis and lags of them. Country: Canada	The cyclical unemployment and what factors influence unemployment is tested and he found that sectoral shifts cannot explain the unemployment but aggregate disturbances do.
Brainard and Cutler (1993)	The data are quarterly for the period 1948.1 to 1991.2. OLS is employed. Unemployment U, the variable that captures the sectoral shift hypothesis σ, and lags of unemployment are the used variables. Country: US	The relationship between the sectoral shifts and unemployment using cross-section volatility is examined. They found that the sectoral shifts can explain a substantial fraction of the unemployment

Table 3: Summary of Literature Review (cont'd)

Author(s)	Data-Method	Results
Hosios (1994)	Data and method are not specified. The variables are the unemployment, vacancies, the reallocative shocks and the number of inherited job openings. Country: not specified.	He examined the unemployment and vacancies with sectoral shifts. He found that for this relationship the key is an externality, the negative impact of temporarily laid off workers on job openings.
Mills et al (1995)	The data are quarterly for the period 1976-1991 for 25 sectors. OLS is employed. The variables are: Unemployment U, the variable that captures the sectoral shift hypothesis σ, the unanticipated monetary policy DMR and lags of unemployment. Country: UK	Tests of the Lilien's hypothesis for the UK economy are applied and the results show that there is a strongly positive impact of sectoral shifts on unemployment in the UK
Mills et al (1995)	The sample is tested using OLS is for the period 1960-1991. Unemployment U, the variable that captures the sectoral shift hypothesis σ, the unanticipated monetary policy DMR, money growth, interest rate and lags of them are the used variables. Country: US.	They examined different factors that may affect unemployment and they found that money growth, interest rates and exports affect significantly the unemployment
Caporale et al (1996)	The data are quarterly for the period 1948:1-1991:2 for the US economy and the method is VAR. Unemployment U, the variable that captures the sectoral shift hypothesis CSV, the unanticipated monetary policy DMR, money growth terms of trend and lags of unemployment are the used variables. Country: US.	The target is to see if sectoral shifts or demand shocks can explain unemployment and they found that demand shocks in rates, monetary base and the consumer price index can explain at most the unemployment rate
Fortin and Araar (1997)	The period is 1970-1993 using quarterly data for 13 sectors. A reduced form equation for the unemployment is used. Unemployment U, the variable that captures the sectoral shift hypothesis CSV, the unanticipated monetary policy DMR, money growth terms of trend and lags of unemployment are the used variables. Country: Canada.	They tried to estimate the importance of sectoral shifts in explaining short term fluctuations in unemployment. What is found is that the dispersion index and the terms of trend have a significant impact on the unemployment rate and the activity shocks have no impact on short term fluctuations of the Canadian unemployment.

Table 4: Summary of Literature Review (cont'd)

Author(s)	Data-Method	Results
Shin (1997)	Two different samples are used, 1961-1991 and 1972-1991. OLS is employed. The variables are: unemployment, the dispersion index across and within industries, the growth rate of money supply, the economywide mean return and lag of unemployment. Country: US.	He examined the effects of intersectoral and intrasectoral shocks on aggregate unemployment and the result is that the intersectoral shock explains the aggregate unemployment significantly better than the intrasectoral shock and the effects of the intersectoral shock are more stable even after she adds the lagged unemployment rates as independent.
Chiarini and Piselli (1999)	Quarterly data for the period 1975:1-1993:3 from the Italy economy. VAR (3) model and Johansen's tests and ML estimation method are employed using 10 industry sectors. Consumption real wage, labor productivity, price wedge, worked hours, unemployment and the sectoral shift proxy variable are used. Country: Italy	The effect of permanent sectoral shifts on unemployment and the wage formation process are analyzed and what is concluded is that permanent shifts in employment lead to permanent increases in unemployment and permanent sectoral shifts are significant determinants of unemployment.
Sakata (2000)	Quarterly data on a 13 sector decomposition and half-yearly data on a 33 sector decomposition and both of nonagricultural employment and both for period 1973-1999. VAR model for both 13 and 33 decomposition sector is employed. The variables are: unemployment, two proxies of sectoral shifts, imports, unanticipated and anticipated money growth and lags of each one variable. Country: Japan	Lilien's sectoral shift hypothesis was tested whether is valid for the case of Japan, and particularly for male and female unemployment. The results indicate a positive effect of sectoral shifts on aggregate unemployment and gender differences in how human capital is attached to male and female workers (the sectoral shifts hypothesis is valid for male and not for female unemployment)
Pelloni and Polasek (2003)	Quarterly data for the period 1968-1998 using the Bayesian method. VAR-GARCH-M is employed. Employment and employment shares for different sectors are used. Country: UK,US and Germany	The authors examined the macroeconomic effects of sectoral shocks and the results showed that the re-allocation shocks account for about 58%, 45% and 51% of the aggregate employment variability for U.S., U.K. and Germany respectively

Table 5: Summary of Literature Review (cont'd)

Author(s)	Data-Method	Results
Tao and Li (2007)	8250 cross-sectional observations according to their unemployment duration for the period from 1998 to 2001 are used. Construction of a log likelihood function. The variables are: unemployment, gender, financial support, age, education, firm scale, marital status, number of household members, time. Country: Taiwan	It is examined how the sectoral shifts influence the unemployment duration. The total effect of the sectoral shifts is divided to the overall effect which is negative, more hires longer the unemployment and the specific effect which is positive, the unemployed have less opportunities to find a job, lengthening the duration
Reicher (2011)	The data are for U.S. 5 big sectors after 1960 and for Germany 5 sectors after1991. Baysian method and Markov Chain Monte Carlo algorithm are employed. The used variables are the unemployment and the proxy for sectoral shifts. Country: US and Germany	A comparison between US and Germany of the impact of sectoral shifts on unemployment is made. It is concluded that in both countries the sectoral shifts are not determinant in explaining unemployment rate.
Byun and Hwang (2012)	Quarterly data for the period 1955Q1-2003Q1 for a 30-industry employment and 1990Q1-2011Q1 for a 36-industry employment. OLS is employed. The variables are: unemployment, measure of dispersion of sectoral shifts, measure of skewness of sectoral shifts, unanticipated monetary shocks, time trend and a lag of unemployment. Country: US	Re-examination of the sectoral shift hypothesis for US using an additional test, a joint test of dispersion of sectoral shifts and skewness and they found that the sectoral shifts play a significant role in explaining the unemployment rate.
Liu (2013)	Annual data for the period 1977-2009 Dynamic latent factor model using Bayesian techniques. proxy of reallocation shocks decomposed to national, regional and state-specific allocation factor Country: US	Examination of the changes of the nature of excess job reallocation for the period 1977-2009. It is proved that the national allocation factor accounts more for the excess job reallocation.

