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The Resilience of UK Regional Employment Cycles

By

Marianne Sensier and Michael Artis

Centre for Growth and Business Cycle Research, Economic Studies,
University of Manchester, Manchester, M13 9PL, UK

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The Resilience of UK Regional Employment Cycles

Marianne Sensier†

(marianne.sensier@manchester.ac.uk)

†Economics, School of Social Sciences and
Centre for Growth and Business Cycles Research,
Arthur Lewis Building, The University of Manchester,
Oxford Road, Manchester, M13 9PL, UK
and

Michael Artis*

*School of Business and Economics, Swansea University, Wales

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Abstract

This paper dates the classical business cycle of quarterly UK GDP, unemployment, aggregate and regional employment to assess turning points in the economic cycle. We analyse synchronisation of the regions with UK employment and investigate which regions lead into recession. We perform the McNemar Test on groups of regions and arrive at Northern and Southern regional clusters. We find that the northern regions have had a greater incidence of recession with southern regions suffering more severe recessions (in terms of total jobs lost). Finally we compare the resilience of the regional employment cycle to UK employment. This most resilient region to the 2008 recession was London from our Southern grouping and the least resilient has been the Northern Ireland in our northern grouping.

JEL classifications: C22, E32.

Keywords: classical business cycle dating algorithm, regional resilience.

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1. Introduction

We study the pattern of cyclical activity for the UK regional business cycles as measured by employment¹. We investigate classical business cycles (absolute falls in economic activity) to monitor how synchronised and correlated are the UK regional cycles from 1992 to 2014 and gauge how resilient regional employment has been during the recent recession. We initially analyse classical business cycle turning points in UK aggregate data and then compare these to turning points in the UK regions employment cycle.

The resilience of regions to withstand economic shocks has been gaining prominence in the spatial economics literature (see Martin, 2012 and Fingleton, et al, 2012). Since the financial crisis of 2008 some regions in the United Kingdom (UK) have rebounded strongly but others have been “bumping along the bottom” (the phrase used to describe the UK economy’s progress since the crisis in King, 2010). We compare the resilience of UK regional cycles to the aggregate data. The resilience of the employment cycle is of interest to Central Government policy makers, and at the regional level to businesses, Local Enterprise Partnerships and to devolved administrations like the Scottish and Welsh Governments as they use the economic levers at their disposal to mitigate the impact of any economic downturn. Martin (2012) defines four interrelated dimensions of resilience that are necessary for describing how a regional economy responds to a recessionary shock. First is resistance which is the sensitivity of a region compared to the nation during the recession, second is the speed and extent of recovery from the recession, third is if the region goes through structural re-orientation and what implications this has for the region’s jobs, output and income. The fourth dimension is the degree of renewal a region will undergo following the shock. We compare the 12 regions of the UK (at the NUTS 1 level) to the UK employment. Our study differs from Martin (2012) who uses fixed turning points in regional annual employment data. We utilise our business cycle dating algorithm to determine the turning points of the employment cycle. In Sensier and Artis (2014) we compare the countries of the UK analysing the annual data, in this paper we analyse quarterly frequency data from the Labour Force Survey and downloaded from the Office for National Statistics.

¹ We analyse this measure as consistent regional GDP data does not exist at a higher frequency than annual and the Gross Value Added (GVA) data that is reported in Regional Trends is a nominal measure and therefore does not reflect real activity in a region.

In the next section we review the classical business cycle dating algorithm of Artis, Marcellino and Proietti (2004). Section 3 presents the dates of turning points in the classical business cycle for UK aggregate data. In section 4 we date turning points in quarterly regional employment and analyse synchronicity. In section 5 we compare the national employment loss of the 2008 recession with the regions of the UK. Finally section 6 offers some conclusions.

2. Business Cycle Dating Algorithm

We utilise the classical business cycle dating algorithm of Artis, Marcellino and Proietti (2004). This approach is nonparametric and similar to Pagan's dating method (Harding and Pagan, 2002 and 2006) which in turn relates to the Bry and Boschan (1971) cycle dating used by the National Bureau of Economic Research (NBER).

The underlying Markov chain can be described as at any time t , the economy can be in either of two mutually exclusive phases: expansion (E_t) or recession (R_t). Our convention is that a peak terminates an expansion and a trough terminates a recession. To enforce the alternation of peaks and troughs it is useful to distinguish turning points within these two phases:

$$\begin{aligned} E_t &\equiv \begin{cases} EC_t \\ P_t \end{cases} \\ R_t &\equiv \begin{cases} RC_t \\ T_t \end{cases} \end{aligned} \tag{1}$$

From the expansion continuation (EC_t) we can make a transition to the peak (P_t) or continue the expansion, but not vice versa as only $P_t \rightarrow RC_{t+1}$ is admissible. Analogously, from recession continuation (RC_t) we can make a transition to the trough (T_t) but $T_t \rightarrow EC_{t+1}$ with the probability of 1. The dating rules impose a minimum duration of a phase of 2 quarters. We also impose the minimum length of the entire business cycle (from peak to peak) to be 5 quarters.

The issue of synchronisation of cycles is addressed by measuring the concordance of the business cycle binary indicator variable (S_t) which takes the value of 1 when the region is in expansion and 0 when in recession. The index of concordance, I_{ij} , is simply the percentage of time units spent in the same phase between two regions:

$$I_{ij} = \frac{1}{T} \sum_{t=1}^T [S_{it}S_{jt} + (1-S_{it})(1-S_{jt})] \quad (2)$$

The mean corrected concordance index is $I_{ij}^* = I_{ij} - \bar{I}_{ij}$, where \bar{I}_{ij} is the estimate of the expected value of the index under the assumption of independence, represents the fraction to be expected when there is no relationship between the cycle in the two regions:

$$I_{ij}^* = 2 \frac{1}{T} \sum_{t=1}^T (S_{it} - \bar{S}_{it})(S_{jt} - \bar{S}_{jt}) \quad (3)$$

Dividing I_{ij}^* by its asymptotic standard error we get the standardised index, this is estimated non-parametrically using a Newey-West estimator. This can be interpreted as a t-statistic for the null hypothesis of independence of cycles.

3. Turning Points in UK Aggregate Activity

We date the turning points of the classical business cycle for UK aggregate data using the business cycle dating algorithm summarised in the Section 2. We analyse output (quarterly Gross Domestic Product), employment and unemployment over the sample 1971q1-2014q4. We apply our algorithm to the level of the data series. The dates of our turning points are listed in Table 1 and charts are presented for each UK aggregate series in Appendix A (note that peaks and troughs are listed as troughs and peaks for unemployment as these series are counter cyclical). As a benchmark for our cycle dating exercise we note the classical business cycle dates reported by the Economic Cycle Research Institute (ECRI: www.businesscycle.com) who analyse a range of data on the UK economy to establish turning points (using a similar method to the NBER in the US who analyse employment, production, sales and income). In January 2009 the ECRI reported that the UK economy had reached the peak turning point of the cycle in May 2008 and then entered a recession in June 2008. This corresponds with the “media” definition of a recession which states that two consecutive negative quarters of GDP growth constitute a recession. The National Statistics Authority confirmed early in 2009 that the UK experienced two consecutive quarters of decline in GDP in the last two quarters of 2008.

