UKCES

UK COMMISSION FOR
EMPLOYMENT AND SKILLS

The Supply of and Demand for High-Level STEM Skills

Technical Report
November 2013

Intelligence Investment Impact

The Supply of and Demand for High-Level STEM Skills: Technical Report

Derek Bosworth, Clare Lyonette and Rob Wilson
University of Warwick
Institute for Employment Research

Marc Bayliss, Simon Fathers
UKCES

November 2013

Table of Contents

1 STEM Occupations and Sectors

1.1 Emerging Sectors: Trends over time

As the present work makes projections into the future, it is important that some sectors and occupations where STEM skills are increasing in importance are not ruled out. In order to investigate this, simple linear time series regressions were estimated for each sector and occupation at the four digit level. Two sets of sector estimates are available: one prior to the 2007 change in SIC (containing 34 [check] four quarter moving averages; and on subsequent to the change in classification, containing 10 [check] four quarter moving averages. While two sets of results have been constructed for SOC (again, one running up to the change in classification and one after), the late change in SOC means that there are only 8 [check] quarterly observations for the post-2010 data set.

At this stage the underlying regressions take the form,

$$STEM\ density = a + bt \qquad (2.1)$$

where t is time (t=1, …, n) and a and b are estimated constants; a represents the constant (the predicted value at time zero) and b is the slope (which is the percentage point change per quarter). The regressions were carried out for all sectors, but the results omit sectors with small numbers of observations.

Table 1 sets out the results for the existing sectors and sectors that increase their densities such that they would be included in the list of STEM sectors on the basis of their STEM densities. Values for the end of the historical period and projected values for 2020 are shown. All three of the main medical sectors that appear in Table ** would be retained, however, the results suggest that fertilizer, etc. manufacture should not be included.

Linear projections were carried about for both medicine and related STEM and core STEM sectors using data from prior to the 2007 change in SIC. Results with negative intercepts were excluded on the grounds that this results from missing or 0s in the original data. Forecasts with $R^2 > .33$ and with slope significance > 5% was included taken to be significant. A sector was found to be emerging if the density and proportions met the criteria set out in Chapter 3 of the full report.

Applying these criteria, no emerging sectors were found for medicine and related STEM. Applying these criteria to core STEM lead to 46 emerging sectors (i.e. sectors that are increasing in their importance). Table 1 and Table 2 sets out the predicted results for 2020.

Repeating the forecasts using data under the 2007 SIC (from 2007 to 2010) yielded the results shown in Table 3 and Table 4 , which show 47 emerging sectors for 2020.

Table 1 Emerging Core STEM Sectors, 2020 ranked by density (from pre-2007 SIC)

Code	Sector name	Constant	Slope	Significance (constant)	Significance (slope)	R^2	F	Density	Proportion
91.12	Professional organisations	9.132	1.019	1.01E-07	1.03E-14	0.872	206.200	100.0	1.391
27.45	Other non-metal production	4.33	1.498	4.42E-01	5.21E-05	0.680	32.824	100.0	0.133
27.41	Precious metals production	20.27	1.820	6.35E-02	2.53E-03	0.356	12.078	100.0	0.079
28.3	Steam generators manufacture	2.42	0.901	4.66E-01	2.30E-05	0.448	25.351	97.93	0.326
85.2	Veterinary activities	27.58	0.627	3.27E-16	1.65E-07	0.604	46.739	94.05	1.096
73.2	Res.,social sciences,humanities	3.08	0.829	2.68E-01	5.16E-06	0.501	31.069	90.94	0.391
24.42	Pharmaceutical preparations man.	25.87	0.499	9.64E-17	1.31E-06	0.544	36.852	78.74	1.404
2.02	Forestry,logging services	4.09	0.660	1.82E-01	3.13E-04	0.414	17.942	74.07	0.200
23.201	Mineral oil refining	18.99	0.471	8.87E-10	3.59E-04	0.338	16.322	68.89	0.065
72.3	Data processing	4.80	0.557	6.03E-02	2.57E-04	0.352	17.322	63.87	0.185
41	Water supply etc	19.69	0.406	5.10E-14	1.94E-05	0.454	25.977	62.72	0.681
62.1	Scheduled air transport	5.652	0.535	2.99E-06	6.46E-11	0.768	100.187	62.34	0.509
31.2	Elec distribution, control man.	14.65	0.371	8.88E-10	3.67E-04	0.347	16.409	53.94	0.109
33.1	Medical eqt,appliances manufacture	9.07	0.423	5.91E-08	1.00E-06	0.553	38.067	53.86	0.878
	Special educ,private non-maintained	1.32	0.474	4.16E-01	7.31E-06	0.489	29.678	51.53	0.354
92.62	Other sporting activities	2.809	0.453	1.95E-05	2.98E-15	0.883	227.077	50.86	2.141
67.12	Securities,fund management	11.14	0.372	2.29E-07	3.01E-04	0.346	16.844	50.53	0.426
36.632	Other manufacture	3.92	0.436	4.42E-02	1.79E-04	0.368	18.449	50.16	0.109
72.6	Other computer activities	26.35	0.220	2.71E-22	2.32E-04	0.357	17.644	49.68	1.495
63.22	Other water transport activities	3.53	0.435	5.11E-02	6.98E-05	0.417	21.735	49.64	0.394
28.12	Builders metal work	1.77	0.434	4.21E-01	5.92E-04	0.357	15.449	47.80	0.479
35.3	Aircraft,spacecraft manufacture	23.44	0.220	4.77E-24	7.43E-06	0.488	29.617	46.73	1.394
70.11	Development,sale of real estate	10.49	0.324	4.25E-12	5.61E-07	0.570	40.733	44.87	2.669
34.1	Motor veh manufacture	10.18	0.303	3.83E-12	1.01E-06	0.552	38.013	42.29	0.723
80.301	Sub-degree level education	11.31	0.245	2.17E-16	3.10E-07	0.587	43.590	37.23	1.036

28.52	General mech engineering	11.33	0.235	3.31E-15	3.52E-06	0.513	32.630	36.25	1.281
75.12	Reguln Govt agency (not Soc Sec)	8.96	0.242	3.64E-13	1.03E-06	0.552	37.940	34.59	4.609
1.11	Growing cereals, other crops	4.91	0.277	1.29E-04	8.50E-05	0.398	20.833	34.28	0.161
75.22	Defence	12.94	0.187	1.09E-18	8.70E-06	0.483	28.999	32.79	1.615
75.25	Fire service	2.15	0.282	5.34E-02	4.03E-05	0.427	23.358	32.00	0.524
34.3	Motor veh parts etc manufacture	9.87	0.206	9.69E-18	7.13E-08	0.626	51.172	31.67	0.098
74.12	Accountng,auditng,tax consultancy	6.260	0.232	4.16E-13	2.80E-09	0.700	70.908	30.87	2.696
91.33	Other membership organisations	7.02	0.206	1.03E-12	5.07E-07	0.573	41.209	28.86	0.113
15.84	Chocolate,cocoa,sugar confect'y	4.26	0.225	5.20E-05	8.12E-05	0.400	20.983	28.09	0.253
92.61	Operation of sports arenas,stadia	3.71	0.228	1.29E-07	1.24E-08	0.668	61.283	27.91	0.991
92.52	Museum activities	4.39	0.204	7.83E-07	9.63E-06	0.479	28.606	26.05	0.418
80.1	Primary educ,priv.,non-maintained	3.04	0.209	8.60E-05	3.15E-06	0.517	33.093	25.22	1.045
15.12	Poultry production,preserving	1.54	0.223	7.53E-02	3.20E-05	0.436	24.169	25.22	0.176
74.5	Labour,personnel recruitment	4.051	0.191	9.71E-11	2.36E-09	0.703	72.078	24.28	1.185
60.21	Other scheduled land transport	2.65	0.196	1.75E-05	1.14E-07	0.614	48.668	23.48	1.015
65.121	Banks	7.63	0.146	7.21E-18	2.92E-07	0.588	43.872	23.06	2.776
67.2	Other insurance activities	6.85	0.136	9.63E-13	1.57E-04	0.373	18.859	21.23	1.229
75.24	Public security,law and order etc	5.41	0.135	1.22E-15	7.73E-08	0.624	50.740	19.69	2.563
85.14	Other human health activities	3.29	0.132	5.09E-10	2.45E-07	0.593	44.739	17.25	1.815
85.11	Hospital activities	2.212	0.133	1.44E-11	1.44E-12	0.821	138.616	16.31	7.933
85.32	Social work without accom	2.92	0.119	2.59E-10	9.27E-08	0.619	49.759	15.57	4.374

Table 2 Emerging Core STEM Sectors, 2020 ranked by proportions (from pre-2007 SIC)

Code	Sector name	Constant	Slope	Significance (constant)	Significance (slope)	R^2	F	Density	Proportion
85.11	Hospital activities	2.212	0.133	1.44E-11	1.44E-12	0.821	138.616	16.31	7.933
75.12	Reguln govt agency (not soc sec)	8.96	0.242	3.64E-13	1.03E-06	0.552	37.940	34.59	4.609
85.32	Social work without accom	2.92	0.119	2.59E-10	9.27E-08	0.619	49.759	15.57	4.374
65.121	Banks	7.63	0.146	7.21E-18	2.92E-07	0.588	43.872	23.06	2.776
74.12	Accountng,auditng,tax consultancy	6.260	0.232	4.16E-13	2.80E-09	0.700	70.908	30.87	2.696
70.11	Development,sale of real estate	10.49	0.324	4.25E-12	5.61E-07	0.570	40.733	44.87	2.669
75.24	Public security,law and order etc	5.41	0.135	1.22E-15	7.73E-08	0.624	50.740	19.69	2.563
92.62	Other sporting activities	2.809	0.453	1.95E-05	2.98E-15	0.883	227.077	50.86	2.141
85.14	Other human health activities	3.29	0.132	5.09E-10	2.45E-07	0.593	44.739	17.25	1.815
75.22	Defence	12.94	0.187	1.09E-18	8.70E-06	0.483	28.999	32.79	1.615
72.6	Other computer activities	26.35	0.220	2.71E-22	2.32E-04	0.357	17.644	49.68	1.495
24.42	Pharmaceutical preparations man.	25.87	0.499	9.64E-17	1.31E-06	0.544	36.852	78.74	1.404
35.3	Aircraft,spacecraft manufacture	23.44	0.220	4.77E-24	7.43E-06	0.488	29.617	46.73	1.394
91.12	Professional organisations	9.132	1.019	1.01E-07	1.03E-14	0.872	206.200	117.12	1.391
28.52	General mech engineering	11.33	0.235	3.31E-15	3.52E-06	0.513	32.630	36.25	1.281
67.2	Other insurance activities	6.85	0.136	9.63E-13	1.57E-04	0.373	18.859	21.23	1.229
74.5	Labour,personnel recruitment	4.051	0.191	9.71E-11	2.36E-09	0.703	72.078	24.28	1.185
85.2	Veterinary activities	27.58	0.627	3.27E-16	1.65E-07	0.604	46.739	94.05	1.096
80.1	Primary educ,priv.,non-maintained	3.04	0.209	8.60E-05	3.15E-06	0.517	33.093	25.22	1.045
80.301	Sub-degree level education	11.31	0.245	2.17E-16	3.10E-07	0.587	43.590	37.23	1.036
60.21	Other scheduled land transport	2.65	0.196	1.75E-05	1.14E-07	0.614	48.668	23.48	1.015
92.61	Operation of sports arenas,stadia	3.71	0.228	1.29E-07	1.24E-08	0.668	61.283	27.91	0.991
33.1	Medical eqt,appliances manufacture	9.07	0.423	5.91E-08	1.00E-06	0.553	38.067	53.86	0.878
34.1	Motor veh manufacture	10.18	0.303	3.83E-12	1.01E-06	0.552	38.013	42.29	0.723
41	Water supply etc	19.69	0.406	5.10E-14	1.94E-05	0.454	25.977	62.72	0.681