3. DATA

This study examines the sectoral shift hypothesis for the United Kingdom. The UK regions are different in terms of population, their skills, the job opportunities and the structure of the economy. Therefore, to better analyze the sectoral shift hypothesis, UK is divided in 12 regions that are presented in the following table:

Table 6: Regions

North East	North West	Yorkshire and the Humber
East Midlands	West Midlands	East of England
London	South East	South West
Scotland	Wales	Northern Ireland

The data are quarterly and the estimation period that is chosen is different for UK and the regions. The data for the UK is running from 1987Q1 to 2011Q4, having 100 observations and for the regions the period is running from 1992Q2 to 2011Q4, having 79 observations. The aim of the analysis is how the reallocation of workers between sectors affects the unemployment, thus we use 19 sectors which are:

Table 7: Sectors

1.Agriculture, forestry and fishing	11.Financial and insurance activities
2.Mining and quarrying	12.Real estate activities
3.Manufacturing	13.Professional,scientific and technical act
4.Electricity,gas,steam and air con supply	14.Administrative and support service activities
5.Water supply, sewerage, waste and remediation	15.Public administration and defence
6.Construction	16.Education
7.Wholeshale and retail trade	17.Human health and social work activities
8.Transport and storage	18.Arts,entertainment and recreation
9.Accomodation and food service activities	19.Other service activities
10.Information and communication	

For the study of sectoral shifts and how these affect the unemployment rate, the dependent variable is the unemployment rate, i. e. the proportion of the workforce that is out of work. In the independent variables include a proxy variable that describes the variation of the unemployment by sector and represents the sectoral shocks (σ). In order to include the monetary policy to our analysis, we use the growth rate of money, M1 and the short term interest rate that refers to the three month interbank offer rate attaching to loans between banks. For the fiscal policy, we use the budget deficit as a percentage of GDP (Gross Domestic Product) and finally as exogenous variable an index of energy prices is used. The data were obtained the databases of: UK National Statistics, Official Labour Market statistics and the OECD (Organization for Economic Co-operation and Development).

Below, the diagrams indicate the movement of the unemployment rate for UK and for regions as well the movement of the rest variables:

Figure 1: Unemployment rate in UK

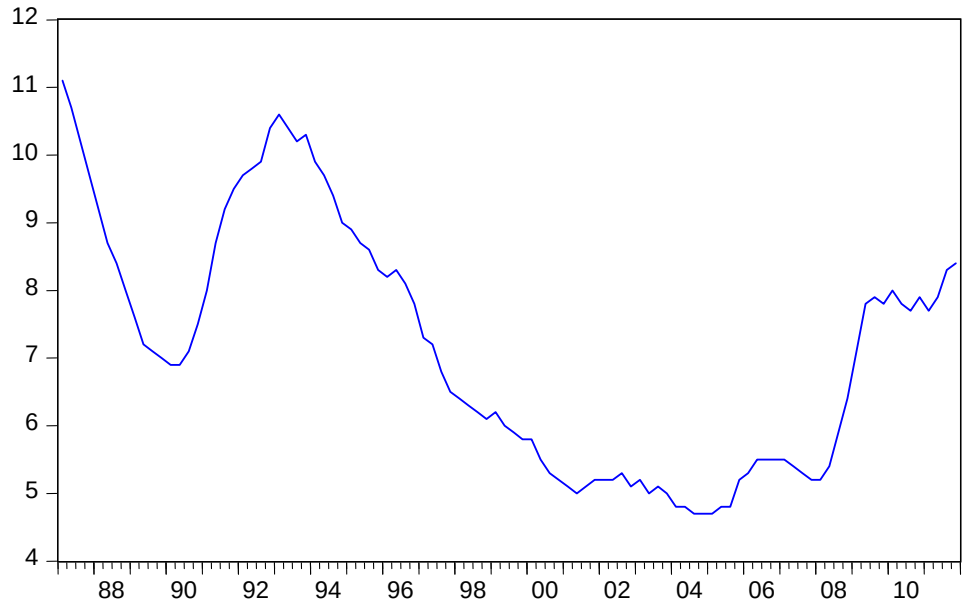


Figure 2: Unemployment rate in regions

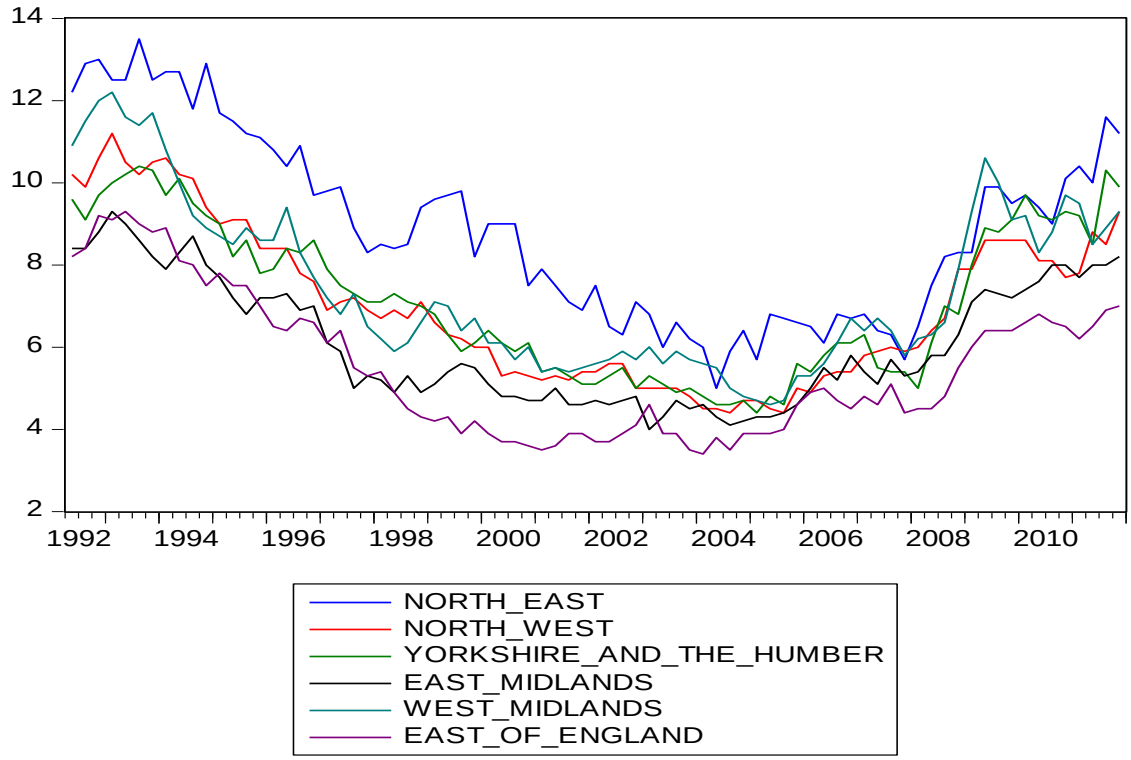
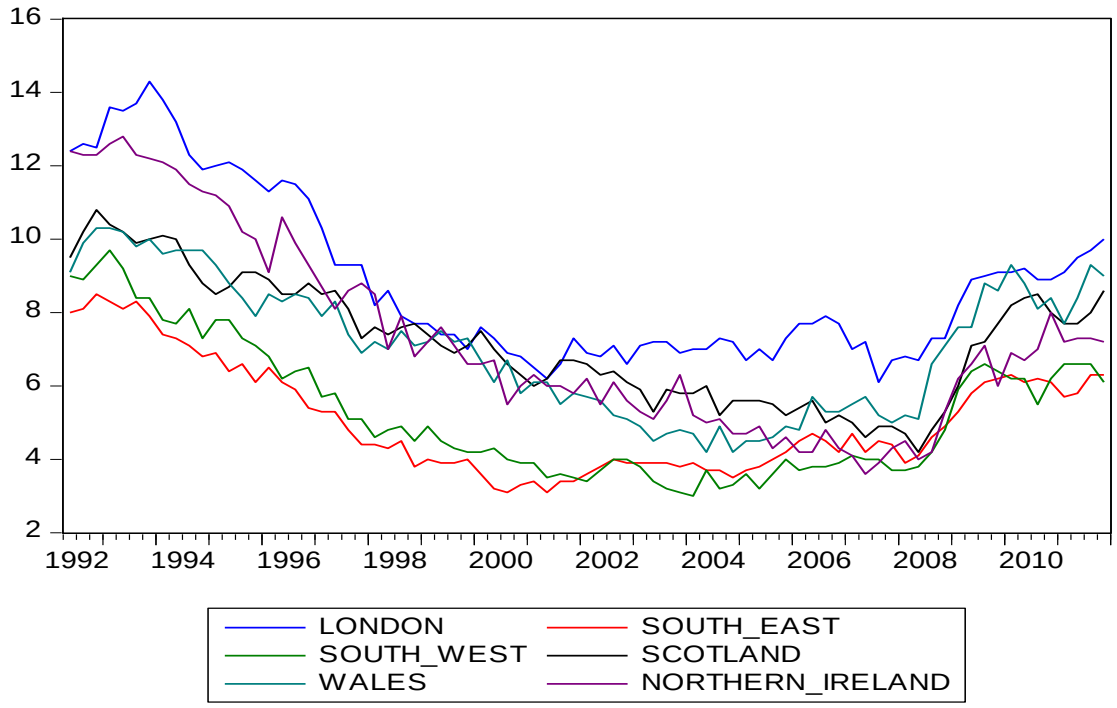