Table 1: Cycle turning points for UK aggregates 1971m1-2014q4

Turning Point	UK (ECRI)	GDP	Employment	Unemployment
Peak				1973q4
Trough				1977q4
Peak		1973q2		1979q2
Trough		1974q1		1984q2
Peak	1974m9	1974q3	1974q3	1985q4
Trough	1975m8	1975q3	1976q3	1986q3
Peak	1979m6	1979q2	1979q4	1990q2
Trough	1981m5	1981q1	1983q2	1993q1
Peak	1990m5	1990q2	1990q2	2001q2
Trough	1992m3	1991q3	1993q1	2002q3
Peak				2004q3
Trough				2007q1
Peak	2008m5	2008q1	2008q2	2007q4
Trough	2010m1	2009q2	2010q1	2010q1
Duration	7 q	5 q	7 q	9 q
Change P to T		-6.04%	-2.39%	57%
Recovery date		2013q3	2012q3	Not yet
Peak				2010q3
Trough				2011q4

In Table 1 we discover that the business cycle peak dated in unemployment (this is counter-cyclical) suggests that the UK economy entered the downturn in 2008 after the peak of 2007q4. According to the GDP and employment series the peak of the cycle was dated in 2008q1 and 2008q2 respectively, these correspond more closely to the 2008m5 date reported by ECRI in the second column. Unemployment data has the most turning points (see Figure A.3). The employment series lags the GDP peak turning point by one quarter but experiences a longer recession though there is less percentage loss of employment peak to trough than GDP. Gregg and Wadsworth, (2010) suggest that during the 2008/9 recession employers held onto workers and cut hours and pay rather than make them redundant. Rafferty, et al (2013) find that the North of England also suffered comparatively high levels of underemployment and over-education during the 2008/9 recession suggesting a potential under-utilisation of skills². The Office for National Statistics reported (see ONS, 2015) that net migration to Britain was 298,000 in 2014 so this addition of migrant workers combined with falling unemployment has boosted the employment level to its highest ever amount of 30,896,000 at the end of 2014. We also see in Table 1 and the graphs that the aggregate unemployment series experience a further

² Time related underemployment exists when the hours of work of an employed person are insufficient in relation to an alternative employment situation in which the person is willing and available to engage (ILO 1998).

downturn late in 2010 and into 2011 which the media has termed the “double-dip”, as the second “peak” in unemployment was higher than the first taking the percentage change from 2007q4 peak to 2011q4 trough means that the level has risen by 67% as compared to 57% after the first dated trough in 2010q1. The GDP series only recovered back to its peak level from before the crisis in 2013q3 but employment was quicker to return to its pre-recession peak level in 2012q3, unemployment is yet to return to its 2007 low.

Table 2 presents the summary statistics for the aggregate series with the probability of expansions more likely for GDP and employment though as likely as the probability of recession for unemployment. The steepness statistic is calculated by dividing the average amplitude by the average duration of the cycle. We notice an asymmetry in the steepness coefficients with a much steeper loss of GDP and employment and gain of unemployment during recessions.

Table 2: Summary Statistics for UK aggregates Business Cycle 1971q1-2014q4

Analysis of Cyclical Information:	GDP	Employment	Unemployment
No. of cycles P to P	5	4	9
No. of cycles T to T	5	5	8
Av. Expansion Prob.	0.86	0.75	0.48
Av. Recession Prob.	0.14	0.25	0.52
Av. Expansion Duration	30.4	33	11.5
Av. Recession Duration	4.8	8.8	9.3
Av. Expansion Amplitude	64,255	2,698.5	-542.6
Av. Recession Amplitude	-11,298	-902.2	580.3
Steepness of Expansions (Amp/Duration)	2113.6	81.8	-47.2
Steepness of Recessions	-2353.8	-102.5	62.2

Table 3: UK aggregates Business Cycle Synchronisation

	GDP	Employment	Unemployment
GDP	1	0.14**	-0.12**
Employment	0.82	1	-0.26**
Unemployment	0.36	0.23	1

Notes: concordance index (bottom left), mean-corrected concordance index (top right), test t-statistics significant at 5% level (**). Sample 1971q1-2014q4.

We present the concordance index for the national series in Table 3. The concordance index at the top right of Table 3 assumes independence and represents the fraction to be expected if there is no relationship between the two cycles.

4. Turning Points in Regional Employment

To study the UK regional business cycle we download labour market data from the UK Statistics Authority³ at the NUTS1 level for Wales, Scotland and Northern Ireland along with the nine English regions: North West (NW), North East (NE), London (LN), South East (SE), East (ET), Yorkshire and Humberside (YH), East Midlands (EM), West Midlands (EM) and the South West (SW). The regional employment data is collected in the Labour Force Survey (LFS) and is seasonally adjusted available from 1992q2. When we can establish the peak turning point of the business cycle we can construct our binary indicator of recessions to check synchronicity of regions with each other and the UK aggregate. The classical business cycle dating algorithm of Artis, *et al* (2004) is next applied to regional employment data detailed in Section 3 between 1992q1 to 2014q4⁴.

The turning points dates from this analysis are listed in Table 4 and charts illustrating these turning points are shown in the Appendix B. From this we can see that the algorithm has dated the peak before the downturn to be 2007q4 for the North West, North East and South West (so they enter recession in 2008q1 two quarters before national employment in 2008q3). In 2008q1 the pre-recession peak is reached by Yorkshire & Humberside, the East and West Midlands, leading national employment by one quarter. Then the South East, Wales, Scotland and Northern Ireland are in recession from 2008q3 coinciding with UK employment. Finally London and the Eastern regions enter recession in 2009 with the peak dated at 2008q4, so lagging national employment by one quarter. All regions then experience a subsequent smaller downturn, with 4 experiencing a third downturn (North East, North West, South West and Wales). Only Yorkshire and Humberside experiences a “double dip” recession where the first peak is the maximum and the second consecutive trough is the minimum.

Summary statistics with averages over expansion and recession cycle phases for each region’s employment data are presented in Table 5. Here we can see that the South East region has the largest average probability of being in expansion (0.82) and the North East the greatest recession probability (0.4) with the greatest number of downturns along with the North West. The South East has the longest expansion

³ See the web-page: <http://www.ons.gov.uk/ons/taxonomy/index.html?nsc1=Labour+Market>.

⁴We calculate the 1992q1 regional levels by applying the proportional shares of regional totals from 1992q2 and dividing total employment by these shares.

average duration (15 quarters) and Wales has the longest recession average duration at 5.8 quarters. Amplitude is a measure of the depth of the cycle, so for an expansion it is the cumulative increase over that phase. Average amplitude is then the mean over all phases. We see that London has the steepest gain of jobs during expansions on average with the South East having the steepest job loss during recessions on average.

Once we have dated our business cycle peaks and troughs we create a binary indicator variable that is one in expansion phases and zero in recession. We investigate how synchronised the business cycle phases are between all pairs of regions and the UK and then we investigate cluster synchronisation with the McNemar test as applied in Bovi (2005). The mean-corrected or standardised concordance index is presented in the top right of Table 6 for the full sample with the stars indicating that the test is significant. The South West is significantly synchronised with 6 other regions and Yorkshire & Humberside with none. Table 6 also reports the concordance index of similarity between the binary indicators at the bottom left. The highest concordance index is between the South West and North West which are in the same business cycle phase for 84% of the time, the mean corrected index for this is 0.25. The regions which are not synchronised with UK employment are London, the East Midlands and the North East.

Table 7: McNemar Test contingency table

		Cluster 2	
		In-phase	Out-of-phase
Cluster 1	In-phase	$N_{in,in} \equiv N_{11}$	$N_{in,out} \equiv N_{12}$
	Out-of-phase	$N_{out,in} \equiv N_{21}$	$N_{out,out} \equiv N_{22}$

In order to test for clustering of region groups we perform the McNemar test (McNemar, 1947, as applied by Bovi, 2005 and Artis and Okubu, 2009). This is a non-parametric test that statistically analyses the frequency of synchronisation for groups of regions arranged in 2x2 contingency tables as presented in Table 7. In our application we test if business cycle phases are taking place at the same time for regions and also tests the relative homogeneity of a cluster of regions. The McNemar test statistic (with a continuity correction suggested in Sheshkin, 2002) is distributed as chi-squared test with one degree of freedom:

$$\chi^2(1) = \frac{(|N_{12} - N_{21}| - 1)^2}{N_{12} + N_{21}} \quad (4)$$

Table 8: McNemar test for alternative region groupings

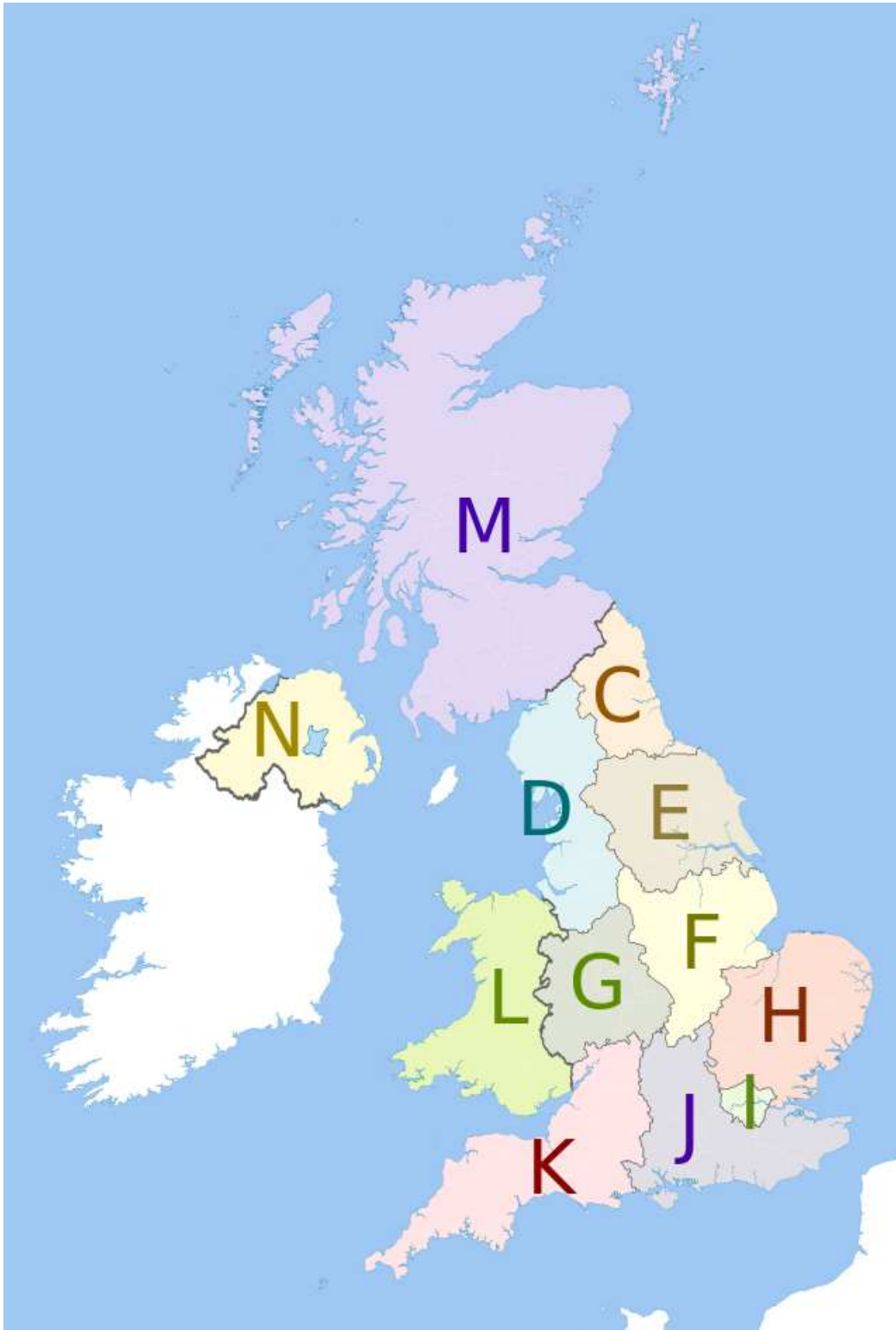
Grouping 1 ($N_{11} = 7; N_{12} = 18; N_{21} = 7; N_{22} = 59$)	1992q1-2014q4
“South” : London, South East, Eastern, East Midlands, South West and West Midlands	4.0 (0.05)
“North” : Wales, Scotland, North West, North East, Yorkshire and Humberside and Northern Ireland	
Grouping 2 ($N_{11} = 7; N_{12} = 13; N_{21} = 22; N_{22} = 49$)	
“East” : London, South East, Eastern, North East, East Midlands and Yorkshire and Humberside	1.83 (0.18)
“West” : Wales, West Midlands, North West, South West, Scotland and Northern Ireland	

Table 9: Average proportion of regional employment of UK total employment

Turning Point	NUTS 1 Region code	Full Sample: 1992-2014	Totals for Grouping 1
Wales	L	4.57%	North: 39%
Scotland	M	8.57%	
North West	D	11%	
North East	C	3.92%	
Yorkshire and Humberside	E	8.26%	
Northern Ireland	N	2.58%	
London	I	12.56%	South 61%
South East	J	14.4%	
Eastern	H	9.57%	
South West	K	8.55%	
East Midlands	F	7.27%	
West Midlands	G	8.73%	

The Eurostat classification is Nomenclature of Territorial Units for Statistics (NUTS) and for level 1 regions and the letter codes are given in Table 9. A map of the United Kingdom shows the location of these regions in Figure 1.

Figure 1: Map of UK NUTS 1 Level Regions



We test a number of different groupings of regions (with 6 in each cluster) but the most significant grouping is a geographical split of the country into North vs.

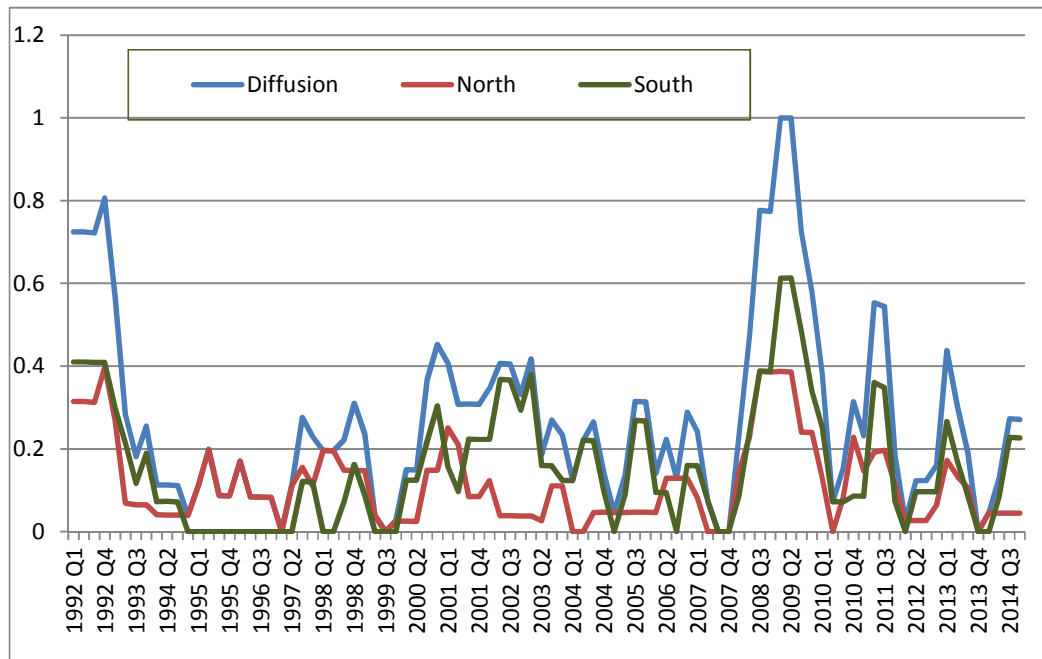
South with the McNemar test results shown in Table 8. Here the Northern cluster includes Scotland, North West, North East, Yorkshire and Humberside, Northern Ireland and Wales and in the Southern cluster we have London, South East, Eastern, East Midlands, West Midlands and the South West. The second most significant test is an East vs. West regional split but here the p-value less significant at 18%. We can conclude with our first grouping that as N_{12} is significantly larger than N_{21} the regions in the Southern cluster are more homogenous than the regions in the Northern cluster. The Southern group also contains 61% of employment in the UK as compared to 39% in the Northern group, as shown on Table 9.

To calculate a common cycle for our Northern and Southern clusters we calculate a weighted diffusion index for the North and South separately where the weights are the time-varying proportions of each regions share of total UK employment. We also calculate this measure for all regions to get an overall index:

$$D_t = \sum_{i=1}^N w_{it} S_{it}, \quad t = 1, \dots, T, \quad \sum_i w_{it} = 1. \quad (5)$$

The average of these weights (w_{it}) over the 1992-2014 sample are detailed in Table 9. Over time the weights have fallen for all the regions in the northern group and increased for all in the southern group apart from the Eastern region.

Figure 2: Diffusion Index for Southern and Northern Clusters



The diffusion index is presented as the blue line in Figure 2 which shows pronounced phases where the national recession occurred in 1992 and between 2008-2010 (with 2009q1 and 2009q2 1 where all regions are in recession). When we compare the diffusion indices for the region clusters we see that there are more recession phases for the northern group (red line) but the southern group (green line) experiences a greater diffusion index in 2009 as there are more workers in this group (61%). The southern group experiences a recession between 2002-3, possibly following the downturn in the US, Germany and France as dated by the Economic Cycle Research Institute.

5. Comparing Regional Resilience for the 2008 Recession

In Table 10 we compare the percentage of employment lost nationally in the 2008 recession with the regions of the UK. To calculate the resistance of regions we compute a sensitivity index (β_r) (from Martin, 2012) which gauges the percentage change in employment lost in a region (E_r) compared to the nation (E_n), as follows:

$$\beta_r = (\Delta E_r / E_r) / (\Delta E_n / E_n) \quad (6)$$

The percentage changes are taken between the peak and the trough turning points of the series and a recession β_r greater than one will show a region that is less resistant than the nation. Here our calculations differ from Martin (2012) as we allow for different peak and trough dates for each region.