75.25	Fire service	2.15	0.282	5.34E-02	4.03E-05	0.427	23.358	32.00	0.524
62.1	Scheduled air transport	5.652	0.535	2.99E-06	6.46E-11	0.768	100.187	62.34	0.509
28.12	Builders metal work	1.77	0.434	4.21E-01	5.92E-04	0.357	15.449	47.80	0.479
67.12	Securities,fund management	11.14	0.372	2.29E-07	3.01E-04	0.346	16.844	50.53	0.426
92.52	Museum activities	4.39	0.204	7.83E-07	9.63E-06	0.479	28.606	26.05	0.418
63.22	Other water transport activities	3.53	0.435	5.11E-02	6.98E-05	0.417	21.735	49.64	0.394
73.2	Res.,social sciences,humanities	3.08	0.829	2.68E-01	5.16E-06	0.501	31.069	90.94	0.391
	Special educ,private non-maintained	1.32	0.474	4.16E-01	7.31E-06	0.489	29.678	51.53	0.354
28.3	Steam generators manufacture	2.42	0.901	4.66E-01	2.30E-05	0.448	25.351	97.93	0.326
15.84	Chocolate,cocoa,sugar confect'y	4.26	0.225	5.20E-05	8.12E-05	0.400	20.983	28.09	0.253
2.02	Forestry,logging services	4.09	0.660	1.82E-01	3.13E-04	0.414	17.942	74.07	0.200
72.3	Data processing	4.80	0.557	6.03E-02	2.57E-04	0.352	17.322	63.87	0.185
15.12	Poultry production,preserving	1.54	0.223	7.53E-02	3.20E-05	0.436	24.169	25.22	0.176
1.11	Growing cereals, other crops	4.91	0.277	1.29E-04	8.50E-05	0.398	20.833	34.28	0.161
27.45	Other non-metal production	4.33	1.498	4.42E-01	5.21E-05	0.680	32.824	100	0.133
91.33	Other membership organisations	7.02	0.206	1.03E-12	5.07E-07	0.573	41.209	28.86	0.113
36.632	Other manufacture	3.92	0.436	4.42E-02	1.79E-04	0.368	18.449	50.16	0.109
31.2	Elec distribution, control man.	14.65	0.371	8.88E-10	3.67E-04	0.347	16.409	53.94	0.109
34.3	Motor veh parts etc manufacture	9.87	0.206	9.69E-18	7.13E-08	0.626	51.172	31.67	0.098
27.41	Precious metals production	20.27	1.820	6.35E-02	2.53E-03	0.356	12.078	100	0.079
23.201	Mineral oil refining	18.99	0.471	8.87E-10	3.59E-04	0.338	16.322	68.89	0.065

Table 3 Emerging Core STEM sectors, 2020, ranked by density (from 2007+ SIC)

Code	Sector Name	Constant	Slope	Significance (constant)	Significance (slope)	R^2	F	Density	Proportion
20.41	Man soap & detgts clean & pol prep	4.09	3.63	3.52E-01	8.09E-05	0.78	40.64	100.00	0.157
33.16	Repair & main aircraft & spacecrft	1.01	3.34	6.40E-01	3.78E-07	0.92	136.31	100.00	0.274
15.11	Tanning, dressing, dye leathrfur	37.45	2.32	1.00E-01	2.25E-01	0.40	3.00	100.00	0.116
46.12	Agnts inv sale fuelmetind chem	7.53	2.77	9.71E-03	1.87E-06	0.87	82.94	100.00	0.381
6.1	Extraction of crude petroleum	19.20	2.37	1.89E-05	2.32E-05	0.80	48.79	100.00	0.712
42.12	Constr railwys & undgrnd railwys	14.03	2.36	3.02E-02	6.74E-03	0.46	11.07	100.00	0.300
42.21	Constr of utility proj for fluids	6.12	2.51	1.44E-01	6.87E-04	0.71	25.54	100.00	0.250
66.29	Othr actv aux to ins & pensn fndng	11.92	2.33	5.50E-02	1.07E-02	0.44	9.80	100.00	0.384
58.29	Other software publishing	41.97	1.59	6.68E-07	1.12E-02	0.41	9.26	100.00	0.355
26.11	Manufof electronic components	13.90	1.88	1.48E-04	8.23E-05	0.75	36.68	100.00	1.611
33.15	Repair & maintenance ships & boats	7.15	1.90	1.01E-01	8.22E-03	0.55	12.17	98.20	0.064
99	Act extraterritorial org & bodies	5.32	1.92	1.27E-01	6.41E-04	0.64	22.18	97.30	1.151
64.99	Oth fin ser,exc ins & pen fund,nec	6.87	1.86	1.61E-02	1.79E-04	0.75	33.33	96.32	0.190
27.9	Manu of other electrical eqmt	14.50	1.64	8.16E-03	2.07E-02	0.37	7.53	93.44	0.569
26.2	Manuf computers & peripheral eqmt	28.91	1.31	1.11E-06	5.31E-03	0.48	11.99	91.97	0.641
28.41	Manuf of metal forming machinery	12.72	1.57	1.41E-04	2.92E-04	0.72	29.41	88.26	0.132
32.99	Other manufacturing n.e.c.	15.03	1.47	1.53E-03	1.13E-02	0.44	9.59	85.44	0.173
52.22	Serv actv incidental to wter trans	10.16	1.53	1.71E-02	6.42E-03	0.46	11.26	83.67	0.362
28.25	Man non-dom cooling & ventiln eqmt	5.61	1.59	2.06E-01	1.81E-02	0.39	7.96	81.85	0.202
11.05	Manufacture of beer	0.34	1.66	8.97E-01	2.90E-04	0.69	27.15	80.13	0.623
22.29	Manuf of other plastic products	0.98	1.64	5.96E-01	5.13E-05	0.80	45.38	79.84	0.255
46.75	Wholesale of chemical products	16.97	1.28	9.68E-06	7.55E-04	0.63	21.23	78.57	0.931
51.1	Passenger air transport	10.88	1.39	3.49E-04	3.18E-04	0.68	26.53	77.43	1.253
49.1	Passngr rail transport, interurban	0.12	1.61	9.71E-01	3.99E-03	0.54	13.82	77.37	0.290
85.51	Sports and recreation education	14.43	1.29	1.05E-03	9.46E-03	0.42	9.84	76.57	0.098

33.13	Repair of electrnc & optical eqmt	5.80	1.37	5.32E-02	3.36E-03	0.55	14.60	71.76	0.271
19.2	Manu of refined petroleum prod	30.43	0.85	7.12E-08	1.80E-02	0.36	7.70	71.01	1.131
75	Veterinary activities	39.10	0.62	3.10E-10	2.26E-02	0.33	7.02	68.87	0.779
86.22	Specialist medical practice activs	4.88	1.32	1.54E-01	7.30E-03	0.45	10.78	68.16	1.135
52.21	Serv actv incidental to land trans	5.35	1.24	2.48E-02	5.62E-04	0.65	22.95	64.98	0.474
25.62	Machining	8.93	1.14	9.75E-04	8.64E-04	0.62	20.48	63.79	1.548
66.3	Fund management activities	12.42	1.07	2.08E-03	2.65E-02	0.34	6.76	63.57	0.153
65.12	Non-life insurance	5.90	1.19	1.43E-02	7.29E-04	0.63	21.43	62.79	2.610
85.53	Driving school activities	3.42	1.15	1.35E-01	2.49E-03	0.58	16.06	58.45	0.283
84.25	Fire service activities	10.19	0.87	1.38E-04	2.56E-03	0.54	15.07	52.14	0.728
10.89	Manu other food products n.e.c.	9.98	0.87	1.20E-03	1.22E-02	0.40	8.97	51.76	0.448
23.61	Man conc prod for constrcn purp	8.62	0.88	9.83E-03	3.04E-02	0.36	6.58	51.03	0.165
84.13	Reg & contr to mre eff op of busin	9.31	0.86	1.76E-04	1.87E-03	0.56	16.51	50.64	0.241
61.1	Wired telecomtions activities	14.71	0.72	4.39E-07	1.72E-03	0.57	16.91	49.45	1.024
29.1	Manufacture of motor vehicles	13.73	0.69	2.67E-09	2.85E-05	0.79	46.62	46.67	0.727
85.42	Tertiary education	27.15	0.38	6.56E-15	6.18E-05	0.76	39.18	45.34	21.518
90.01	Performing arts	1.13	0.89	5.81E-01	4.48E-03	0.49	12.67	44.08	0.656
85.52	Cultural education	0.11	0.84	9.67E-01	2.31E-02	0.33	6.96	40.35	0.410
46.42	Wholesale of clothing and footwear	1.76	0.76	3.09E-01	6.71E-03	0.49	11.59	38.11	0.286
84.12	Reg of actv providing social serv	12.21	0.43	1.89E-09	4.27E-04	0.66	24.62	32.81	2.588
43.22	Plumbng, heat & air-con installatn	3.33	0.49	2.95E-02	1.38E-02	0.39	8.55	26.87	0.061
88.99	Other soc work actv wo accom nec	7.07	0.20	3.75E-08	1.13E-02	0.41	9.23	16.77	3.732

Table 4 Emerging Core STEM sectors, 2020, ranked by proportions (from 2007+ SIC)

Code	Sector Name	Constant	Slope	Significance (constant)	Significance (slope)	R^2	F	Density	Proportion
85.42	Tertiary education	27.15	0.38	6.56E-15	6.18E-05	0.76	39.18	45.34	21.52
88.99	Other soc work actv wo accom nec	7.07	0.20	3.75E-08	1.13E-02	0.41	9.23	16.77	3.732
65.12	Non-life insurance	5.90	1.19	1.43E-02	7.29E-04	0.63	21.43	62.79	2.610
84.12	Reg of actv providing social serv	12.21	0.43	1.89E-09	4.27E-04	0.66	24.62	32.81	2.588
26.11	Manufof electronic components	13.90	1.88	1.48E-04	8.23E-05	0.75	36.68	100.00	1.611
25.62	Machining	8.93	1.14	9.75E-04	8.64E-04	0.62	20.48	63.79	1.548
51.1	Passenger air transport	10.88	1.39	3.49E-04	3.18E-04	0.68	26.53	77.43	1.253
99	Act extraterritorial org & bodies	5.32	1.92	1.27E-01	6.41E-04	0.64	22.18	97.30	1.151
86.22	Specialist medical practice activs	4.88	1.32	1.54E-01	7.30E-03	0.45	10.78	68.16	1.135
19.2	Manu of refined petroleum prod	30.43	0.85	7.12E-08	1.80E-02	0.36	7.70	71.01	1.131
61.1	Wired telecomtions activities	14.71	0.72	4.39E-07	1.72E-03	0.57	16.91	49.45	1.024
46.75	Wholesale of chemical products	16.97	1.28	9.68E-06	7.55E-04	0.63	21.23	78.57	0.931
75	Veterinary activities	39.10	0.62	3.10E-10	2.26E-02	0.33	7.02	68.87	0.779
84.25	Fire service activities	10.19	0.87	1.38E-04	2.56E-03	0.54	15.07	52.14	0.728
29.1	Manufacture of motor vehicles	13.73	0.69	2.67E-09	2.85E-05	0.79	46.62	46.67	0.727
6.1	Extraction of crude petroleum	19.20	2.37	1.89E-05	2.32E-05	0.80	48.79	100.00	0.712
90.01	Performing arts	1.13	0.89	5.81E-01	4.48E-03	0.49	12.67	44.08	0.656
26.2	Manuf computers & peripheral eqmt	28.91	1.31	1.11E-06	5.31E-03	0.48	11.99	91.97	0.641
11.05	Manufacture of beer	0.34	1.66	8.97E-01	2.90E-04	0.69	27.15	80.13	0.623
27.9	Manu of other electrical eqmt	14.50	1.64	8.16E-03	2.07E-02	0.37	7.53	93.44	0.569
52.21	Serv actv incidental to land trans	5.35	1.24	2.48E-02	5.62E-04	0.65	22.95	64.98	0.474
10.89	Manu other food products n.e.c.	9.98	0.87	1.20E-03	1.22E-02	0.40	8.97	51.76	0.448
85.52	Cultural education	0.11	0.84	9.67E-01	2.31E-02	0.33	6.96	40.35	0.410
66.29	Othr actv aux to ins & pensn fndng	11.92	2.33	5.50E-02	1.07E-02	0.44	9.80	100.00	0.384

46.12	Agnts inv sale fuelmetind chem	7.53	2.77	9.71E-03	1.87E-06	0.87	82.94	100.00	0.381
52.22	Serv actv incidental to wter trans	10.16	1.53	1.71E-02	6.42E-03	0.46	11.26	83.67	0.362
58.29	Other software publishing	41.97	1.59	6.68E-07	1.12E-02	0.41	9.26	100.00	0.355
42.12	Constr railwys & undgrnd railwys	14.03	2.36	3.02E-02	6.74E-03	0.46	11.07	100.00	0.300
49.1	Passngr rail transport, interurban	0.12	1.61	9.71E-01	3.99E-03	0.54	13.82	77.37	0.290
46.42	Wholesale of clothing and footwear	1.76	0.76	3.09E-01	6.71E-03	0.49	11.59	38.11	0.286
85.53	Driving school activities	3.42	1.15	1.35E-01	2.49E-03	0.58	16.06	58.45	0.283
33.16	Repair & main aircraft & spacecrft	1.01	3.34	6.40E-01	3.78E-07	0.92	136.31	161.11	0.274
33.13	Repair of electrnc & optical eqmt	5.80	1.37	5.32E-02	3.36E-03	0.55	14.60	71.76	0.271
22.29	Manuf of other plastic products	0.98	1.64	5.96E-01	5.13E-05	0.80	45.38	79.84	0.255
42.21	Constr of utility proj for fluids	6.12	2.51	1.44E-01	6.87E-04	0.71	25.54	100.00	0.250
84.13	Reg & contr to mre eff op of busin	9.31	0.86	1.76E-04	1.87E-03	0.56	16.51	50.64	0.241
28.25	Man non-dom cooling & ventiln eqmt	5.61	1.59	2.06E-01	1.81E-02	0.39	7.96	81.85	0.202
64.99	Oth fin ser,exc ins & pen fund,nec	6.87	1.86	1.61E-02	1.79E-04	0.75	33.33	96.32	0.190
32.99	Other manufacturing n.e.c.	15.03	1.47	1.53E-03	1.13E-02	0.44	9.59	85.44	0.173
23.61	Man conc prod for constrcn purp	8.62	0.88	9.83E-03	3.04E-02	0.36	6.58	51.03	0.165
20.41	Man soap & detgts clean & pol prep	4.09	3.63	3.52E-01	8.09E-05	0.78	40.64	100.00	0.157
66.3	Fund management activities	12.42	1.07	2.08E-03	2.65E-02	0.34	6.76	63.57	0.153
28.41	Manuf of metal forming machinery	12.72	1.57	1.41E-04	2.92E-04	0.72	29.41	88.26	0.132
15.11	Tanning, dressing, dye leathrfur	37.45	2.32	1.00E-01	2.25E-01	0.40	3.00	100.00	0.116
85.51	Sports and recreation education	14.43	1.29	1.05E-03	9.46E-03	0.42	9.84	76.57	0.098
33.15	Repair & maintenance ships & boats	7.15	1.90	1.01E-01	8.22E-03	0.55	12.17	98.20	0.064
43.22	Plumbng, heat & air-con installatn	3.33	0.49	2.95E-02	1.38E-02	0.39	8.55	26.87	0.061