Figure 3: Unemployment rate in regions (cont'd)



As we can see from the diagrams for both the UK and the regions there is a downward trend of the unemployment rate after 1993 and an upward trend after 2008. Generally, for the UK 1993 and 2010 were two years with the highest peaks.

Below the diagrams of the variables are presented:

Figure 4: Money growth rate (M1)

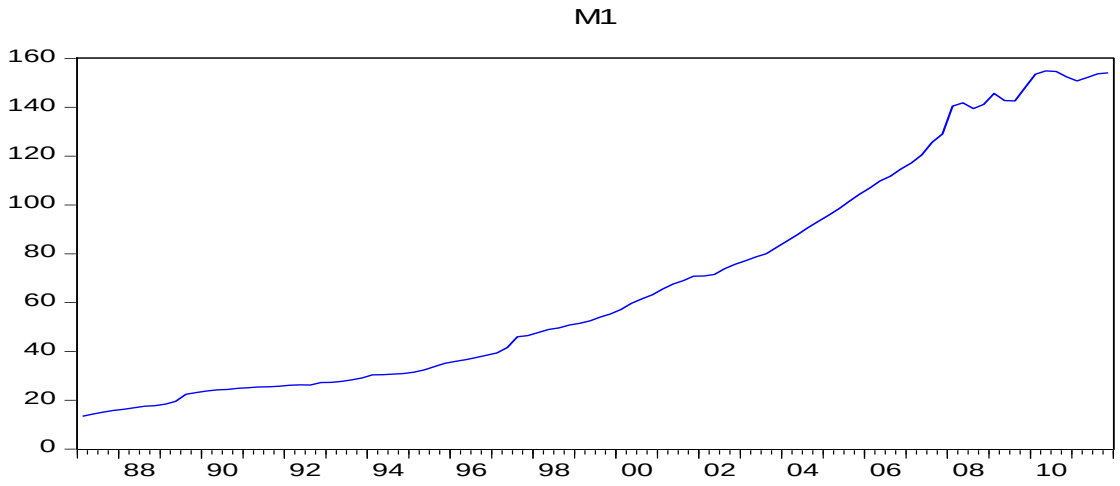


Figure 5: Energy price index

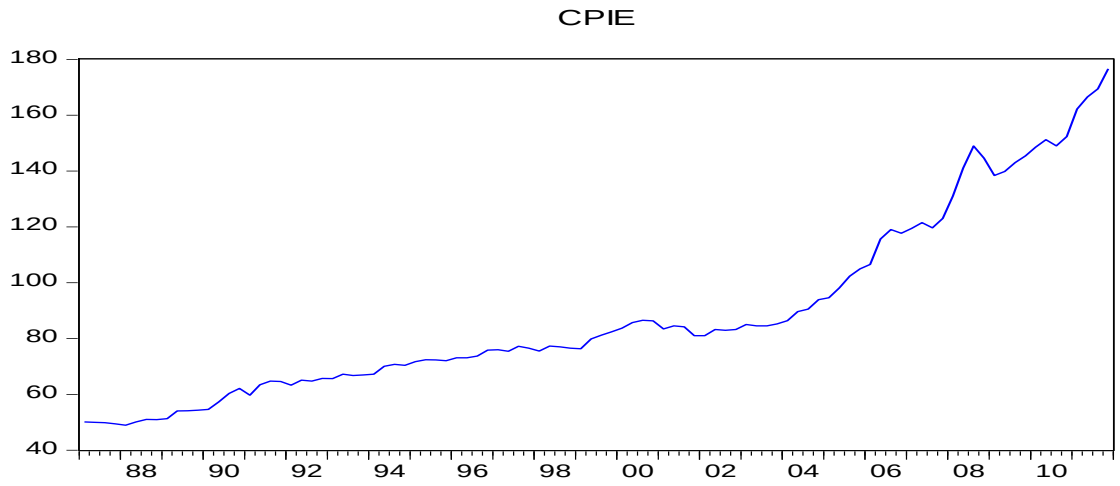


Figure 6: Budget Deficit (% of GDP)

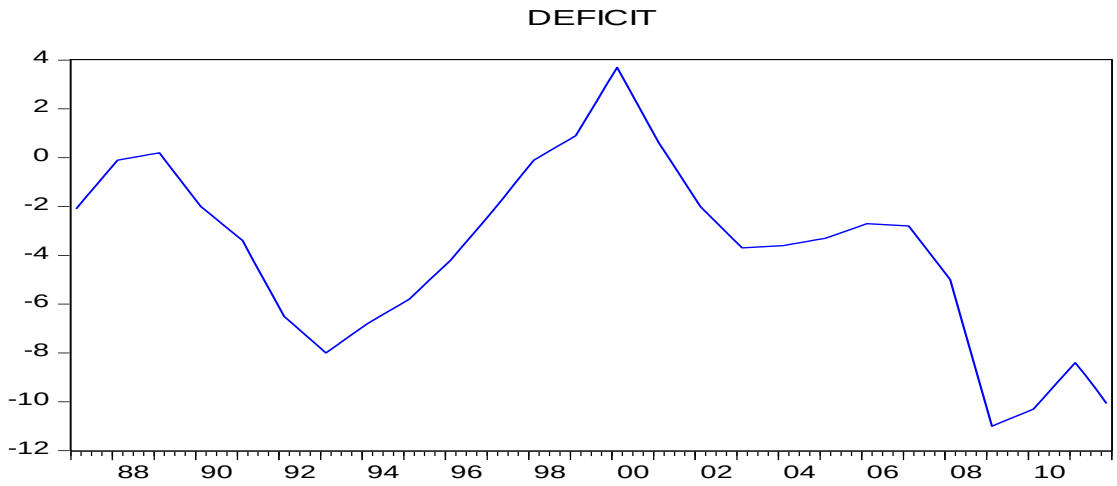
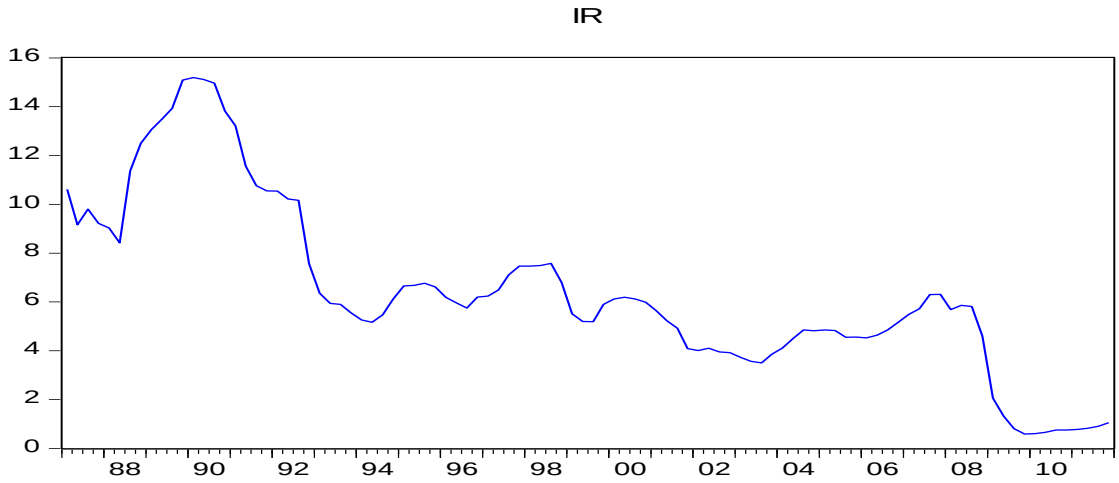