Table 10 documents the effect of the global financial crisis on regions of the UK (here ordinary font of the peaks and troughs signifies the region's cycle coincides with that of UK employment, bold font indicates that the region leads and italics symbolise the region is lagging). Yorkshire experienced a "double dip" recession with the longest downturn of 11 quarters duration, taking in 3 falls of employment until reaching a minimum value in 2010q3. The greatest percentage loss in employment was in Northern Ireland at -5.87% followed by the North East with -5.56% along with most other regions from the Northern group. We compare regional resilience with Martin's sensitivity index (the Beta in Table 10) to compare regions to national employment. London has been the most resistant region losing less than the UK aggregate experiencing the smallest loss of employment of -2.37% (this region has net in-migration with others regions experiencing out migration, see ONS, 2015) and has

the shortest duration and recovered its peak employment level first by 2010q3 in the shortest amount of time in 7 quarters. The least resilient region has been Northern Ireland with the North East the least resilient region in England. All regions have now recovered their peak turning point dated at the start of the recent crisis with the North East taking the longest time to return to this peak in 28 quarters by 2014q4.

Most of the regions experienced a further fall in employment. This is not classified as a double dip recession as the second trough needs to be lower than the first to become the lowest minimum. The UK aggregate only falls over one quarter in 2011 by -0.58%, this is compared to the regions experiencing this second decline and again the North East is the least resilient with -4.73% fall in employment. Further falls in employment are dated between 2012 and 2013 for the North East, North West, West Midlands, the East, the South West and Wales with the West Midlands experiencing the largest fall of -2.48%.

6. Conclusions

We have investigated the classical business cycles for UK GDP, unemployment and national employment as well as for the regions (over the sample 1992 to 2014). We confirm what has already been reported in the literature that the drop in employment over the 2008 recession was less severe than the loss of GDP and the peak level of employment was returned to in 2012q3 one year before GDP in 2013q3. The impact could have been cushioned by people working less hours rather than taking redundancy and greater amounts of external and internal migration into and around the country boosting employment levels (ONS, 2015). Employment was more resilient than GDP and more resilient than it was recovering from the 1990s recession.

We discover that all regions have experienced a second recession after the 2008 crisis but only Yorkshire and Humberside experiences a “double dip” recession. The South West is the most synchronised region in the UK. When we analyse the employment cycle at the regional scale we find a greater incidence of downturns than in the aggregated data.

We utilise the McNemar test to identify a common cycle for North vs. South clustering for regions. The diffusion index illustrates that the northern regions have had a greater incidence of recession with southern regions suffering more severe recessions (in terms of total jobs lost as they are the larger share with 61% of UK

employment). This result is supported by the resilience analysis which shows that the most resilient region in the 2008 recession was London from our Southern grouping and the least resilient has been Northern Ireland in our northern grouping. How did London “Get away with it”? Overman (2011) suggests the larger proportion of middle income earners and jobs in the service industry helped London recover quicker. London has the largest and most diverse labour market. Bank bailouts helped save the banking sector.

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Table 4: Classical Business Cycle turning points for UK and Regional Employment data, 1992q1-2014q4

Turning Point	North East	North West	Yorks & Humber	East Midlands	West Midlands	East	London	South East	South West	Wales	Scotland	Northern Ireland	UK
Peak	1993q2	1994q4	1992q3	1993q3			1992q4						1990q2
Trough	1994q4	1995q2	1993q1	1994q3	1992q4	1993q2	1993q4	1992q4	1993q1	1993q2	1992q4	1993q4	1993q1
Peak		1997q1	1995q4								1995q1	1997q3	
Trough		1997q3	1996q4								1996q1	1998q3	
Peak	1997q3	1998q3		1998q2	1998q3		1997q2			1997q2	1997q4	1999q3	
Trough	1999q2	1999q1		1998q4	1999q1		1997q4			1998q2	1998q3	2000q2	
Peak	2000q2	2000q2	2000q4	2000q2	2002q4	2001q1	1999q4	2000q2	2000q3	2000q4	2000q4		
Trough	2001q1	2000q4	2001q2	2001q1	2003q3	2003q1	2000q2	2000q4	2001q1	2001q2	2002q1		
Peak	2001q4			2002q3	2005q1	2004q1	2001q2	2002q1	2005q2	2004q2	2003q2	2003q1	
Trough	2003q1			2003q3	2005q4	2004q4	2003q1	2002q3	2005q4	2006q4	2003q4	2003q4	
Peak			2006q1	2006q3	2006q3	2005q2	2003q3						
Trough			2007q1	2007q2	2007q1	2006q2	2004q3						
Peak	2007q4	2007q4	2008q1	2008q1	2008q1	2008q4	2008q4	2008q2	2007q4	2008q2	2008q2	2008q2	2008q2
Trough	2009q2	2009q4	2009q2	2010q3	2009q1	2010q1	2009q2	2009q3	2010q1	2010q1	2010q1	2009q2	2010q1
Peak	2010q3	2010q3	2010q2	2011q2	2012q4	2012q1	2011q1	2011q1	2010q3	2011q1	2011q2	2011q2	
Trough	2011q3	2011q2	2010q4	2011q4	2013q3	2013q1	2011q3	2011q3	2011q2	2011q3	2011q4	2013q2	
Peak	2012q3	2012q4							2012q4	2013q4			
Trough	2013q1	2013q3							2013q2				

Table 5: Summary statistics for classical turning points in regional employment data, 1992q1-2014q4

Summary Statistics	NE	NW	YH	EM	WM	East	London	SE	SW	Wales	Scotland	NI	UK
No. of cycles P to P	7	7	6	7	6	5	7	5	6	6	6	5	1
No. of cycles T to T	8	8	6	7	7	6	7	5	6	6	7	6	2
Av. Expansion Prob.	0.6	0.71	0.79	0.7	0.77	0.67	0.75	0.82	0.72	0.62	0.71	0.67	0.87
Av. Recession Prob.	0.4	0.29	0.21	0.3	0.23	0.33	0.25	0.18	0.28	0.38	0.29	0.33	0.13
Av. Expansion Duration	7.9	9.3	12.2	9.1	11.8	12.4	9.9	15	11	9.5	10.8	12.4	80
Av. Recession Duration	4.6	3.4	3.2	4	3	5	3.3	3.4	4.3	5.8	3.9	5	6
Av. Expansion Amplitude	53	98.7	95.8	86.2	105.7	140.8	228.4	203	119.5	59.8	109.8	66.2	6323
Av. Recession Amplitude	-30.9	-41	-41.5	-31.1	-47.3	-36.8	-48.6	-56.4	-39.3	-27.1	-45.8	-22.8	-568.5
Steepness of Expansions	6.75	10.63	7.88	9.43	8.93	11.36	23.17	13.53	10.86	6.3	10.14	5.34	79.04
Steepness of Recessions	-6.68	-12.15	-13.11	-7.79	-15.78	-7.37	-14.78	-16.59	-9.07	-4.65	-11.86	-4.55	-94.75

Table 6: Regional Employment Concordance with UK Employment

Turning Point	NE	NW	YH	EM	WM	East	London	SE	SW	Wales	Scotland	NI	UK
NE	1.00	0.16**	0.01	0.12*	0.08	0.02	0.06	0.16**	0.12*	-0.00	0.07	0.11	0.07
NW	0.70	1.00	0.05	0.04	0.15**	0.03	-0.04	0.15**	0.25**	0.06	0.07	0.05	0.16**
YH	0.57	0.67	1.00	0.07	0.06	-0.00	-0.04	0.03	0.08	0.08	0.05	-0.00	0.08*
EM	0.66	0.62	0.68	1.00	0.08	-0.05	-0.02	0.06	0.05	-0.01	0.08	0.02	0.07
WM	0.63	0.76	0.72	0.68	1.00	0.05	-0.07	0.07	0.13**	0.07	0.04	0.09	0.09*
East	0.55	0.60	0.60	0.52	0.64	1.00	0.12**	0.08	0.10	0.14*	0.09	0.05	0.13**
London	0.61	0.57	0.61	0.58	0.57	0.71	1.00	0.04	-0.05	0.01	0.01	0.08	0.00
SE	0.72	0.78	0.72	0.68	0.74	0.68	0.70	1.00	0.18**	0.14**	0.11**	0.08	0.15**
SW	0.66	0.84	0.71	0.63	0.75	0.67	0.55	0.82	1.00	0.20**	0.09*	0.05	0.19**
Wales	0.52	0.61	0.65	0.53	0.63	0.68	0.57	0.72	0.75	1.00	0.12*	0.06	0.16**
Scotland	0.61	0.65	0.67	0.66	0.65	0.66	0.61	0.74	0.68	0.67	1.00	0.13**	0.16**
NI	0.64	0.62	0.60	0.59	0.68	0.61	0.66	0.68	0.63	0.60	0.71	1.00	0.11**
UK	0.64	0.82	0.79	0.72	0.79	0.76	0.68	0.88	0.85	0.75	0.82	0.74	1.00
Concordance With No. of Regions	4	4	0	1	2	2	1	5	6	4	4	1	

Notes: concordance index (bottom left), mean-corrected concordance index (top right), test t-statistics significant at 5% level (**) and 10% (*).
Sample: 1992q1-2014q4.