2 The Stock Flow Model

2.1 Introduction

The construction of a stock flow model for STEM is a particularly daunting task, as the demographic factors that give stock flow models their strength is a relatively small component of the model. Nevertheless, developing such a model is an interesting exercise that allows the user of the model to test what happens to supply under various scenarios, for example, increases in the supply of new STEM graduates, increases in the proportion of new graduates who choose STEM as opposed to non STEM jobs, increases in the retention of STEM individuals within STEM jobs, etc.

For simplicity, the present discussion focuses on core STEM degree holders.

2.2 Principles of the Stock-Flow Model

This section describes the construction of the stock-flow model of supply for core STEM degree holders in the UK. It includes a novel combination of historical pseudo-cohort modelling with projected future pseudo-cohort outcomes, as described below, and is, therefore, something of a hybrid model. The rationale for this combined historical and projected pseudo-cohort approach is that the more complete pseudo-cohorts start further in the past. So, if the analysis explores a group aged 20-24 in 2010, this group will be aged 30-34 in 2020 and aged 35-39 in 2025 (the end of the forecast period). Any group that will be younger than this in 2025 was too young in 2010 to have been a STEM degree holder.

The idea of pseudo cohort analysis is well entrenched in statistical analyses.[1] Pseudo cohort (or if they were available, cohort) data are invaluable in modelling and projecting qualifications because they enable the researcher to examine and model qualification transitions, for example, to see what proportion of individuals transfer from one level of qualification to a higher level of qualification from one year of age to the next. A "proper" cohort (or panel) of people is an identified group of individuals at some point in time (the first sweep of a survey) who are then followed up in subsequent years (e.g. annually or five yearly) by further sweeps of the survey; there are many examples of this type of survey.[2] The term pseudo in the present context at least takes the meaning "having the appearance of" (rather than "false" or "spurious") – indeed, if the conditions outlined below are met, it takes the meaning "having the characteristics of". What a pseudo cohort does is to look at a group of individuals aged, for example, 16 in 1998, and a corresponding but not the same group who are 17 in 1999, ... 27 in 2009. Essentially, cohort studies examine the same group of individuals longitudinally and pseudo cohort studies explore individuals of different ages in different years, as if it were the same group of individuals as they age over time.

Traditionally, stock flow models take the latest data available, by year of age and "roll these on" into the future, moving them down by one year of age for each additional year into the future. In the current model, five year age bands are used and therefore, the rolling on is five years into the future, rather than one year. To illustrate this, Table 5 sets out an example for the number of core STEM degree holders, just illustrating the process of "rolling on" for a few years, showing that a cohort of 20-24 year olds with a STEM degree in 2010 become 25-29 in 2015, 30-34 in 2020 and so on. Two immediate issues are highlighted in the table: the first is illustrated by the leading diagonal – as it is unlikely that the number of 20-24 year olds with a STEM degree will remain the same by the time they become 25-29, as people are still in education and the pool of STEM graduates is likely to improve with each year of age, at least for some while. This qualification transition process needs to be modelled in some way; the second is the missing information in the top right hand corner – this is a space that traditional stock flow models need to fill.

[1] Uren, Z. (2006). *The GHS Pseudo Cohort Dataset (GHSPCD): Introduction and Methodology*. SMB 59 09/06. UK Office for National Statistics. Newport. http://www.statistics.gov.uk/articles/nojournal/Sept06SMB_Uren.pdf

[2] Examples include the *Youth Cohort Survey*, the *British Cohort Study* and the *British Birth Cohort Surveys*.

Table 5 Example of "rolling on" the latest information

	2010	2015	2020	2025
20-24	336,397			
25-29	519,994	336,397		
30-34	526,077	519,994	336,397	
34-39	532,453	526,077	519,994	336,397
40-44	474,604	532,453	526,077	519,994
45-49	427,328	474,604	532,453	526,077
50-54	336,664	427,328	474,604	532,453
55-59	297,955	336,664	427,328	474,604
60-64	271,447	297,955	336,664	427,328

Two methods were used to fill in this triangle. Transition ratios were constructed and used to modify the age 20-24 population when it was rolled on to the 25-29 block to account for the increase in graduates in this group. The top row (e.g. ages 20-24 in 2015 onwards) was filled in by projecting future pseudo-cohorts. These methods are discussed in Sections 2.2 and 2.3 below.

2.2.1 The Transition Ratio

In order to construct the transition ratios (factors to multiply the age 20-24 group by when rolling them onward to account for the flow of new graduates into this group) a stock flow table like Table 5 was constructed. Unlike Table 5, this table had every year included from 2001-2025. Using this table, historic transition ratios were constructed for the six transitions between ages 20-24 and 25-29 in the LFS data (i.e. 2001 to 2006, 2002 to 2007, etc.). The historical transition ratios are equal to the 2006 age 25-29 population divided by the 2001 age 20-24 population, etc. The FORECAST function in Excel was then used on these historical transition ratios to predict the transition ratios for 2010 to 2015, 2015 to 2020 and 2020 to 2025. Once the transition ratios were obtained, future 25-29 boxes could be filled in by multiplying the corresponding 20-24 box by the transition ratio.

2.2.2 Projecting Future Cohorts

There is also the issue of the first row of missing triangle of information (see Table 5). This was handled by modelling the inflow group (e.g. modelling the inflow of individuals aged 20-24 with STEM degrees) and then applying the transition proportions in the same way as the rest of the matrix.

The inflow of ages 20-24 was modelled using the results of the simple time series approach in the Qualifications Model developed for the UK Commission in its Ambition 2020 reports to project the future number of 20-24 year olds qualified at NQF4 and 5 and then multiplying that population by the share of those graduates predicted to be holding a STEM degree.

The UK Commission model used LFS data from 2001 to 2010 to calculate the share of the population aged 20-24 that were qualified to NQF4 and 5. These proportions were projected into the future using Excel's FORECAST function. Then these proportions were converted into populations by multiplying the proportion by ONS's population for that age group. Similarly, the share of NQF4 and 5 graduates aged 20-24 holding a STEM degree was forecast from 10 years of LFS data from 2002 to 2011. The number of core STEM degree holders was divided by the total number of degree holders to provide the proportion with STEM degrees over the historical period. This proportion was then forecast into the future using Excel's FORECAST function. The projected NQF4&5 population was then multiplied by the predicted proportion of STEM degree holders to provide the age 20-24 pseudo-cohort for future years. 2.4 Setting up the sub-matrices (by employment and by occupation and sector)

2.2.3 Predicting Future Employment Rates, Employment by Sector and Occupation etc.

The discussion so far has focused on setting up a stock for the total population of Core STEM graduates. Once the total population of Core STEM graduates is predicted for future years, it can be used to predict the total population of subgroups, such as the total employed population or the total population working in a Core STEM occupation.

The future employment rate (and unemployment rate) by age group can be adjusted in the model to see the impact of different scenarios on the employed population. Data for two scenarios is provided. The first is the forecast scenario in which the projected employment (and unemployment rates) were predicted using Excel's FORECAST function on the historical core STEM employment rates. The second is the pre-recession scenario in which the average employment rate from 2001 to 2005 is calculated. These employment rates are multiplied by the Stock Flow of the entire STEM population in order to produce estimates of the employed, unemployed and inactive population.

A Stock Flow chart for employed Core STEM graduates working in a core STEM sector and/or core STEM occupation is created by multiplying the Stock Flow chart for employed population by the percent of STEM graduates working in STEM. Historical values for 2002 to 2011 were used to forecast future values using Excel's FORECAST function. Values for other scenarios such as a pre-recession one can also be placed into the sheet.

The a breakdown of the Core STEM employment into Core STEM sector and Core STEM occupation and Core STEM sector and non STEM occupation and Core STEM occupation and non STEM sector is also available. These three blocks are obtained by multiplying the Core STEM Employment box above by the % working in these three categories (they must sum up to 100). Historical values are calculated from LFS data and used to predict future values with the FORECAST function.

3 Commuting and Labour Supply

3.1 Trends in Labour Market Status

3.1.1 Trends in the Labour Market Status of Medicine and related STEM Graduates in the Four Nations

Figure 1 shows the employment, unemployment and activity rates for medicine and related STEM graduates England (Figure 1 (a)-(c)), Scotland (Figure 1 (d)-(f)), Wales (Figure 1 (g)-(i)) and Northern Ireland (Figure 1 (j)-(l)) between 2001 and 2011.

England. In England, the employment rates for medicine and related STEM graduates were around 89 per cent in 2006, before the recession hit. Once the recession started in 2007, the employment rate dropped to 82 per cent in 2009. The employment rate recovered a bit at first, increasing to 84 per cent in 2009 before going down to 83 per cent in 2011. The unemployment rate is very low. In 2007, unemployment was only around one per cent, increasing in 2008 with the recession, peaking at two per cent in 2010 and then started dropping again. It is inactivity rather than unemployment which appear to reflects the trends in employment rates. As the employment rates drop, the inactive rates increase and *vice versa*. Prior to the recession, the inactivity rate for Medicine and related STEM graduates in England was around five per cent in 2005. It then increased to 17 per cent in 2009 before dropping down again to 15 per cent in 2009. Since then, the inactive rate has gone back up, and is approaching 16 per cent.

Scotland, Wales and Northern Ireland

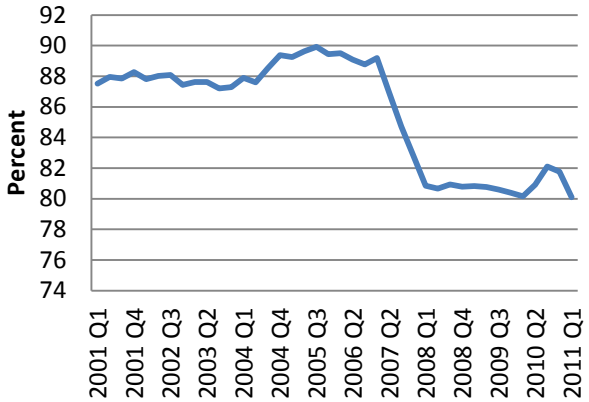
In 2011, the employment rate of medicine and related STEM graduates in Scotland and Wales was 80 per cent, in England it was 83 per cent and in Northern Ireland it was 87 per cent. The trends in employment for medicine and related STEM graduates in Scotland and Wales are very similar to England. In Scotland, employment peaked at around 92 per cent prior to the recession before dropping down to 78 per cent in 2008. Employment then increased again to 82 per cent in 2009 before starting to go down again in 2010. In Wales, the employment rate of medicine and related STEM graduates was 93 per cent prior to the recession when it dropped down to 83 per cent. Like England and Scotland, the employment recovered a bit in 2009 going up to 85 per cent before declining again in 2010 down to 80 per cent. The data is a bit more jumpy for Northern Ireland, but there is a downward trend due to the recession in which employment dropped from around 90 before the recession down per cent to 81 per cent. The current employment rate in Northern Ireland is 87 and on the rise. In contrast, the employment rates in England, Scotland and Wales are currently decreasing.

The unemployment rates for medicine and related STEM graduates in Scotland has jumped around a bit. They were around 1.75 per cent in 2007, dropped to one per cent in 2009, then went back up to 1.75 per cent in 2010 before starting to drop again in the past few quarters. Unemployment was close to zero in Wales and Northern Ireland before the recession. In Wales, it increased to one per cent with the recession and has been declining since 2010. In Northern Ireland, unemployment increased to nearly three per cent in 2010 but since has dropped to one per cent.