Figure 7: Interest rate



What we can deduce from the diagrams is that for the variables under consideration stationarity does not hold. For our analysis the variables will be treated as stationary since there is a floor and a ceiling. Bounded variables can be treated as stationarity. The Augmented Dickey-Fuller stationarity test was applied and is presented below:

Table 8: Results of the stationarity test of Dickey-Fuller

	Augmented Dickey-Fuller test statistic	**Probability**
Variable		
Unemployment_UK	-1.989454	0.2911
Unemployment_North East	-1.526550	0.5151
Unemployment_North West	-1.266267	0.6415
Unemployment_Yorkshire and the Humber	-1.043859	0.7338
Unemployment_East Midlands	-1.140575	0.6959
Unemployment_West Midlands	-1.605875	0.4748
Unemployment_East of England	-1.371378	0.5921
Unemployment_London	-1.496710	0.5301
Unemployment_South East	-1.813774	0.3713
Unemployment_South West	-2.049305	0.2657
Unemployment_Scotland	-1.313428	0.6197
Unemployment_Wales	-1.184528	0.6775
Unemployment_Northern Ireland	-2.082819	0.2521
M1	1.732003	0.9997
CPIE	3.435233	1.0000
Deficit	-2.029417	0.2740
Interest rate	-1.083010	0.7201

In the following table, the descriptive statistics of the unemployment for UK and the regions and the rest of the variables are presented:

Table 9: Descriptive statistics of the unemployment rate in UK and regions

	UNEMPLOYMENT						
	UK	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England
Mean	7.138000	8.889873	7.027848	7.139241	6.110127	7.441772	5.534177
Skewness	0.359430	0.310318	0.444373	0.241347	0.435408	0.685491	0.629415
Kurtosis	1.919478	1.973777	2.005431	1.648103	1.767766	2.367821	2.232128
Jarque-Bera	7.017866	4.734475	5.856001	6.782867	7.494203	7.502505	7.157014

	UNEMPLOYMENT					
	London	South East	South West	Scotland	Wales	Northern Ireland
Mean	8.859494	5.082278	5.291139	7.203797	7.073418	7.288608
Skewness	0.881084	0.708204	0.726180	0.239739	0.105313	0.708420
Kurtosis	2.464042	2.386955	2.389759	2.057906	1.729253	2.359866
Jarque-Bera	11.16693	7.840863	8.169076	3.678240	5.461403	7.956643

	M1 growth rate	CPIE(energy index)	Budget Deficit	Interest Rate
Mean	68.01700	88.74600	-3.671333	6.424400
Skewness	0.652865	1.023375	-0.265981	0.691694
Kurtosis	2.052913	3.062412	2.421939	3.235654
Jarque-Bera	10.84128	17.47118	2.571411	8.205393

The results emerging from the tables are:

1. The average unemployment rate in UK for the period 1987-2011 is approximately 7%. For the regions the average unemployment rate for the period 1992-2011 fluctuates approximately between 5% and 8% and
2. None of the variables follows the normal distribution. this can be seen from values of skewness, kurtosis and Jarque-Bera. According to the theory, if the variables follow the normal distribution, skewness must be zero but in our case the values are different from zero, in other words, there are deviations from the mean. Kurtosis must be equal to 3 and in our data this does not hold. This means that when the value is greater or less than 3 that means that we have more observations in the right or the left side of the distribution respectively. Finally the value of the Jarque-Bera is equal to 5,14. As we can see from the tables for all the variables the value is less or over this number.

4. METHODOLOGY

4.1 Model construction

In order to research the sectoral shift hypothesis and how unemployment is affected by that, a proxy variable that describes the sectoral shocks must be calculated. For that purpose the Lilien's proxy variable will be used. The way of calculation is the following:

$$\sigma_t = \left[\sum_{i=1}^{N} \frac{y_{it}}{Y_t} \left(\Delta \log y_{it} - \Delta \log Y_t \right)^2 \right]^{1/2}$$

where y_{it} is the employment by sector *i*, $i = 1, \ldots, N$ at time *t* and Y_t is the overall employment at time *t*.

Using the data that were mentioned in the previous section and computing the dispersion of the sectoral shifts, we can depict the simultaneous behavior of them across time. So, the following diagrams are resulted:

Figure 8: Illustration of unemployment rate along with the dispersion index for UK