Table 10: Regional Employment Resilience Compared to UK Employment

	NE	NW	YH	EM	WM	ET	LN	SE	SW	WL	SC	NI	UK
Peak	2007q4	2007q4	2008q1	2008q1	2008q1	<i>2008q4</i>	<i>2008q4</i>	2008q2	2007q4	2008q2	2008q2	2008q2	2008q2
Trough	2009q2	2009q4	<i>2010q4</i>	<i>2010q3</i>	2009q1	2010q1	2009q2	2009q3	2010q1	2010q1	2010q1	2009q2	2010q1
% loss	-5.56	-2.48	-3.94	-3.28	-3.49	-2.65	-2.37	-2.50	-3.19	-4.19	-4.50	-5.87	-2.39
Beta	2.33	1.04	1.65	1.37	1.46	1.11	0.99	1.05	1.34	1.76	1.89	2.46	1.00
Steepness	10.83	10.00	8.82	7.10	22.25	15.00	45.50	21.40	9.11	8.29	16.43	11.75	101.29
Duration	6	8	11	10	4	5	2	5	9	7	7	4	7
Recovery d	2014q4	2014q1	2013q4	2013q4	2012q3	2011q1	2010q3	2013q2	2014q1	2013q2	2013q3	2011q2	2012q3
Q to recover	28	25	23	23	18	9	7	20	25	20	21	12	17
	NE	NW	YH	EM	WM	ET	LN	SE	SW	WL	SC	NI	UK
Peak	2010q3	2010q3		2011q2			2011q1	2011q1	2010q3	2011q1	2011q2	2011q2	2011q2
Trough	2011q3	2011q2		2011q4			2011q3	2011q3	2011q2	2011q3	2011q4	2013q2	2011q3
% loss	-4.73	-1.06		-1.99			-1.18	-1.16	-1.92	-1.54	-1.11	-1.37	-0.58
Beta	8.2	1.84		3.45			2.04	2.00	3.33	2.66	1.93	2.37	1.00
Steepness	13.75	11.33		21.50			23.00	24.50	16.33	10.50	14.00	1.38	170
Duration	4	6		2			2	2	3	2	5	8	1
	NE	NW	YH	EM	WM	ET	LN	SE	SW	WL	SC	NI	UK
Peak	2012q3	2012q4			2012q4	2012q1			2012q4	2013q4			
Trough	2013q1	2013q3			2013q3	2013q1			2013q2	2014q2			
% loss	-1.65	-1.58			-2.48	-0.38			-0.71	-1.93			
Beta					4.29	0.66							
Steepness	9.5	17			21.33	2.75			9	13.5			
Duration	2	3			3	4			2	2			

Appendix A: Business Cycle Dating for UK aggregate data

Figure A.1: UK GDP

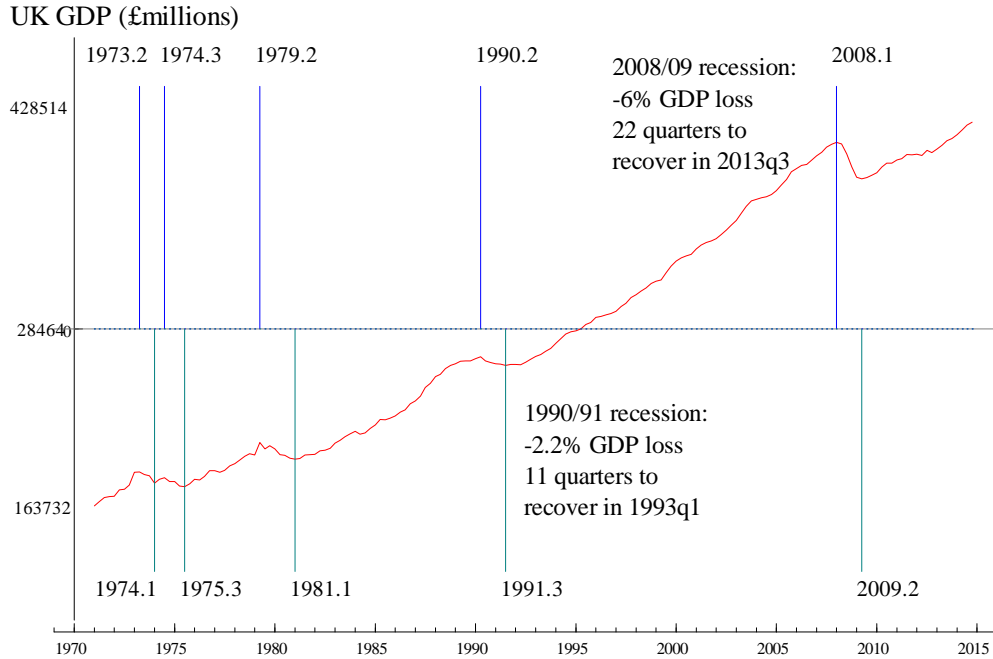


Figure A.2: UK Employment data (ONS code: MGRZ)

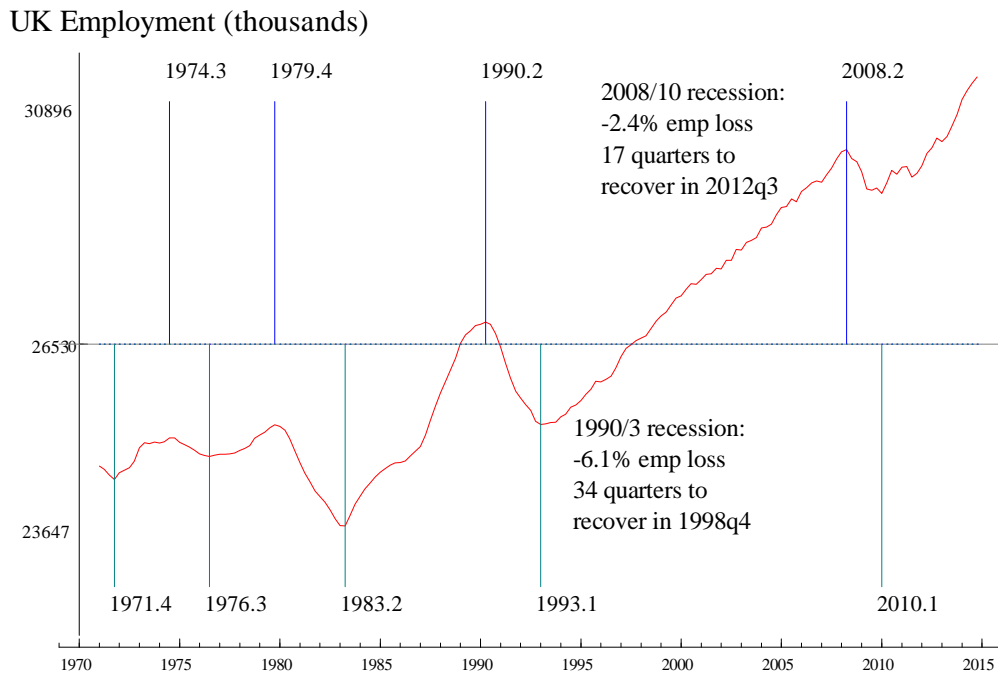
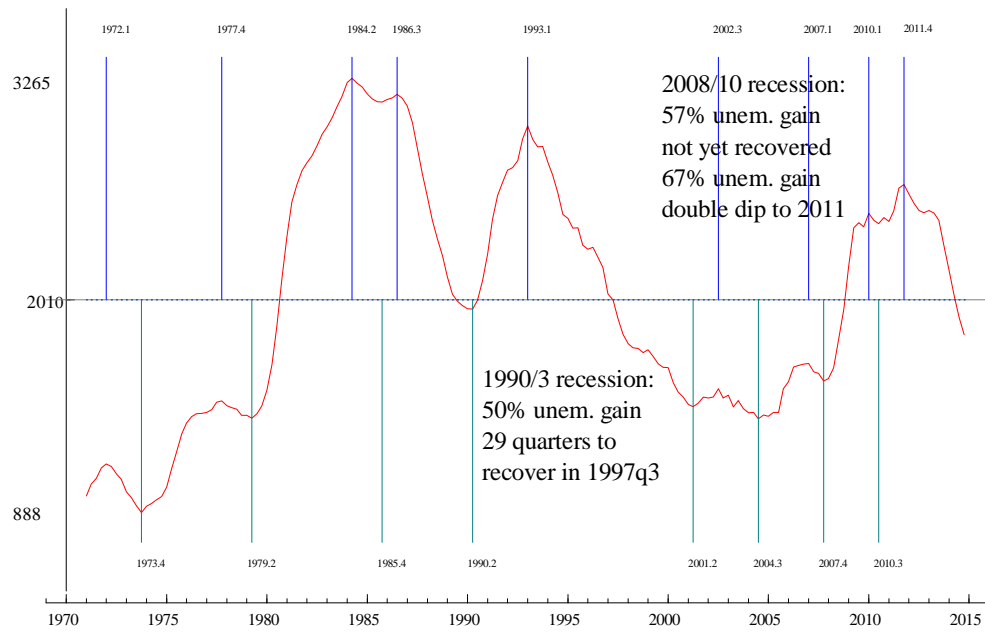