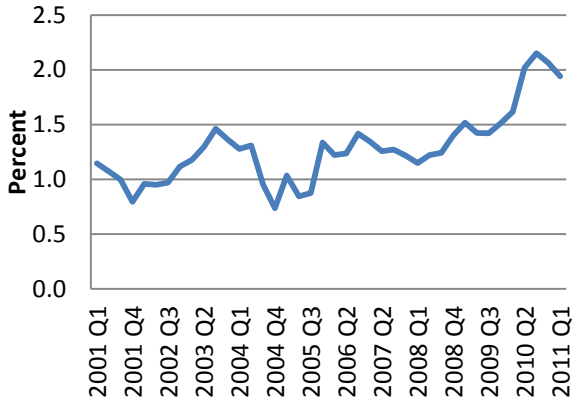
The inactivity graphs for Scotland and Wales are similar to that for England. The inactive rate was around nine per cent in Scotland in 2005 and increased to 22 per cent in 2009. The inactive rate dropped again to 17 per cent in 2009 but is on the rise again and was over 20 per cent in 2011. In Wales, the inactivity rate was around five per cent before the recession, it increased to 17 per cent in 2009 but has been going up in recent years and was around 20 per cent in 2011. The picture in Northern Ireland differs. The inactive rate reached a low of seven per cent in 2005 but increased before the recession and stayed high around 17 per cent for a few years before starting a downward trend in late 2009. The 2011 inactive rate in Northern Ireland is around 12 per cent and heading down, unlike England, Scotland and Wales in which inactivity is increasing.

Figure 1 Employment, Unemployment and Inactivity Rates for Medicine and Related STEM Graduates in the four Nations, 2001-2011

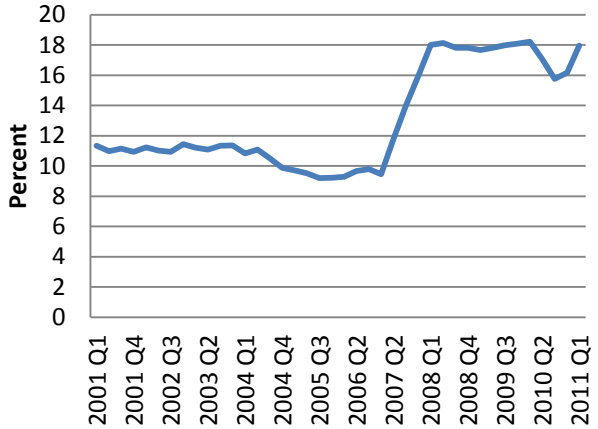
(a) Employment of Medicine and Related STEM Graduates, England (%)



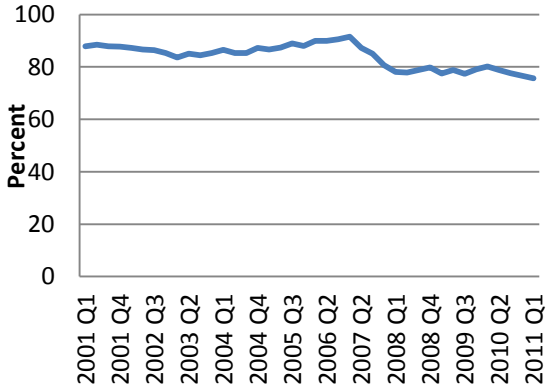
(b) Unemployment of Medicine and Related STEM Graduates, England (%)



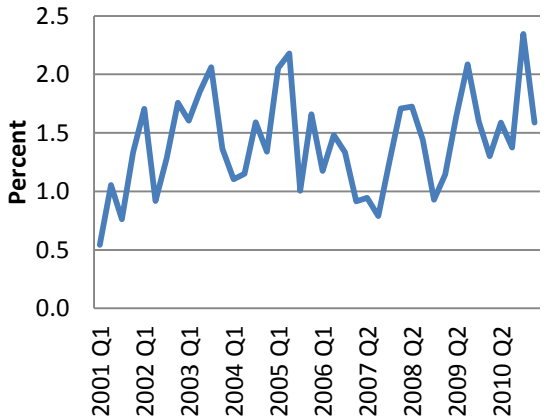
(c) Inactivity of Medicine and Related STEM Graduates, England (%)



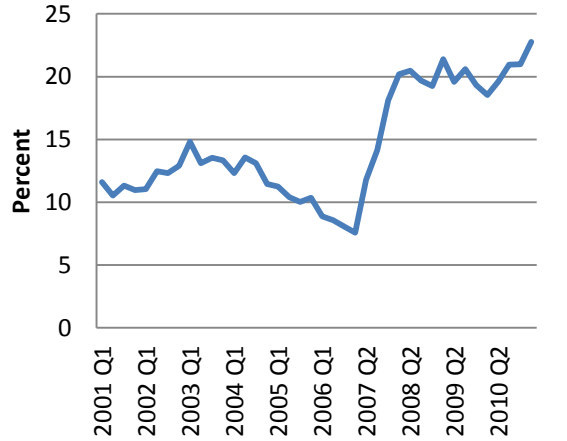
(d) Employment of Medicine and Related STEM Graduates, Scotland (%)



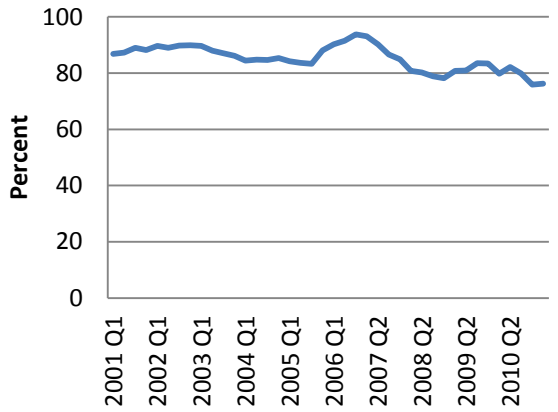
(e) Unemployment of Medicine and Related STEM Graduates, Scotland (%)



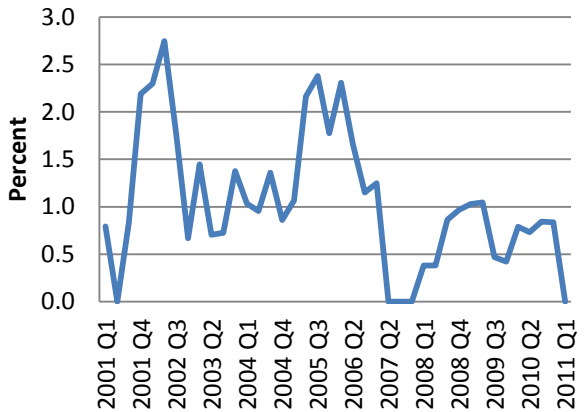
(f) Inactivity of Medicine and Related STEM Graduates, Scotland (%)



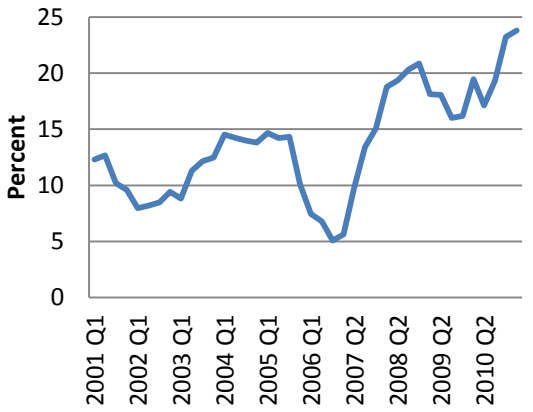
(g) Employment of Medicine and Related STEM Graduates, Wales (%)



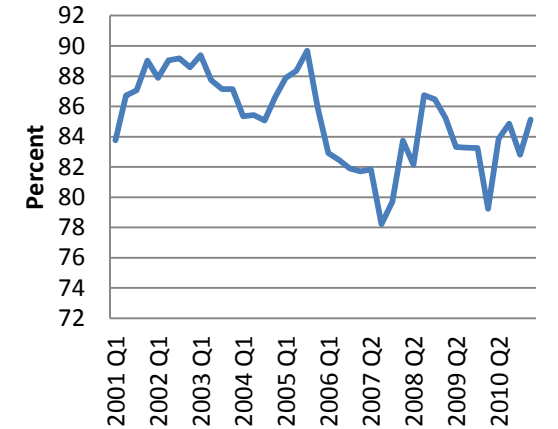
(h) Unemployment of Medicine and Related STEM Graduates, Wales (%)



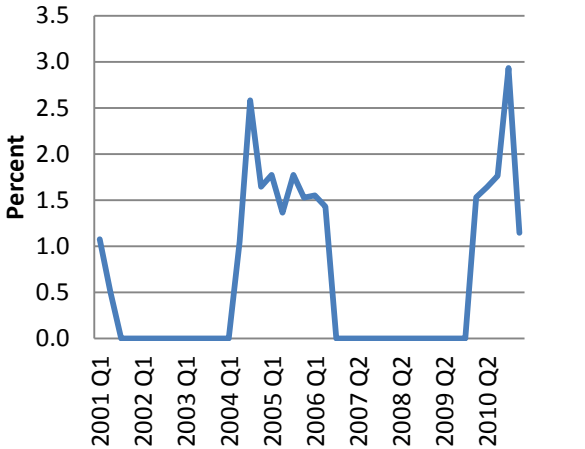
(i) Inactivity of Medicine and Related STEM Graduates, Wales (%)



(j) Employment of Medicine and Related STEM Graduates, Northern Ireland (%)



(k) Unemployment of Medicine and Related STEM Graduates, Northern Ireland (%)



(l) Inactivity of Medicine and Related STEM Graduates, Northern Ireland (%)

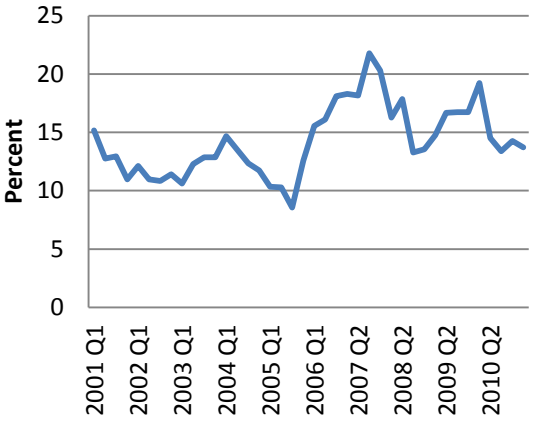
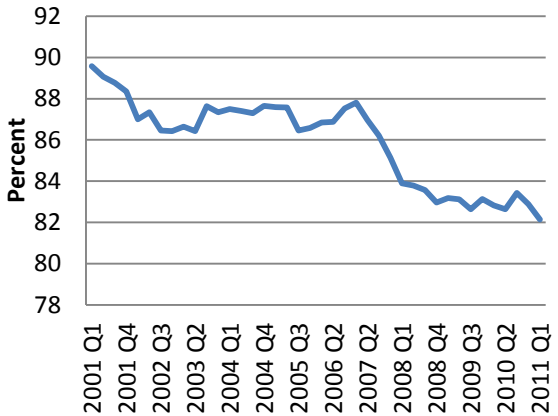
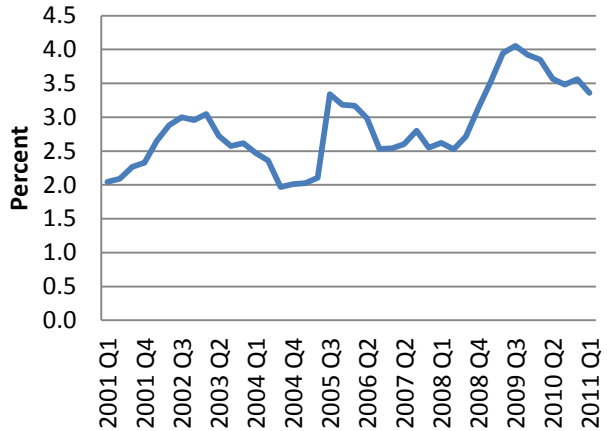


Figure 2 Employment, Unemployment and Inactivity Rates for Core STEM Graduates England, Scotland, Wales, Northern Ireland, 2001-2011.