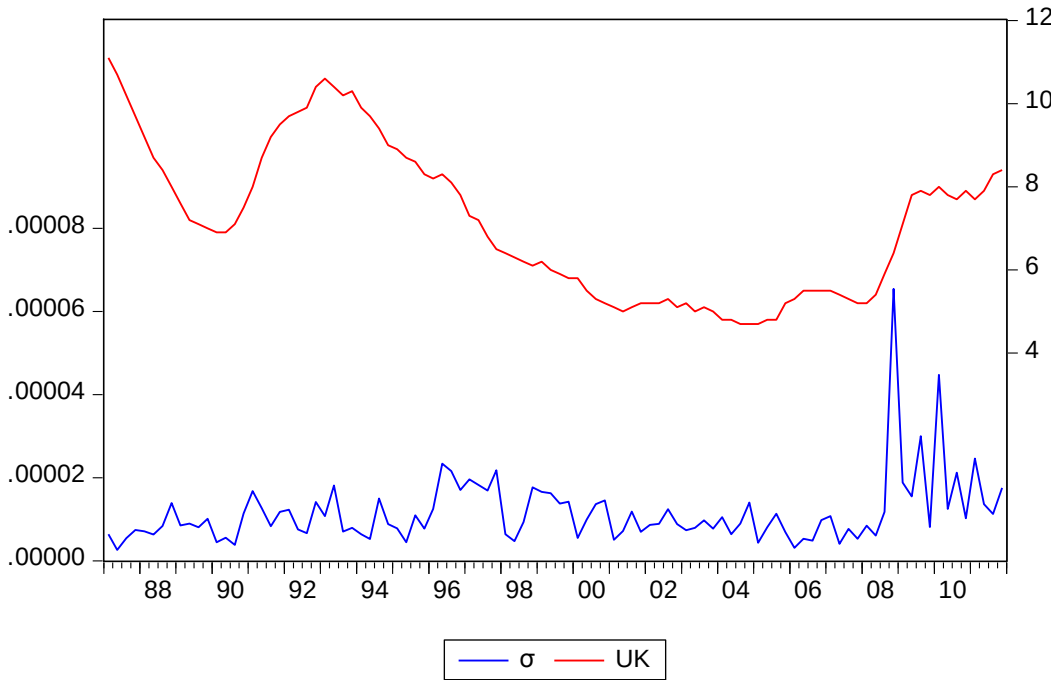
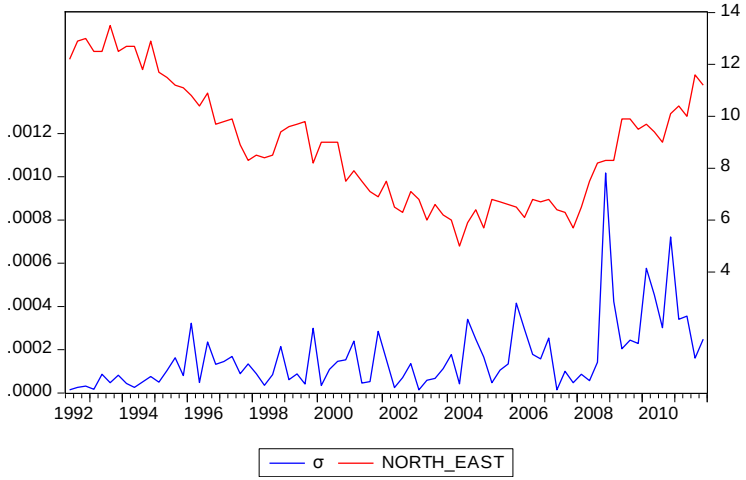
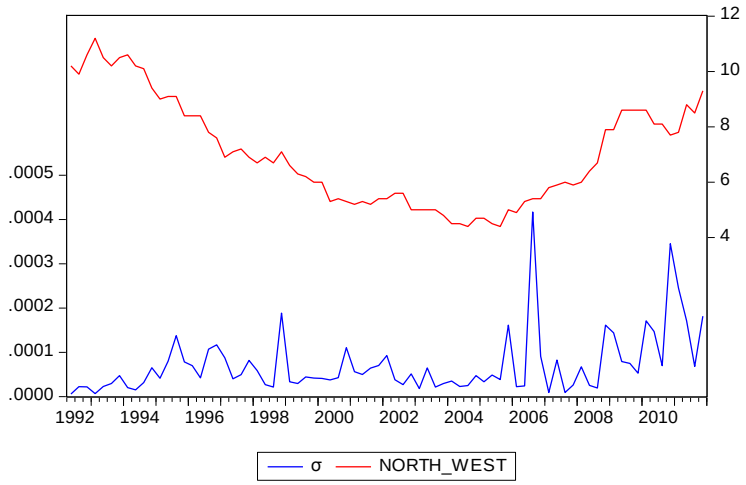
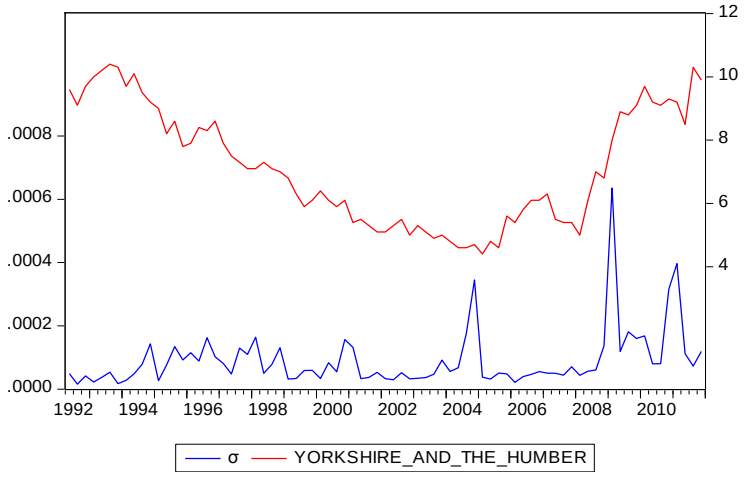


Figure 9: Illustration of unemployment rate along with the dispersion index for regions







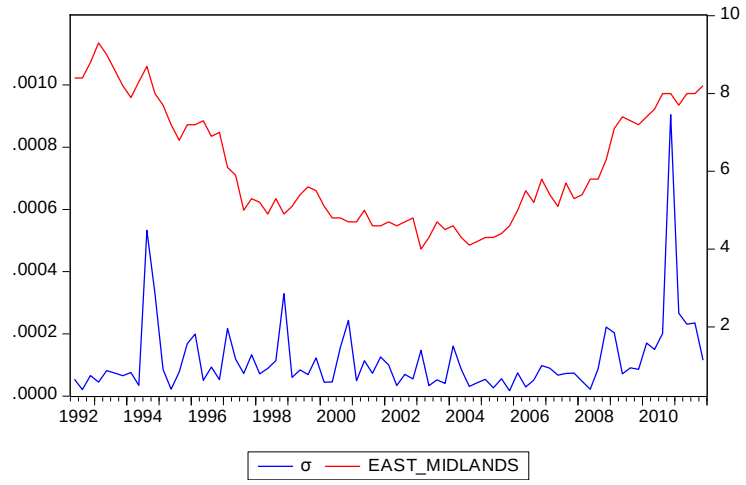
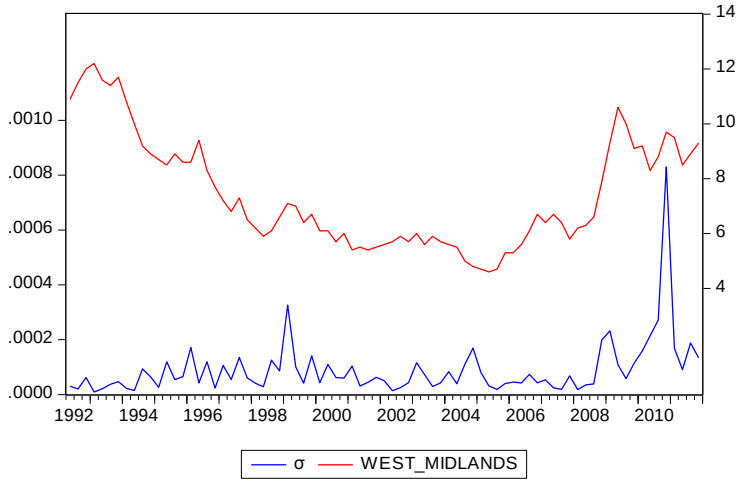
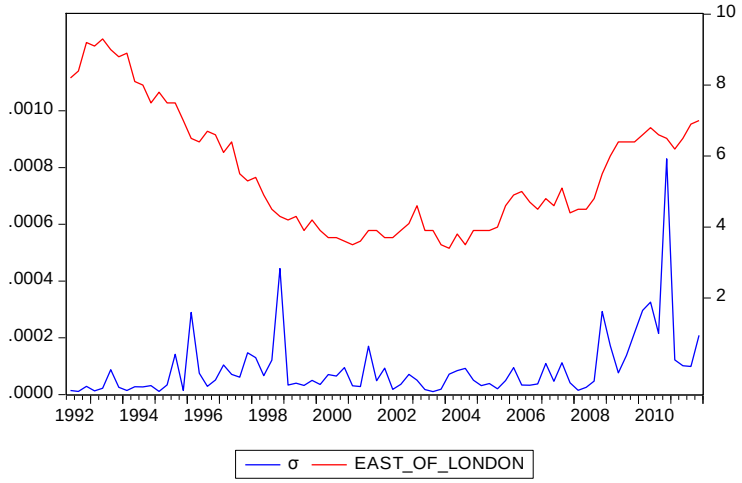