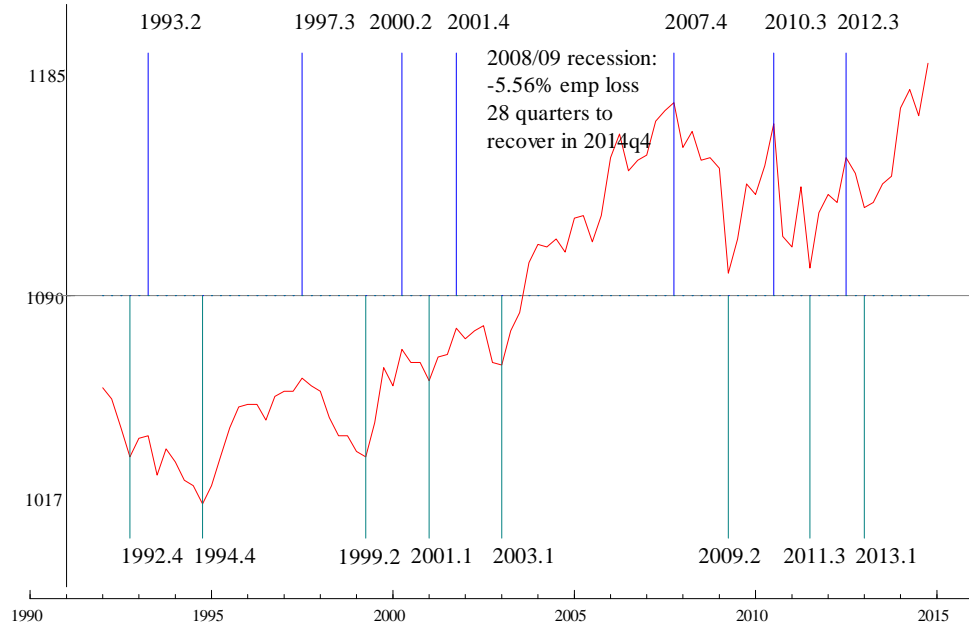
Figure A.3: UK Unemployment (ONS code: MGSC)

UK Unemployment (thousands)