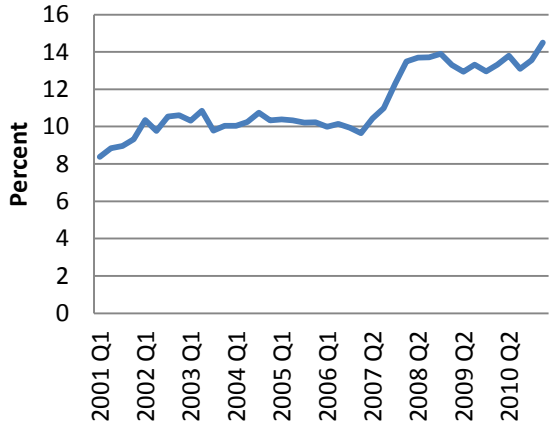
(a) Employment of Core STEM Graduates, England (%)



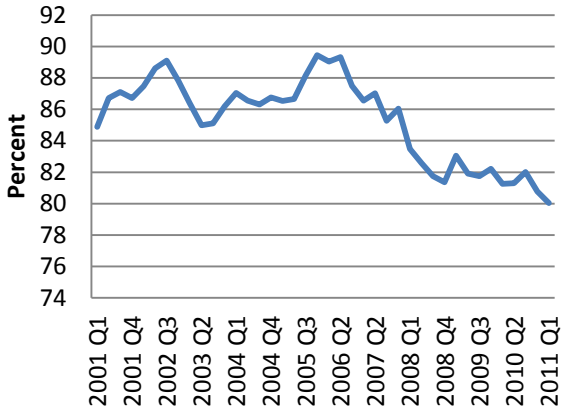
(b) Unemployment of Core STEM Graduates, England (%)



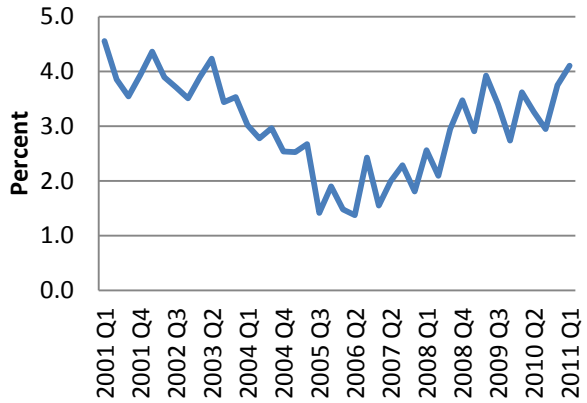
(c) Inactivity of Core STEM Graduates, England (%)



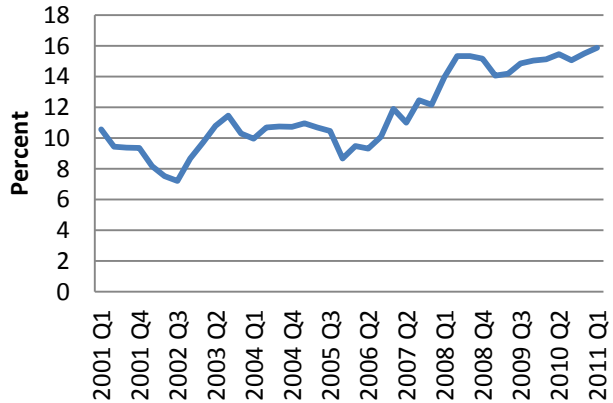
(d) Employment of Core STEM Graduates, Scotland (%)



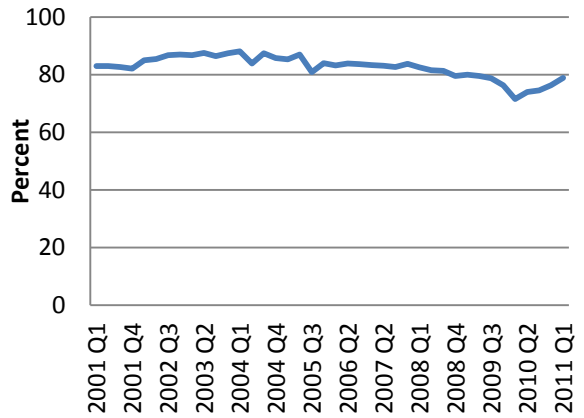
(e) Unemployment of Core STEM Graduates, Scotland (%)



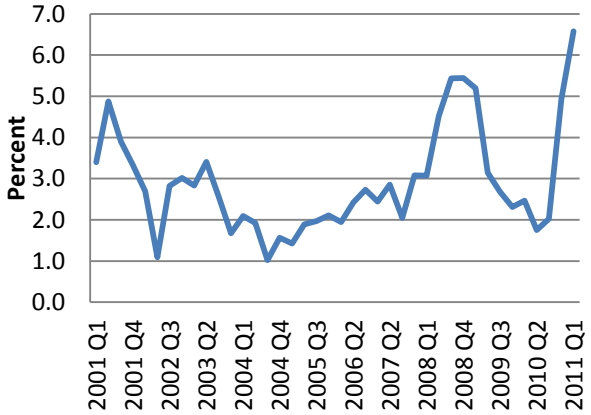
(f) Inactivity of Core STEM Graduates, Scotland (%)



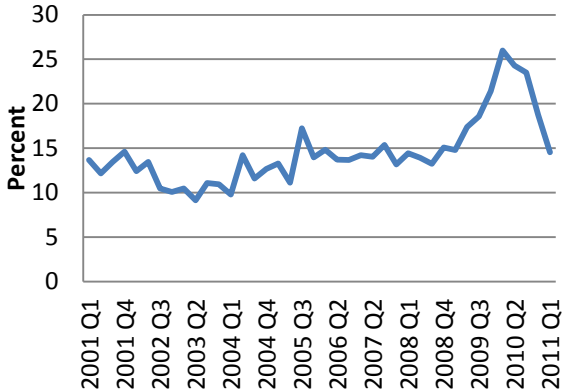
(g) Employment of Core STEM Graduates, Wales (%)



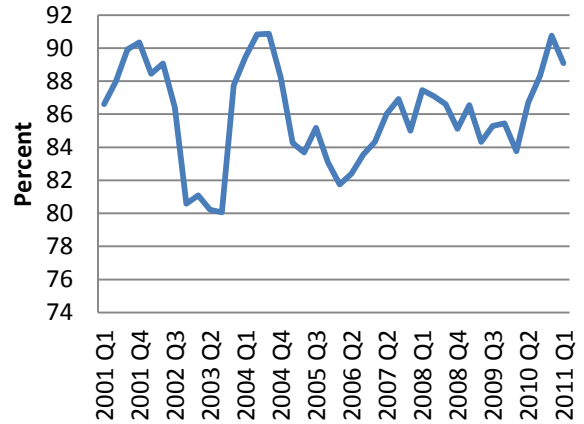
(h) Unemployment of Core STEM Graduates, Wales (%)



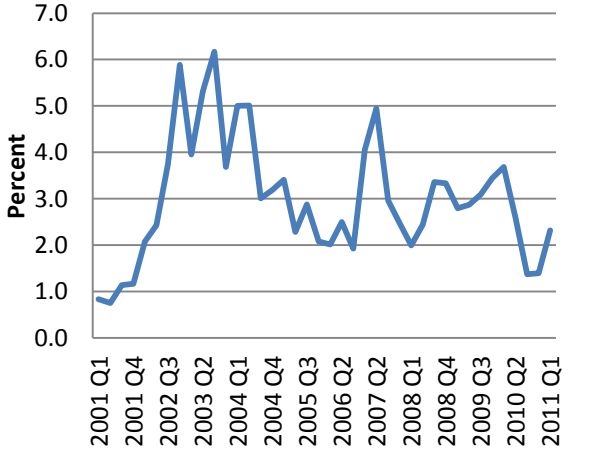
(i) Inactivity of Core STEM Graduates, Wales (%)



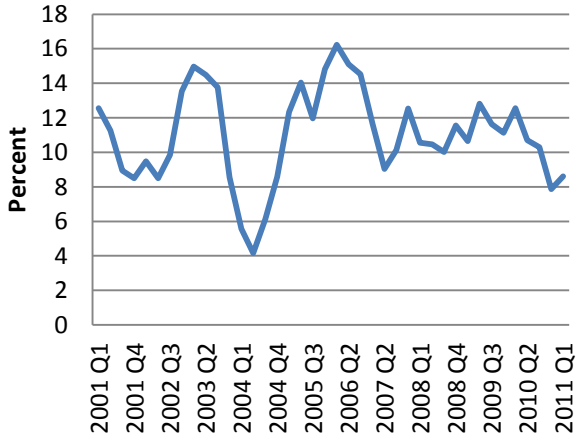
(j) Employment of Core STEM Graduates, Northern Ireland (%)



(k) Unemployment of Core STEM Graduates, Northern Ireland (%)



(l) Inactivity of Core STEM Graduates, Northern Ireland (%)



3.1.2 Trends in the Labour Market Status of Core STEM Graduates in the Four Nations

Figure 2 shows the employment, unemployment and activity rates for Core STEM graduates England (Figure 2 (a)-(c)), Scotland (Figure 2 (d)-(f)), Wales (Figure 2 (g)-(i)) and Northern Ireland (Figure 2 (j)-(l)) between 2001 and 2011.

England

Figure 2 (a)-(c) show the employment, unemployment and inactivity rates for graduates with core STEM degrees in England from 2001 until the beginning of 2011. As Figure 2 (a), show the employment rate of core STEM graduates starts at nearly 90 per cent in 2001 but them drops through 2002 to under 87 per cent. The employment rate then picks up a bit and plateaus at around 88 per cent until the recession starts in 2007. Then the employment rate drops to around 84 per cent and remains there. Although the employment rate picked up briefly in 2010, it has dropped again. The inactivity graph (c) mirrors the employment graph, as people move into activity as a result of being unable to find jobs. The inactivity rates started off low at 8 per cent in 2001, increased until 2002, then plateaus at around 10 percent until the recession hit in 2007. Once the recession hit, the inactivity rates increased to over 12 per cent and then have levelled off. The unemployment rate in figure (b) has jumped around a bit, but shows a trend of generally increasing over time before starting to come back down again after 2009. At 2001, the unemployment rate was just over two per cent and it reached a peak of around four per cent in 2009 and then has dropped to 3.5 per cent in 2011.

Scotland, Wales and Northern Ireland

Figure 2 (d)-(f) show the employment, unemployment and inactivity rates for Scotland, Figure 2 (g)-(i) are for Wales and Figure 2 (j)-(l) are for Northern Ireland. The employment trends for Scotland are very similar to England, except that the employment rates are increasing from 2001 to 2002 for Scotland. Scotland's core STEM employment rate peaked at just under 90 per cent, like England in 2005 and plateaued there before dropping as the recession hit in 2007. The employment rate dropped sharply with the recession to 82 per cent at the end of 2008. The employment rate has remained around 82 to 83 per cent since. The recession did not cause employment to drop as sharply in Wales (Figure 2 (g)) at first. The employment rate in Wales didn't drop off until 2009 but then it dropped further than it did in England or Scotland to a low of under 75 per cent in 2009. Since then the employment rate has increased and has levelled off at around 82 per cent, in line with the current core STEM employment rates in England and Scotland. Figure 2 (j) shows the employment rates for core STEM in Northern Ireland. Unlike, the other three nations, the employment rate in Northern Ireland oscillates quite a bit. The employment rate is around 92 per cent in 2002 (higher than the other nations), then drops to 83 per cent in 2003. The employment rates then rises back up to 93 per cent in 2004, then down to 83 per cent again in 2005. The employment rate increases to around 90 per cent before the recession hits. Then the trend mirrors England and Scotland: the employment rate drops in 2007 down to 84 per cent at the end of 2008 and then picks up to 91 per cent again in 2009 and 2010 but has dropped a bit in the last couple of quarters.

The inactivity rates in Figure 2 (f), (i) and (l) for Scotland, Wales and Northern Ireland reflect the respective employment graphs. When the employment increases, the inactivity rates decrease, the inactive rates peak when the employment rates drop. Scotland's inactive rates were lower than England's prior to the recession at 9 per cent but they increased with the recession to a current level of over 14 per cent, higher than England's by two percentage points. The inactivity rates in Wales were higher than for England and Scotland before the recession (13 per cent in Wales) and the increase in inactivity in response to the recession was delayed just as Wale's dip in employment was delayed. Inactivity rates in Wales did not increase until 2009, when they shot up to 24 per cent before quickly dropping back to pre-recession levels. The inactivity rates in Northern Ireland oscillate. After the recession, they increased to 12 per cent then dropped down to seven per cent, far below the inactive rates in England, Scotland and Wales.

Unemployment in Scotland (Figure 2 (g)) reached a minimum of under two per cent in 2005 and increased with the recession to three per cent in 2007 and has remained there. In Wales, unemployment was around two per cent before the recession, shot up to 6 per cent in 2008, then dropped back to three per cent in 2009 before increasing back to 6 per cent again in 2011. In Northern Ireland, the unemployment rate has jumped around but was at a low of two per cent before the recession, then increased to five per cent before dropping to under two per cent in 2010. Now unemployment has started to increase again. The unemployment rate in Wales is currently higher than in England, Scotland and Northern Ireland.

3.1.3 Trends in the Labour Market Status of Non STEM Graduates in the Four Nations

Figure 3 shows the employment, unemployment and activity rates for non STEM graduates England (Figure 3 (a)-(c)), Scotland (Figure 3 (d)-(f)), Wales (Figure 3 (g)-(i)) and Northern Ireland (Figure 3 (j)-(l)) between 2001 and 2011.