Figure 10: Illustration of unemployment rate along with the dispersion index for regions (cont'd)





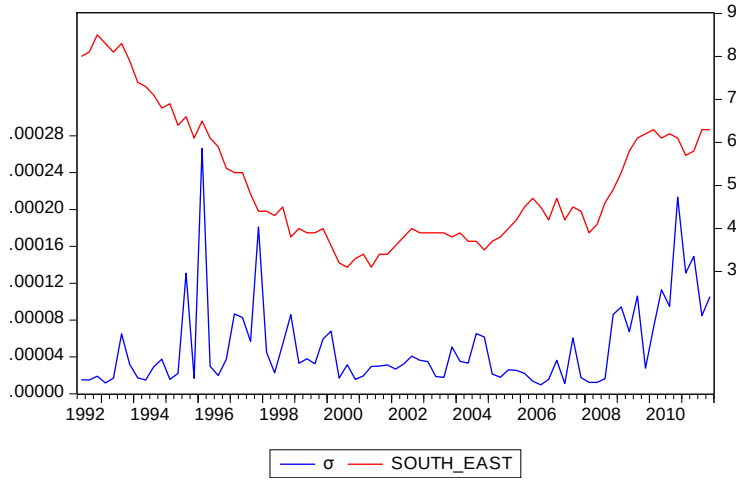
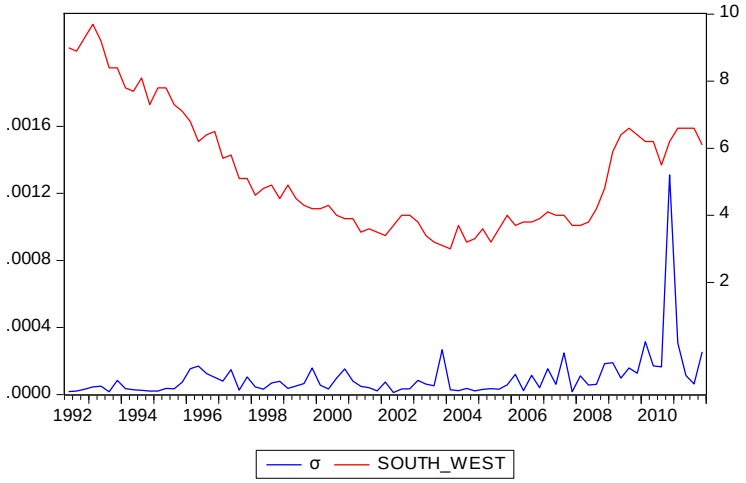
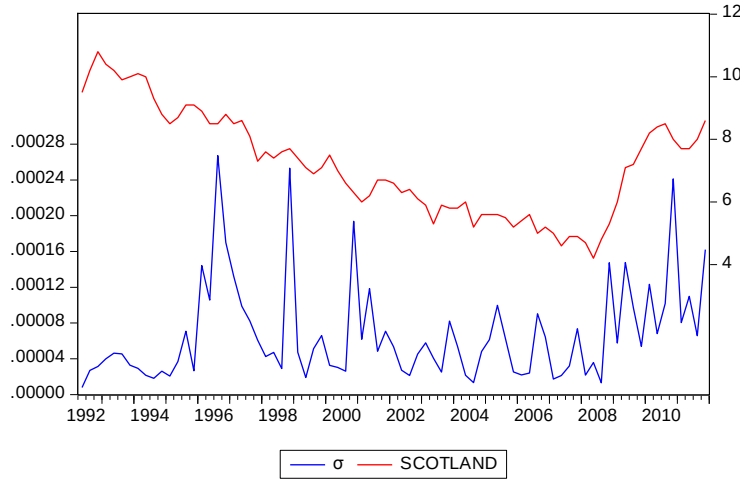
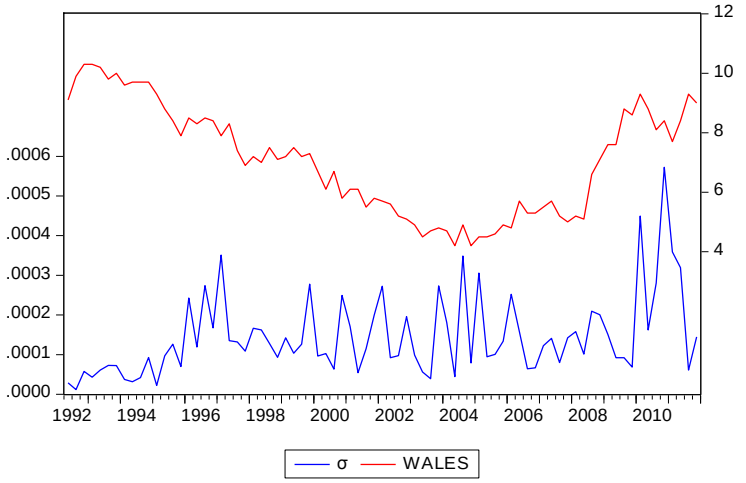
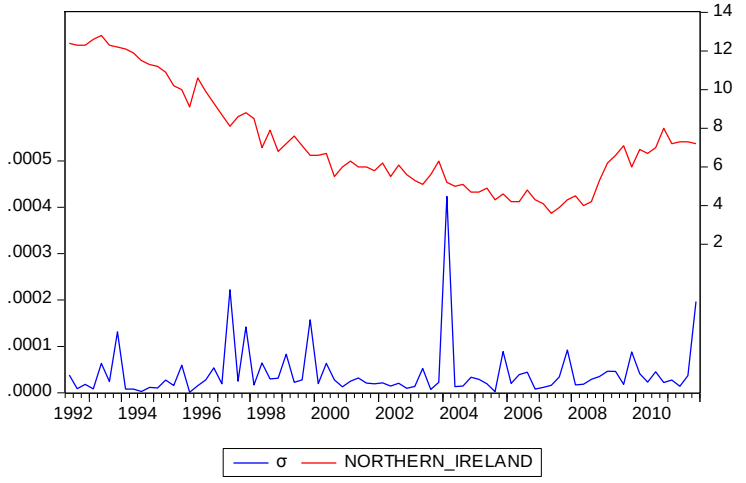


Figure 11:Illustration of unemployment rate along with the dispersion index for regions (cont'd)









The reason for that is to see the correlation, positive or negative, between them. As we can see from the diagrams for all the regions and UK there is a positive correlation between these two variables. In other words in periods where the unemployment was rising or decreasing, the increase or the decrease respectively of the proxy variable, i.e. the sectoral shocks, was more observable. Of course there were short periods when the two variables had a negative correlation due to externalities.