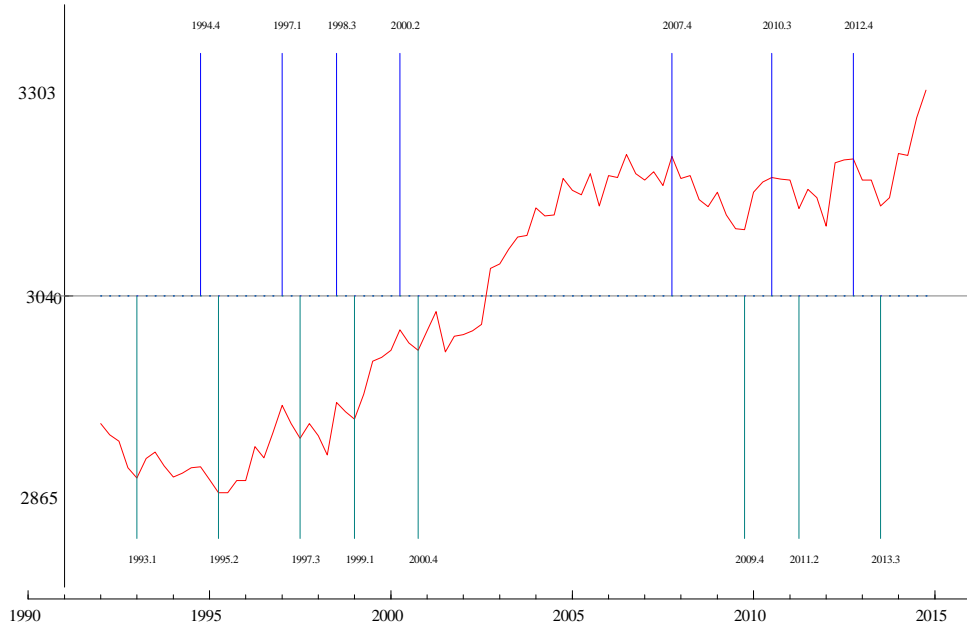


Appendix B: Classical Business Cycle Dating for UK regional data

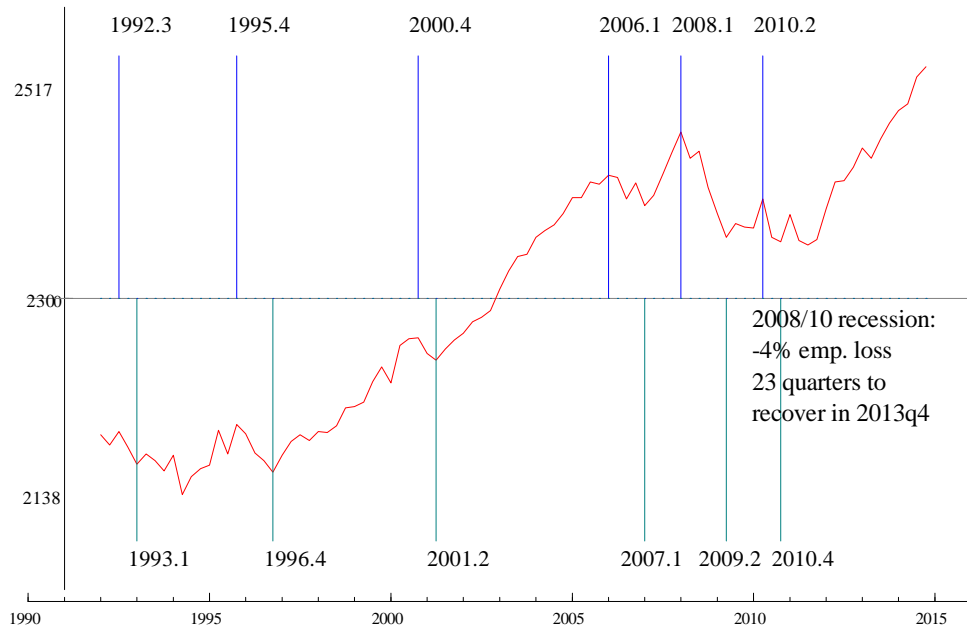
North East Employment



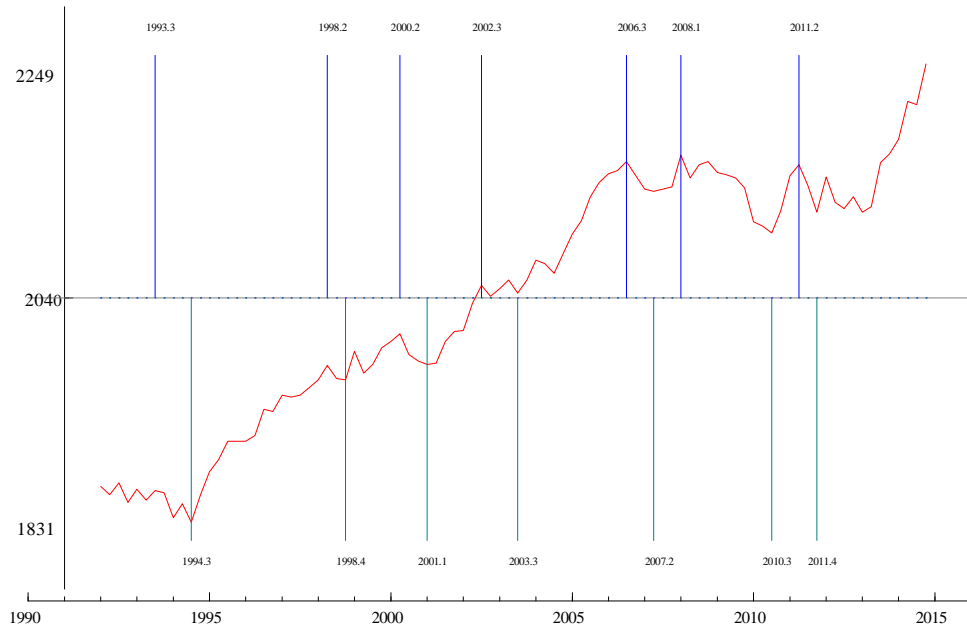
North West Employment



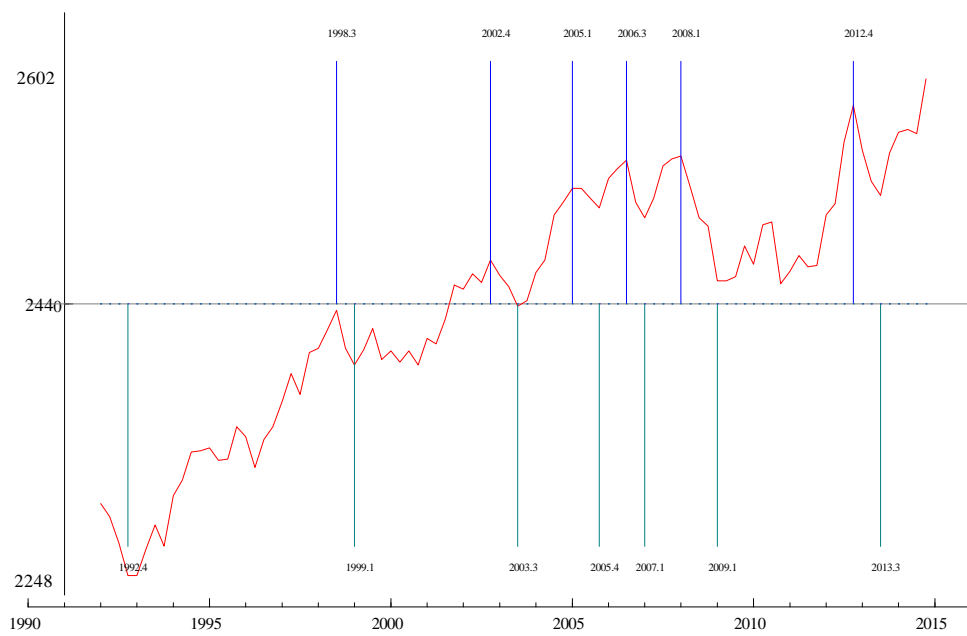
Yorkshire & Humberside Employment



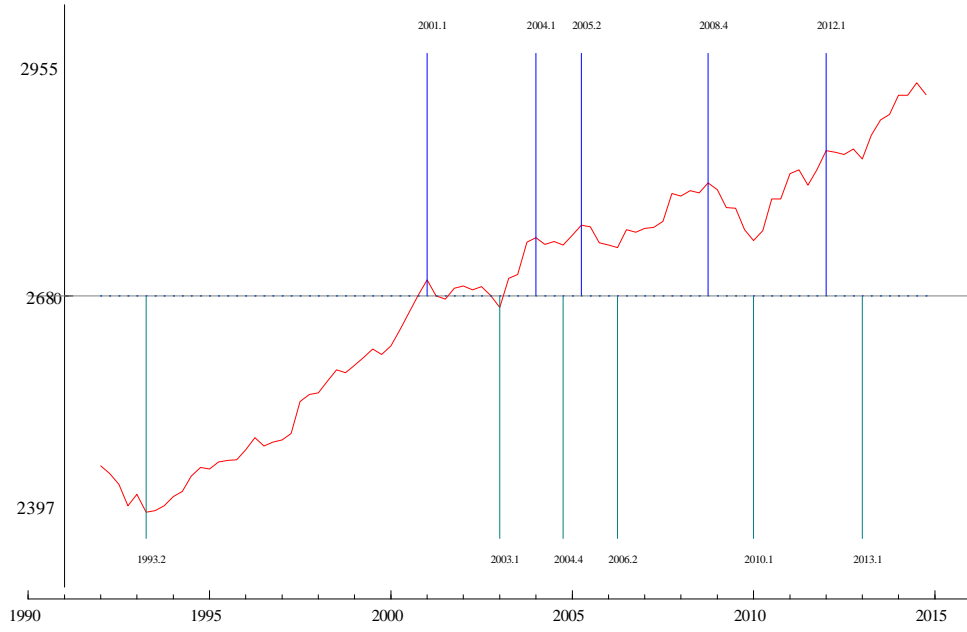
East Midlands Employment



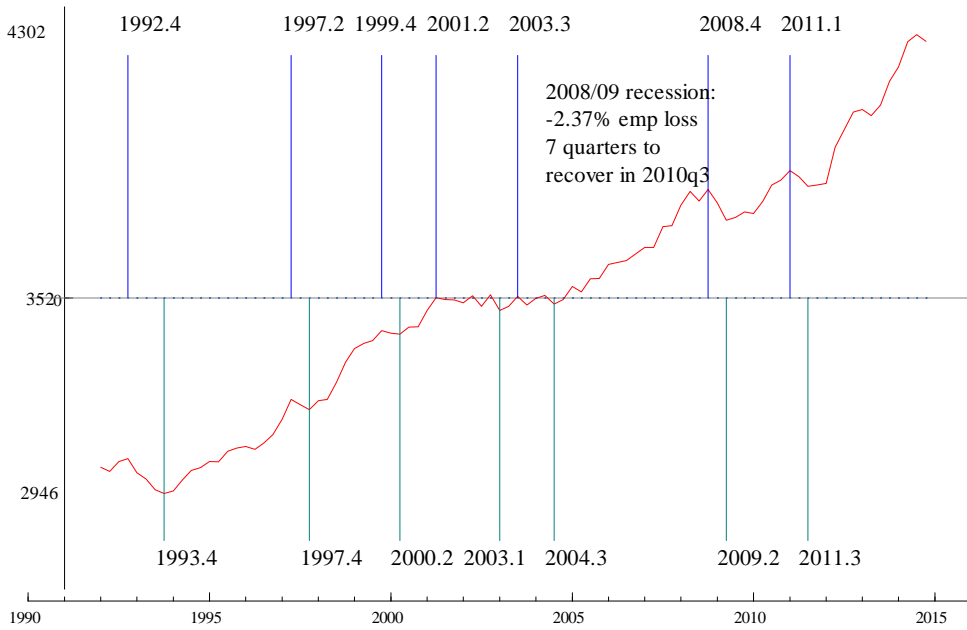
West Midlands Employment



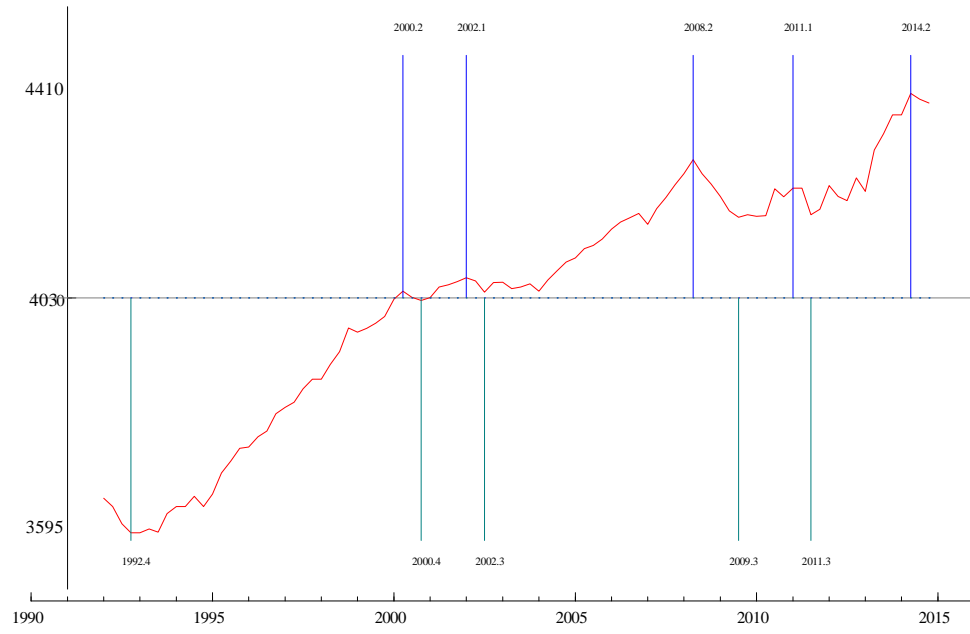
East Employment



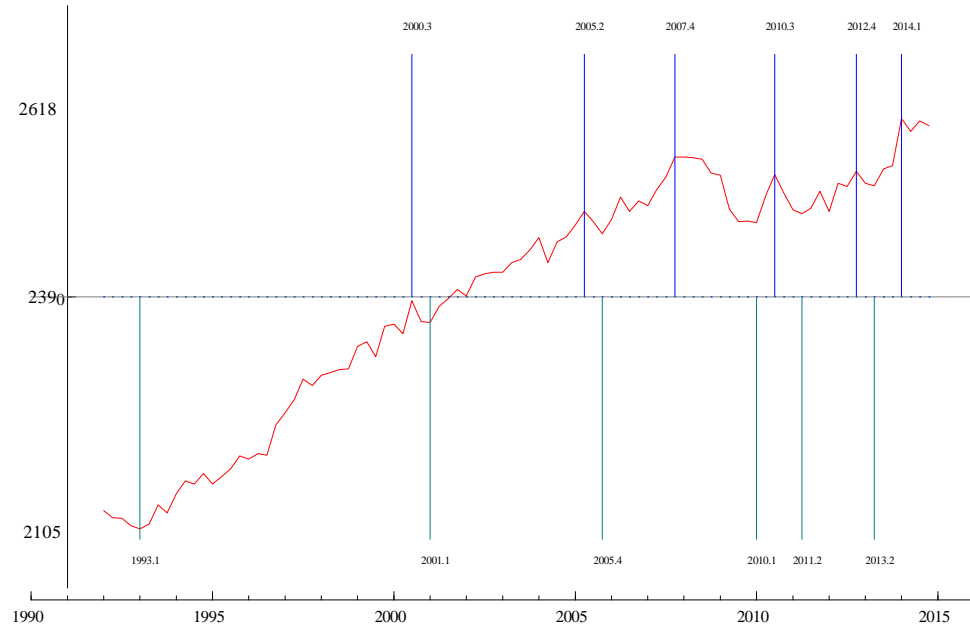
London Employment



South East Employment



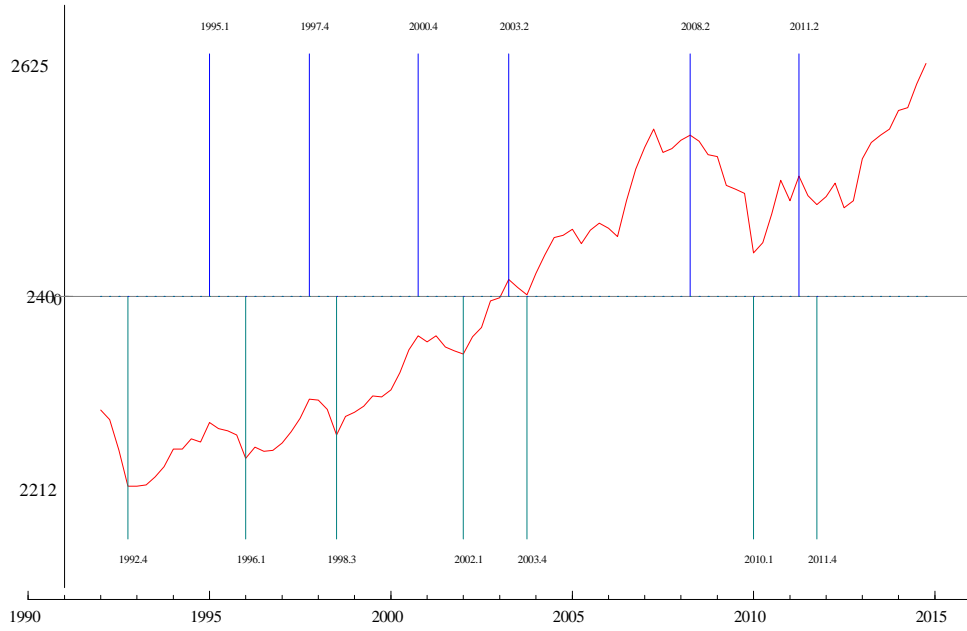
South West Employment



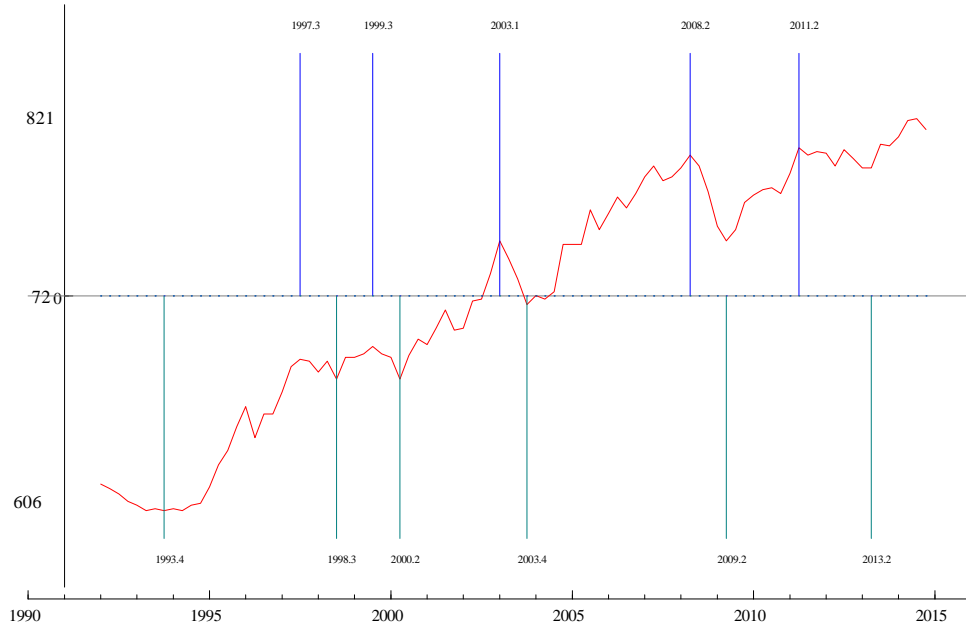
Wales Employment



Scotland Employment



Northern Ireland Employment



Data Appendix: ONS Code Table

Code	Description
MGSC	LFS: Unemployed: UK: All: Aged 16+: 000s, Seasonally adjusted (SA)
MGRZ	LFS: In employment: UK: All: Aged 16+: 000s, SA
YCJZ	LFS: In employment: Wales: All: Thousands: SA
YCKA	LFS: In employment: Scotland: All: Thousands: SA
YCJQ	LFS: In employment: North West (GOR): All: Thousands: SA
YCJP	LFS: In employment: North East: All: Thousands: SA
YCJV	LFS: In employment: London: All: Thousands: SA
YCJW	LFS: In employment: South East (GOR): All: Thousands: SA
YCJU	LFS: In employment: East: All: Thousands: SA
YCJR	LFS: In employment: Yorks & the Humber: All: Thousands: SA
YCJS	LFS: In employment: East Midlands: All: Thousands: SA
YCJT	LFS: In employment: West Midlands: All: Thousands: SA
YCJX	LFS: In employment: South West: All: Thousands: SA
ZSFG	LFS: In employment: Northern Ireland: All: Thousands: SA
ABMI	Gross Domestic Product: chained volume measure: (2011 base year), SA, £millions