England

Figure 3 (a)-(c) show the employment, unemployment and inactivity rates for graduates with non STEM degrees in England from 2001 until the beginning of 2011. As Figure 3 (a), shows the employment rate of non STEM graduates starts increases from 2001 to a peak of 88 per cent in 2004 (below the core STEM peak of just under 90 per cent) but them drops when the recession hits in 2007 to low of just over 82 per cent (this is two percentage points below the core STEM low of 84 per cent). Starting in mid-2009, the employment rate has picked back up again to about 84 per cent, which is in line with the current core STEM employment rate.

The inactivity graph (c) mirrors the employment graph, as people move into activity as a result of being unable to find jobs. The inactivity rates started off at 10 per until the recession hit in 2007 (this is similar to the pre-recession core STEM inactivity rate). Once the recession hit, the inactivity rates increased to over 14 per cent in 2009 and then have dropped down to 12.5 per cent. The unemployment rate in figure (b) has jumped around a bit, was generally around 2.5 per cent leading up the recession in 2007 where it rose to over 3.5 per cent before levelling off. These are in line with the unemployment rates for core STEM.

Scotland, Wales and Northern Ireland

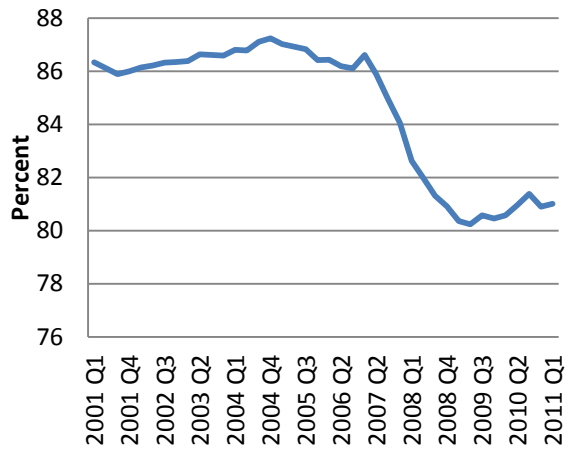
The trends in the non STEM employment rate are very similar for England, Scotland and Northern Ireland. In all three, the employment rate is relatively constant until the recession, then it drops sharply before picking back up again. In Scotland, the employment rate of non STEM graduates peaked at 89 per cent in 2003, dropped to 80 per cent in 2009 and then picked up again reaching 84 per cent at the start of 2011. In Northern Ireland, the pre-recession employment rate peaked at 92 per cent, then dropped to 82 per cent by 2009 then picked up again, reaching 87 per cent in 2011. The employment rates in Wales have jumped around a bit. There was a peak of 92 per cent in 2005, but it dropped down to 85 per cent just before the start of the recession. Employment then dropped down to 82 per cent and then recently picked back up to 85 per cent. The current employment rates of non STEM graduates are similar among the four nations: 84 per cent in England, 84 per cent in Scotland, 87 per cent in Northern Ireland and 85 per cent in Wales.

The non STEM inactivity rates reflect the trends observed in the employment rates. Scotland's inactivity graph is very similar to England's. The in active rate is around 10 per cent prior to the recession, increases to a max of 17 per cent in 2009 and then drops down to 12.5 per cent. The graph for Wales has a few dips but generally shows an inactivity rate of around 12 per cent prior to the recession, then increases to 15 per cent in 2009 before dropping down to 10 per cent. In Northern Ireland, the inactivity rate reached a minimum of 5 per cent in 2005 and then rapidly increased to 15 per cent in 2009 before coming down to 9 per cent.

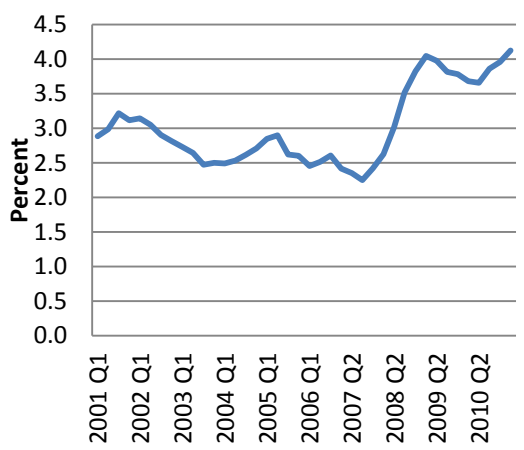
The trends in unemployment vary more amongst the regions. In Scotland, the unemployment rate was about two per cent before the recession, and increased to a peak of 4.5 per cent in 2009 before dropping down to 3.5 per cent. However the unemployment has started to tick back up again in the past few quarters. In Wales, the unemployment rate has oscillated between two to four per cent, with a slight upward trend over time. In Northern Ireland, unemployment has jumped around a bit and was at a low of under one per cent in 2007 and increased to a high of four per cent in 2009. The current unemployment rate for non STEM graduates is around three per cent in Northern Ireland.

Figure 3 Employment, Unemployment and Inactivity Rates for non STEM Graduates England, Scotland, Wales, Northern Ireland, 2001-2011.

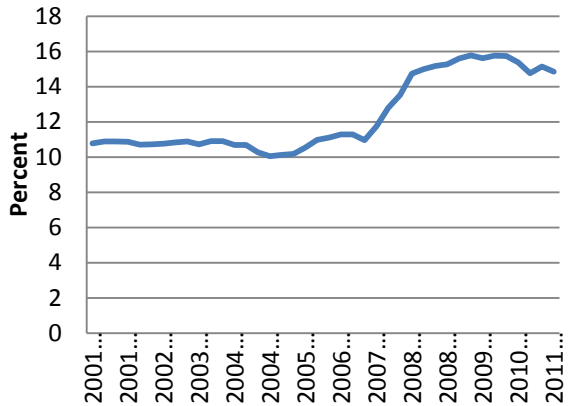
(a) Employment of Non STEM Graduates, England (%)



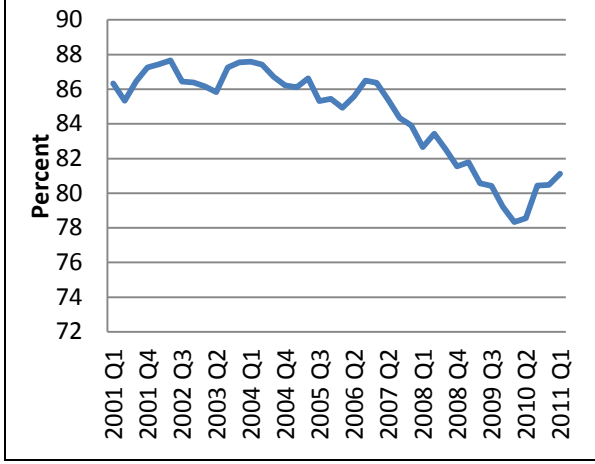
(b) Unemployment of Non STEM Graduates, England (%)



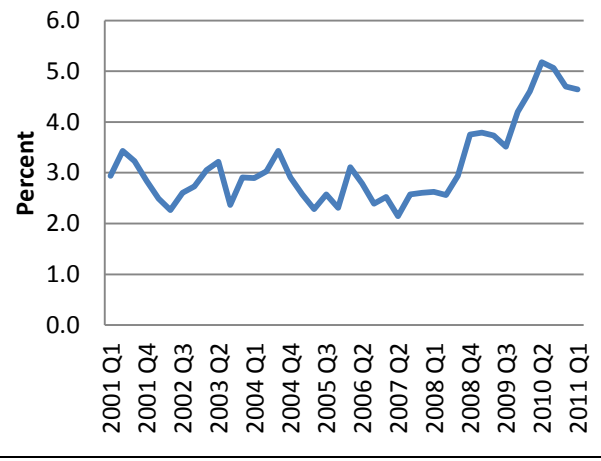
(c) Inactivity of Non STEM Graduates, England (%)



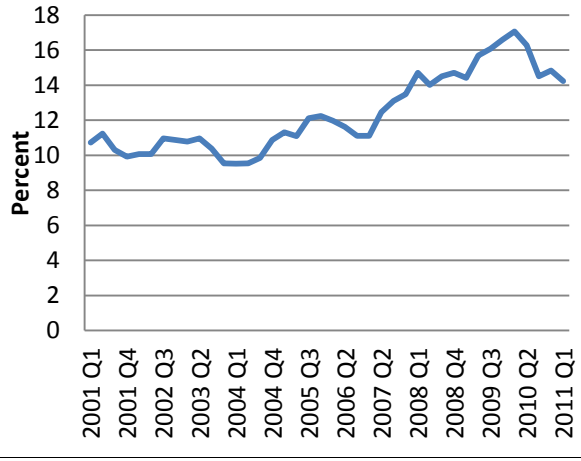
(d) Employment of Non STEM Graduates, Scotland (%)



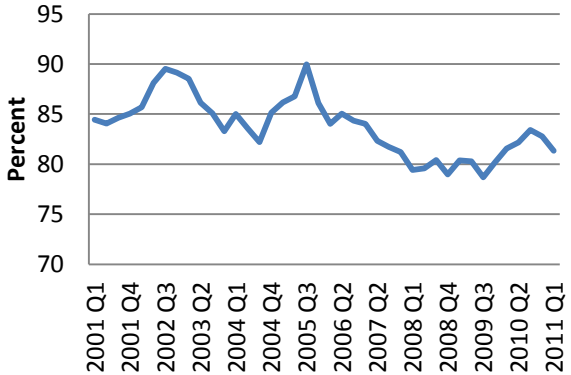
(e) Unemployment of Non STEM Graduates, Scotland (%)



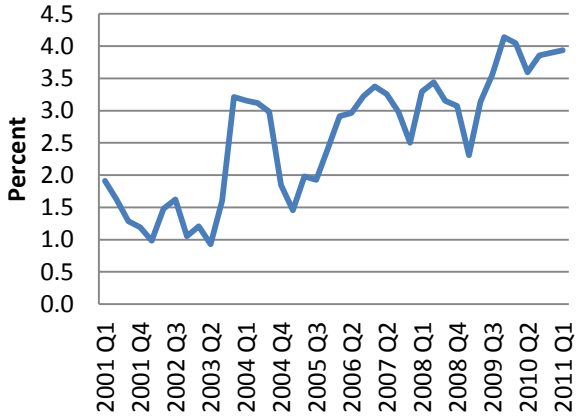
(f) Inactivity of Non STEM Graduates, Scotland (%)



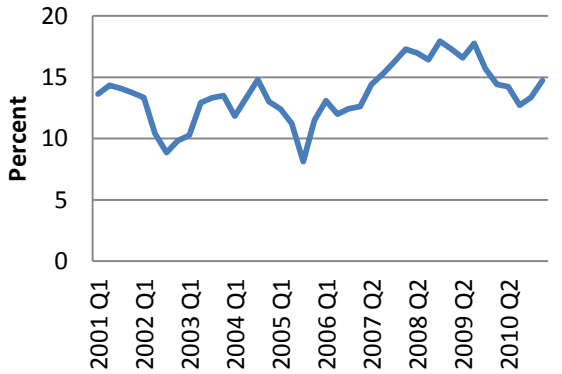
(g) Employment of Non STEM Graduates, Wales (%)



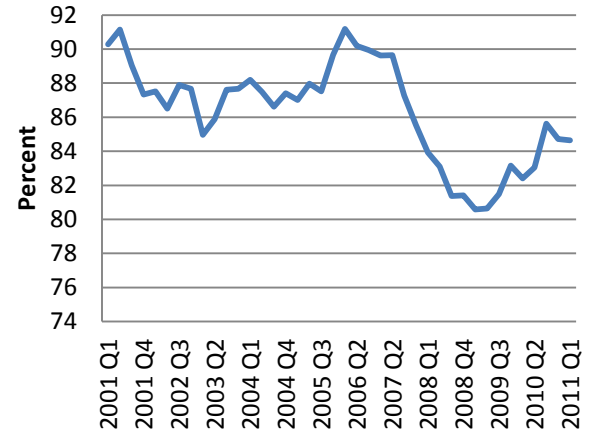
(h) Unemployment of Non STEM Graduates, Wales (%)



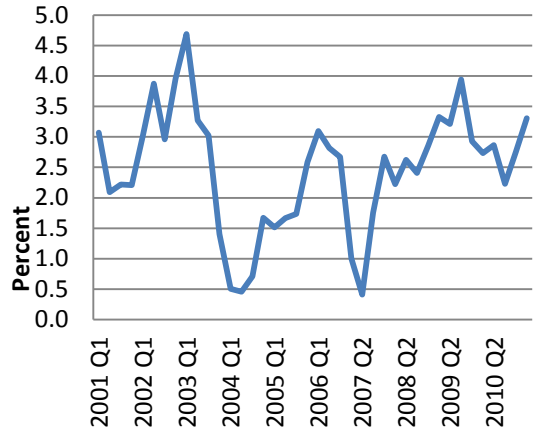
(i) Inactivity of Non STEM Graduates, Wales (%)



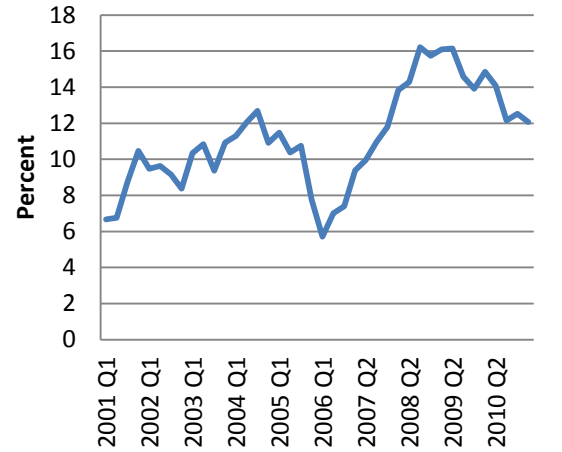
(j) Employment of Non STEM Graduates, Northern Ireland (%)



(k) Unemployment of Non STEM Graduates, Northern Ireland (%)



(l) Inactivity of Non STEM Graduates, Northern Ireland (%)



3.1.4 Comparisons between STEM and Non STEM in the Four Nations

England

The shape of the employment rate graphs for England are very similar for medicine and related STEM graduates and core STEM graduates. The employment rate drops with the recession, reaches a low in 2009, picks up briefly and then starts going down again. In non-STEM, the employment rate dropped with the recession and has since recovered.