4.2. OLS estimation

After defining and calculating the sectoral shifts we continue to apply the OLS (Ordinary Least Squares) method over the data of UK in order to see how the sectoral shocks affect the unemployment. This method is used because we want to estimate a linear equation for the UK. The equation is the following:

$$U_t = b_0 + b_1\sigma_t + b_2\Delta\log M1_t + b_3\Delta\log CPIE_t + b_4 deficit_t + b_5 ir_t + e_t$$

Where U_t is the unemployment rate

σ_t is the dispersion index

$M1_t$ is the growth rate of money

$CPIE_t$ is the index of energy prices

$deficit_t$ is the budget deficit and

ir_t is the short term interest rate

The equation will be checked for autocorrelation, heteroscedasticity using the Breusch-Godfrey and the Arch LM test respectively and the statistical importance of the coefficients. The variables that most affect the unemployment rate will arise from the importance of the coefficients.

The expected result of the regression is an important and positive influence of σ to unemployment.

4.3. Panel Data

The part for the regions, instead of OLS, panel data methodology will be employed. In general, this method is used because the data includes both cross-sectional and time series data, like estimating in two dimensions. Here the dimensions are the regions and the time. There are two approaches for the study of the panel data: the fixed and the random effects models which are explained below. Moreover we can divide panel in two categories, balanced and unbalanced panel. The first occurs when we have for each region the same number of observations of time series while the second occurs when for some regions the number of the observations of time series is fewer or more. In practice both balanced and unbalanced panel data can be applied on fixed and random panel data. Thus, in our case we use balanced panel data.

Starting with the general equation we have:

$$y_{it} = bx_{jit} + e_{it} \qquad (1)$$

where y_{it} is the dependent variable, b is the coefficient of the independent variable and x_{jit} is the independent variable and e_{it} is the disturbance term, $j = 1, \ldots, M$ the number of independent variables, $i = 1, \ldots, N$ the number of the regions *and* $t = 1, \ldots, T$ the time.

The fixed effects model

In the fixed effects models we assume that the constant term of the regression, is different across regions and constant over time, the constant term is the term that captures the effects, and the coefficients of the independent variables are constant over both regions and time. So we can divide e_{it} into a constant term that varies over regions and the remainder disturbance term, i.e.:

$e_{it} = a_i + v_{it}$, so the equation (1) becomes,

$y_{it} = a_i + bx_{jit} + v_{it}$ and using the data it becomes,

$$U_{it} = a_i + b_1\sigma_{it} + b_2\Delta\log M1_{it} + b_3\Delta\log CPIE_{it} + b_4 deficit_{it} + b_5 ir_{it} + v_{it} \quad (2)$$

The random effects model

In the random effects models we assume that the intercept has the same behavior like the one in the fixed effects but the difference between them is that here the intercept is the sum of a constant term c and a random variable η_i. Thus we decompose e_{it} into these two terms and we have

$e_{it} = c + \eta_i + v_{it}$, so equation (1) becomes,

$y_{it} = c + bx_{jit} + \eta_i + v_{it}$ and using the data we have it becomes,

$$U_{it} = c + b_1\sigma_{it} + b_2\Delta\log M1_{it} + b_3\Delta\log CPIE_{it} + b_4 deficit_{it} + b_5 ir_{it} + \eta_i + v_{it} \quad (3)$$

After applying the fixed and the random effects models we will see if the dispersion index, in other words the σ, affects the unemployment rate. Moreover we will test which of the rest variables have an impact on unemployment.

Lastly we also employ the Hausman test. This test is applied on the random effects models in order to see if the random effects are correlated with the independent variables. In other words this test shows us which of the two models is more appropriate for our analysis.

5. EMPIRICAL RESULTS

Most of the literature supports the sectoral shift hypothesis, meaning that the job reallocation plays an important role in explaining the unemployment. In this research the results that emerge from the regressions at the first look show that there is no sectoral shift hypothesis support but with a closer look we can say that this hypothesis holds.

First, we will start from the results from the UK data. As mentioned in the previous section the method that was employed was OLS. The table 10 presents the

results of the first two models that were used, having as dependent variable the unemployment in levels.

The first model includes all the variables that were mentioned at the beginning in the data section. The initial model was tested for autocorrelation and in order to correct it lags of the unemployment were added. As we can see the first important result is that while sectoral shifts have a positive impact on unemployment, Liliens' hypothesis does not hold since the statistical importance of the coefficient of the sectoral shifts proxy is too low, 0.805. Another important result is that the impact of the unemployment of the previous period plays a significant and positive role in determining unemployment of the next period. Finally, we can see that the unemployment does not depend on money growth and the energy price index since the coefficients are not important for the period we examine. So, we proceed to estimate the second model where we have taken out these two variables. We can see that the results do not differ much i.e. the sectoral shifts index has a small importance, 0.762 and the importance of the unemployment of the previous period is too big, 12.84. One last similarity between these two models is that there is a negative impact and a positive impact of the budget deficit and the interest rate respectively on the unemployment rate.

The table 11 presents the results of the OLS estimation having as dependent variable the unemployment in first differences. The results that arise are the same as before. As we can see, in the first model where all the variables are used, the job reallocation does not play an important role in the prediction of unemployment since the statistical significance is small, 0.433. After the correction of the autocorrelation we can see that the first lag of the unemployment continues to be an important factor and this is confirmed by the statistical significance of the coefficient, 3.87. In the next model where the energy price index is excluded we can observe that the significance of the sectoral shift index falls to 0.351 and the significance of the first lag of the unemployment remains almost the same. The budget deficit and the interest rate keep the negative and positive effect, respectively, on the unemployment rate but almost with the half statistical importance than before.

Generally, in both cases where the dependent variable is in its levels and first differences we prefer the model where the non-important variables are excluded from

Table 10: Ols estimation

	Dependent variable : unemployment rate					
Independent variable	***coefficient***	***t-statistic***	***probability***	***Coefficient***	***t-statistic***	***probability***
Constant	0.184664	2.077617	0.0407	0.128172	1.616603	0.1095
σ	1901.610	0.805363	0.4228	1752.752	0.762426	0.4478
M1 growth rate	-1.396582	-1.433031	0.1555	-	-	-
CPIE(index of energy prices)	-0.349578	-0.441805	0.6597	-	-	-
Budget Deficit	-0.030613	-3.633866	0.0005	-0.031433	-3.842308	0.0002
Interest rate	0.026615	3.919414	0.0002	0.023529	3.592253	0.0005
Unemployment(-1)	1.259451	11.69649	0.0000	1.318111	12.84164	0.0000
Unemployment(-2)	-0.209030	-1.194463	0.2356	-0.190338	-1.106618	0.2714
Unemployment(-3)	0.005290	0.029985	0.9761	-0.187078	-1.947858	0.0545
Unemployment(-4)	-0.120096	-.1.211018	0.2292	-	-	-
R^2	0.990681			0.990544		
Adj. R^2	0.989706			0.989913		
Log likelihood	36.18372			35.13545		
Akaike info criterion	-0.545494			-0.580112		
Schwarz criterion	-0.278375			-0.394309		
ARCH LM test			0.8118			0.7820
Ramsey test			0.9412			0.8766