The employment rates between medicine and related STEM, core STEM and not STEM graduates are similar. Prior to the recession they were around 89 per cent, 90 per cent and 88 per cent, respectively. Once the recession hit they dropped to a low of 82 per cent for medicine and related STEM, 84 per cent for core STEM and 82 per cent for non STEM. After the recession, employment rates in 2011 were 83 per cent for medicine and related STEM, 84 per cent for core STEM and 84 per cent for non STEM.

The trends in unemployment were similar for the three groups. Unemployment increased when the recession hit, peaked in 2008 or 2009 before levelling off (non STEM) or dropping (medicine and related STEM and core STEM). In 2011, unemployment was low for all three groups: one per cent for medicine and related STEM, 3.5 per cent for core STEM and 3.5 per cent for non STEM.

In activity rates were higher for medicine and related STEM then for core STEM and non STEM. Prior to the recession, the inactive rate of medicine and related STEM graduates in England was around five per cent, it then increased to a maximum of 17 per cent and was approaching 16 per cent in 2011. For core STEM and non STEM they were eight and 10 per cent prior to the recession, over 12 and 14 per cent at the peak and down to around 12.5 per cent in 2011.

Scotland, Wales and Northern Ireland

In all three nations, the 2011 employment rate was lowest for medicine and related STEM graduates. Non STEM graduates had the highest employment rates in Scotland and Wales but core STEM was highest in Northern Ireland. In Scotland in 2011, the employment rate was 80 per cent for medicine and STEM related graduates, between 82 and 83 per cent for core STEM graduates and 84 per cent for non STEM graduates. In Wales in 2011, the employment rate of medicine and related STEM graduates was 80 per cent, 82 per cent for core STEM and 85 per cent for non STEM graduates. In Northern Ireland, 2011 employment rates were 87, 90 and 87 per cent for medicine and related STEM, core STEM and non STEM graduates, respectively. Employment rates of non STEM graduates are currently on the increase in all three of the nations.

Unemployment rates were lowest for medicine and related STEM graduates. In 2011, the unemployment rates for Medicine and related STEM graduates were less than two per cent in Scotland and one per cent in Wales and Northern Ireland.

In Scotland and Wales, 2011 inactivity was the highest for medicine and related STEM, followed by core STEM and then by non STEM. In 2011, the inactive rates in Scotland were 20, 14 and 12.5 per cent for medicine and related STEM, core STEM and non STEM, respectively. In Wales, they were 20, 13 and 10 per cent, respectively. In Northern Ireland, inactive rates were the highest for medicine and related STEM (12 per cent in 2011), followed by non STEM (nine per cent in 2011) and then core STEM (seven per cent).

3.1.5 Trends in the Labour Market Status of Med STEM Graduates in the Nine English Planning Regions

Medicine and Related STEM Graduates

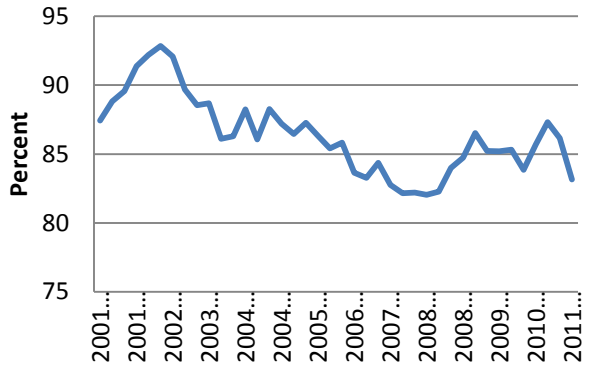
In most of the regions, employment rates of medicine and related STEM graduates have declined with the recession, recovered a bit and then have started dropping again. The 2011 employment rates range from around 87 per cent in London and the Southwest to 76 per cent in the East Midlands.

Unemployment of medicine and related STEM graduates was very low in all the regions. The data jumps around a bit because of low numbers but was generally around one to two per cent. It was around three per cent in the West Midland and North East.

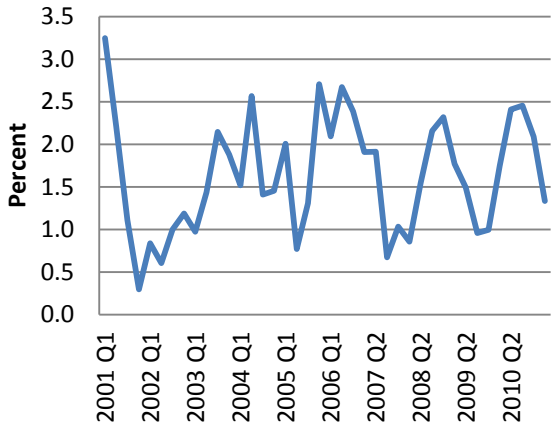
When the recession hit, inactivity rates increased in all of the regions. Since then they have levelled off in the South East and East Midlands. In the North East, inactivity has been dropping as the recession has faded. In the rest of the regions, inactivity declined after a rapid increase but has started to rise again. The East Midlands has the highest inactivity rate by far, 22 per cent in 2011. Inactivity in the other regions in 2011 ranged from 12 per cent in London to 17 per cent in the South East, North West and North East.

Figure 4 Employment, Unemployment and Inactivity Rates for Medicine and Related STEM Graduates in the Nine English Planning Regions, 2001-2011

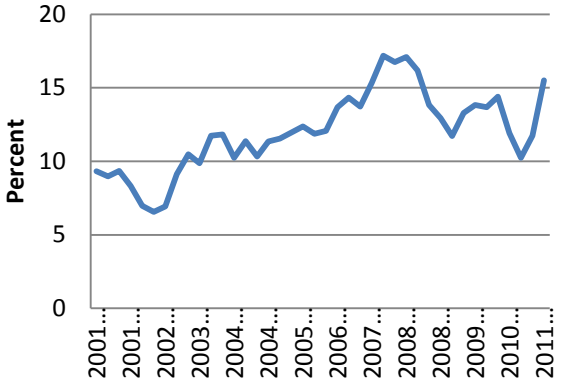
(a) Employment of Medicine and Related STEM Graduates, London (%)



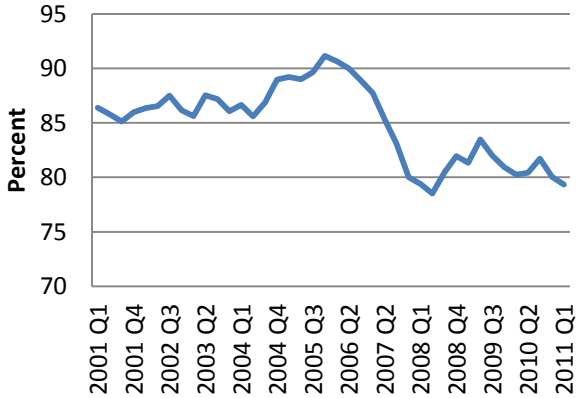
(b) Unemployment of Medicine and Related STEM Graduates, London (%)



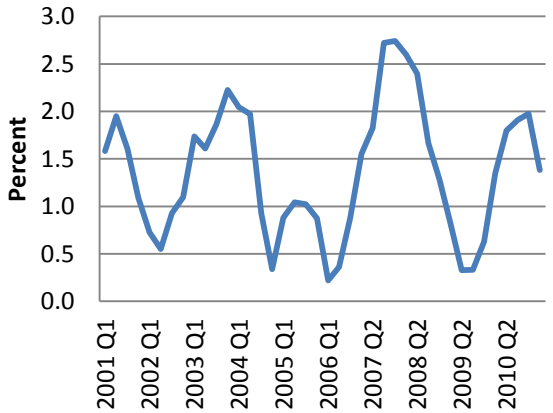
(c) Inactivity of Medicine and Related STEM Graduates, London (%)



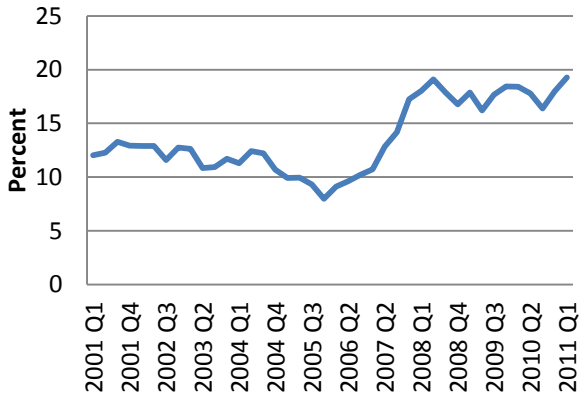
(d) Employment of Medicine and Related STEM Graduates, South East (%)



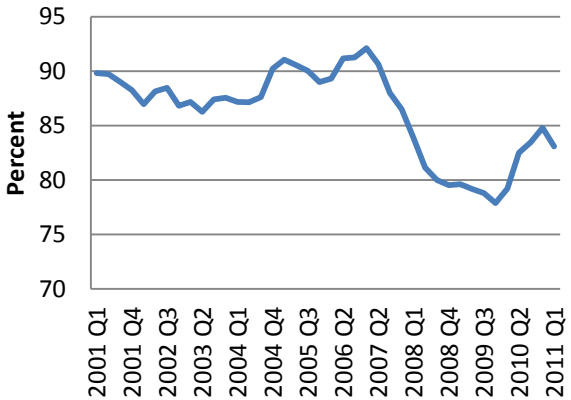
(e) Unemployment of Medicine and Related STEM Graduates, South East (%)



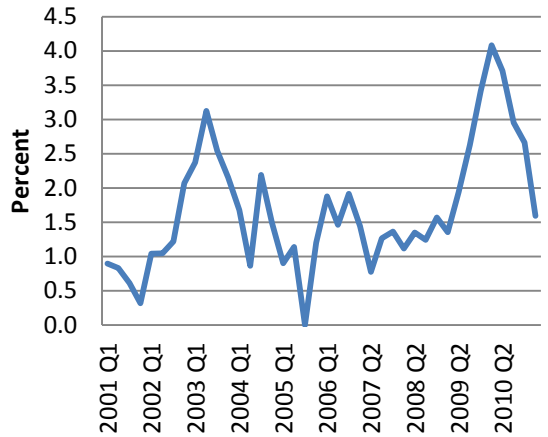
(f) Inactivity of Medicine and Related STEM Graduates, South East (%)



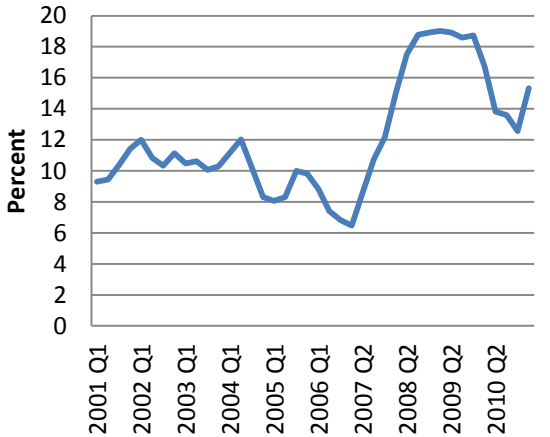
(g) Employment of Medicine and Related STEM Graduates, East of England (%)



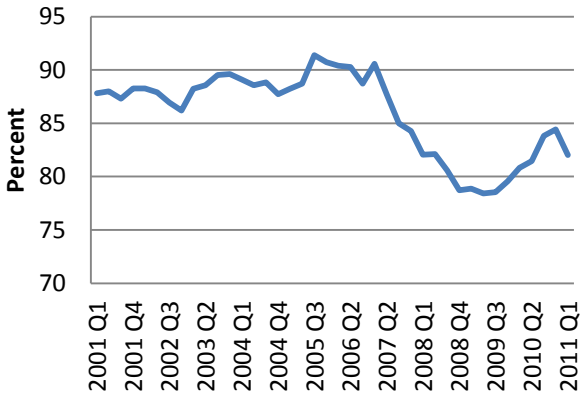
(h) Unemployment of Medicine and Related STEM Graduates, East of England (%)