Table 11: Ols estimation (cont'd)

	Dependent variable : dlog(unemployment rate)					
Independent variable	***coefficient***	***t-statistic***	***Probability***	***Coefficient***	***t-statistic***	***Probability***
Constant	-0.012815	-1.259525	0.2111	-0.011780	-1.192778	0.2361
σ	158.4589	0.433767	0.6655	125.3637	0.351655	0.7259
M1 growth rate	-0.120954	-0.810419	0.4199	-0.122674	-0.825843	0.4111
CPIE(index of energy prices)	0.055095	0.457446	0.6485	-	-	-
Budget Deficit	-0.001395	-1.345595	0.1819	-0.001432	-1.391313	0.1676
Interest rate	0.001233	1.403287	0.1640	0.001230	1.406266	0.1631
Unemployment(-1)	0.409709	3.874829	0.0002	0.409270	3.887959	0.0002
Unemployment(-2)	0.229546	2.155512	0.0338	0.231055	2.180318	0.0318
R^2	0.482893			0.481677		
Adj. R^2	0.442222			0.447122		
Log likelihood	216.1160			216.0021		
Akaike info criterion	-4.291052			-4.309322		
Schwarz criterion	-4.078705			-4.123518		
ARCH LM test			0.9149			0.9197
Ramsey test			0.7795			0.9078

the equations. This can be easily seen by the values of R^2, Log likelihood, Akaike and Schwarz criteria.

For the regions, panel methodology was employed. As we mentioned in the previous section we use this method because we examine the data in two dimensions, the regions and the time. Also we have mentioned that two different methods will be used, the fixed and the random effects.

In the table 12 we can see the model with all the variables included, using the fixed and the random effects respectively. In both cases we can observe that the coefficient of the variable that represents the sectoral shifts is not important, 0.71 with fixed effects and 0.78 with random effects, meaning that the reallocation shocks do not affect the unemployment. All the others variables are determinants factors for the unemployment with a negative correlation between unemployment and M1, CPIE budget deficit and positive correlation with interest rate. Applying the Hausman test in order to see which model is more appropriate for our analysis, we can conclude that using random effects the results are better.

In table 13 we use a model which is the same as before with the difference that a lag of the unemployment is added. Here the results are different between the two methods. In the first method, the fixed effects, the proxy remains non-significant and the CPIE is significant at 10% significance level. But in the second, random effects the sectoral shocks are significant at 10% and almost at 5% significance level. CPIE loses totally its importance. The application of the Hausman test shows one more time that the use of random effects in the equation constitutes a better method

Observing these two tables and comparing the R^2 of them we can see that the model that includes a lag of the unemployment gives better estimates for the parameters.

The last model that we estimate and is presented in table 14 is a regression of unemployment on all the variables and dummies using fixed effects. As dummies the frequency of the data were used i.e. the quarters, 1992Q2 to 2010Q3. From the estimations of the results we keep only the variables and the dummies that were important and we reestimate the model using only these variables. The outcome of the regression is very interesting. The coefficient of the sectoral shocks is significant at all significance levels and the correlation between them is positive. All the other variable are important for the estimation of the unemployment.

Table 12: Panel estimation

	Dependent variable : unemployment rate					
	Fixed effects			***Random effects***		
Independent variable	***coefficient***	***t-statistic***	***probability***	***coefficient***	***t-statistic***	***probability***
Constant	3.440447	17.14891	0.0000	3.435162	9.235687	0.0000
σ	241.3102	0.717981	0.4729	268.0104	0.798078	0.4250
M1 growth rate	-21.67164	-3.325303	0.0009	-21.64562	-3.321317	0.0009
CPIE(index of energy prices)	-18.85686	-3.913441	0.0001	-18.82685	-3.907233	0.0001
Budget Deficit	-0.376349	-24.49901	0.0000	-0.376324	-24.49742	0.0000
Interest rate	0.448476	16.58248	0.0000	0.448947	16.60054	0.0000
R^2	0.595008			0.439375(weighted) 0.324564(unweighted)		
Adj. R^2	0.588048			0.436399		
Log likelihood	-1692.257			-		
Akaike info criterion	3.606026			-		
Schwarz criterion	3.693077			-		
Hausman test						1.0000

Table 13: Panel estimation (cont'd)

	Dependent variable : unemployment rate					
	Fixed effects			***Random effects***		
Independent variable	***coefficient***	***t-statistic***	***probability***	***coefficient***	***t-statistic***	***probability***
Constant	0.312964	4.631826	0.0000	0.183878	2.862109	0.0043
σ	110.5404	1.144938	0.2525	178.0661	1.903466	0.0573
M1 growth rate	-6.544410	-3.470343	0.0005	-5.894760	-3.130715	0.0018
CPIE(index of energy prices)	-2.545214	-1.819300	0.0692	-1.869343	-1.340336	0.1805
Budget Deficit	-0.053006	-9.532796	0.0000	-0.040814	-7.840499	0.0000
Interest rate	0.033965	3.611983	0.0003	0.019531	2.146269	0.0321
Unemployment(-1)	0.906241	101.6291	0.0000	0.939956	132.5614	0.0000
R^2	0.966090			0.964596(weighted) 0.964596(unweighted)		
Adj. R^2	0.965462			0.964367		
Log likelihood	-501.9778			-		
Akaike info criterion	1.111064			-		
Schwarz criterion	1.204172			-		
Hausman test						1.0000

Table 14: Panel estimation (cont'd)

	Fixed with dummies		
Independent variable	***Coefficient***	***t-statistc***	***Probability***
Constant	3.574619	19.12640	0.0000
σ	723.5316	2.341153	0.0194
M1 growth rate	-15.52886	-2.553136	0.0108
CPIE (index of energy prices)	-34.85588	-7.121224	0.0000
Budget deficit	-0.372566	-24.25594	0.0000
Interest rate	0.410994	16.00857	0.0000
1993Q2	2.147667	5.456970	0.0000
1993Q3	1.717530	4.338976	0.0000
1993Q4	2.059586	5.245679	0.0000
1994Q2	2.437246	6.179514	0.0000
2008Q4	-3.084016	-7.528989	0.0000
2009Q1	-1.971083	-4.583251	0.0000
2010Q2	0.609065	1.525099	0.1276
R^2	0.664962		
Adj. R^2	0.656623		
Log likelihood	-1602.374		
Akaike info criterion	3.431169		
Schwarz criterion	3.554064		

So we can conclude that the sectoral shocks play an important role in predicting and explaining the unemployment. In other words, the sectoral shift hypothesis holds for UK for the period 1992-2011.

6. CONCLUSION

In this study the target was to examine Liliens' sectoral shift hypothesis for the United Kingdom, as well as for its regions. In other words we tested how moves of workers between sectors affect the unemployment rate of the UK economy. We used as basic variables the unemployment rate and the dispersion index that represents the sectoral shifts. In order to see what other factors influence the unemployment rate we used also exogenous variables and variables for monetary and fiscal policy. Because of the structure of data, the method that was applied for the UK was OLS and for the regions was panel data. The initial result is that the sectoral shift hypothesis is not valid for the

UK because of the insignificance of the variable in our regressions. But applying the panel data and taking a better look at the results we can conclude that the sectoral shifts have a positive and significant impact on the unemployment rate of the UK economy. The diversity of data from other papers is due to different used variables, frequency of data and applied method.

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