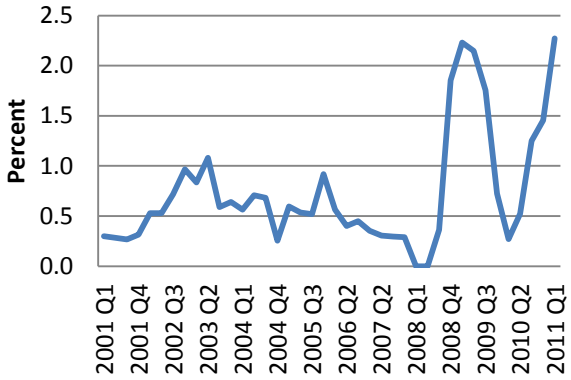
(i) Inactivity of Medicine and Related STEM Graduates, East of England (%)



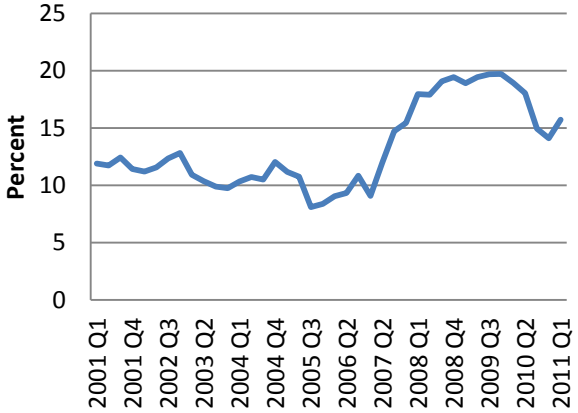
(j) Employment of Medicine and Related STEM Graduates, South West (%)



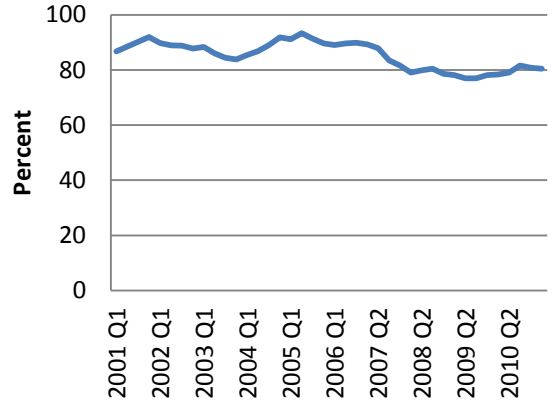
(k) Unemployment of Medicine and Related STEM Graduates, South West (%)



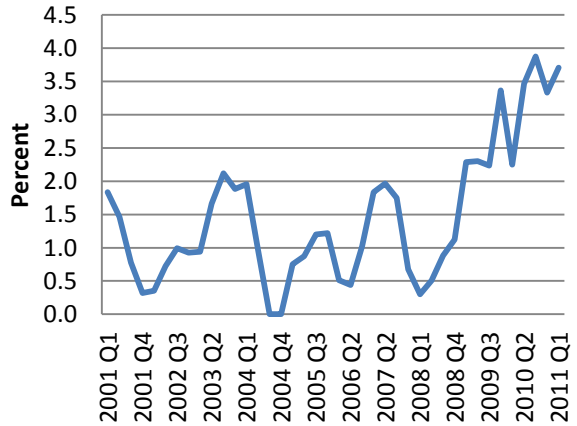
(l) Inactivity of Medicine and Related STEM Graduates, South West (%)



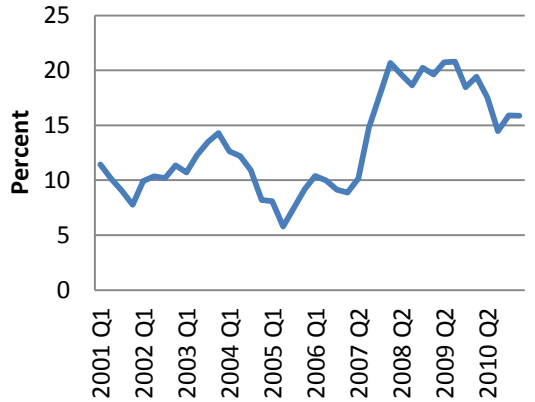
(m) Employment of Medicine and Related STEM Graduates, West Midlands (%)



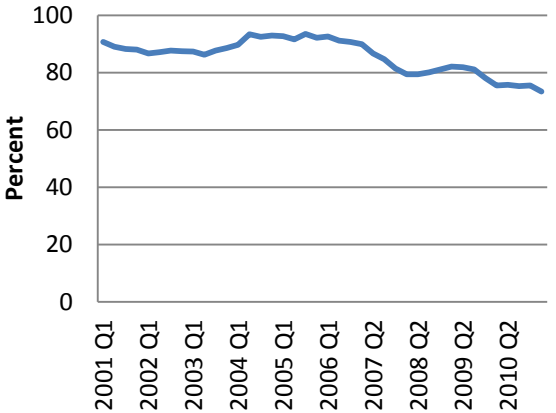
(n) Unemployment of Medicine and Related STEM Graduates, West Midlands (%)



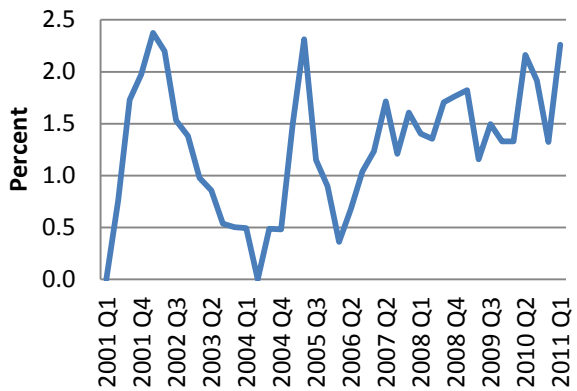
(o) Inactivity of Medicine and Related STEM Graduates, West Midlands (%)



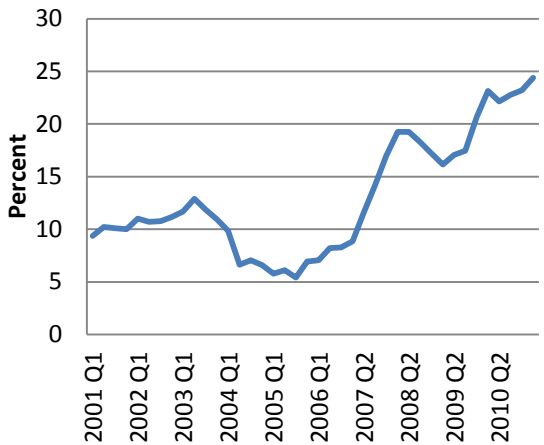
(p) Employment of Medicine and Related STEM Graduates, East Midlands (%)



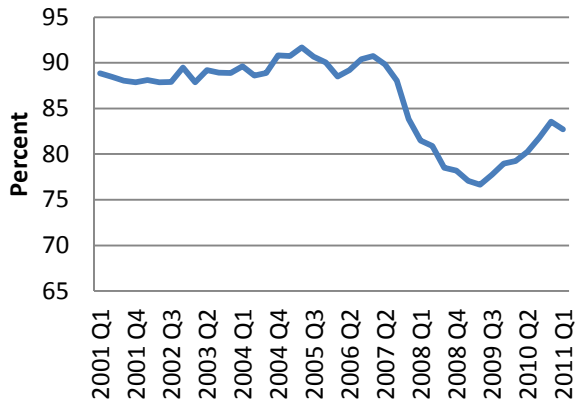
(q) Unemployment of Medicine and Related STEM Graduates, East Midlands (%)



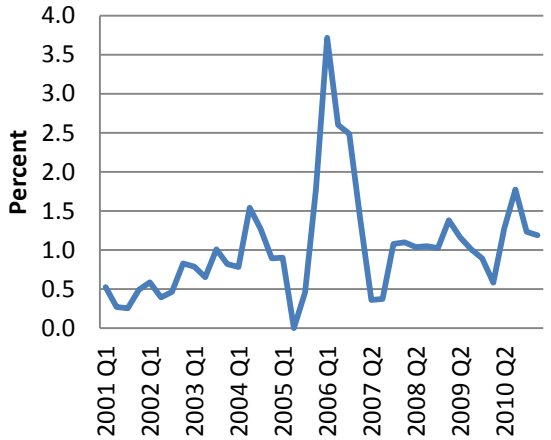
(r) Inactivity of Medicine and Related STEM Graduates, East Midlands (%)



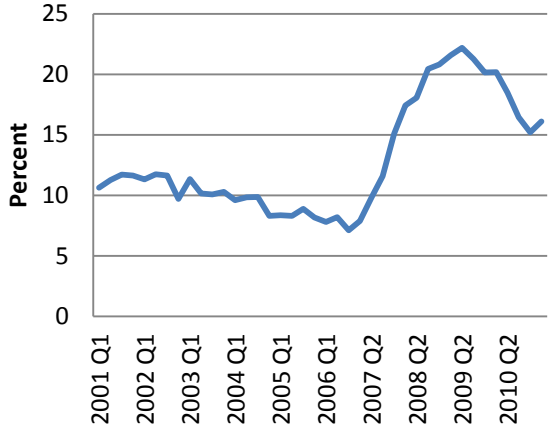
(s) Employment of Medicine and Related STEM Graduates, Yorkshire and the Humber (%)



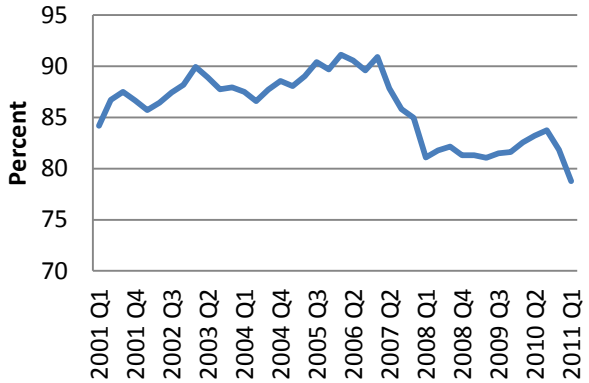
(t) Unemployment of Medicine and Related STEM Graduates, Yorkshire and the Humber (%)



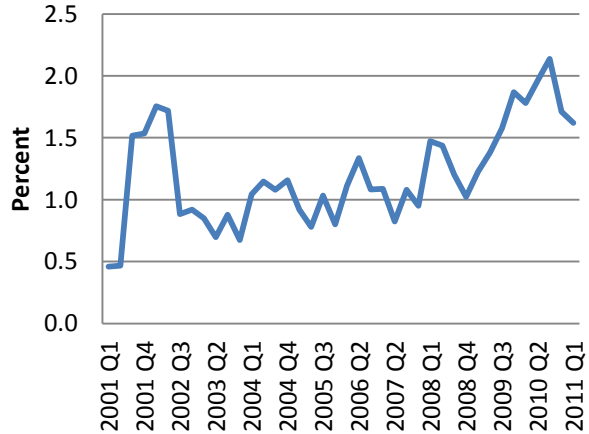
(u) Inactivity of Medicine and Related STEM Graduates, Yorkshire and the Humber (%)



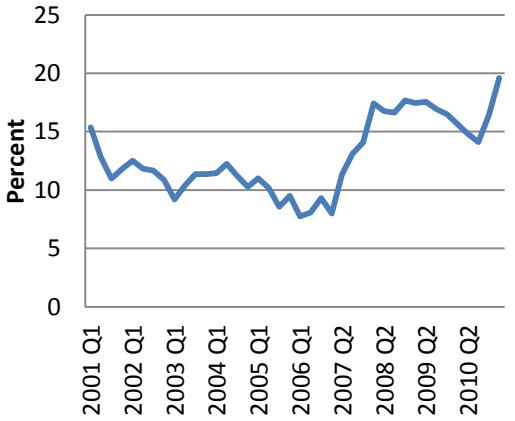
(v) Employment of Medicine and Related STEM Graduates, North West (%)

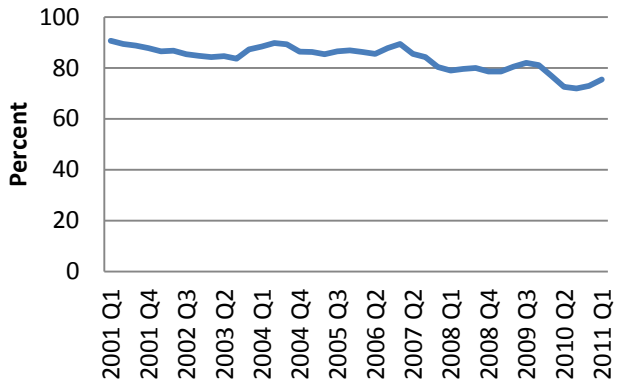
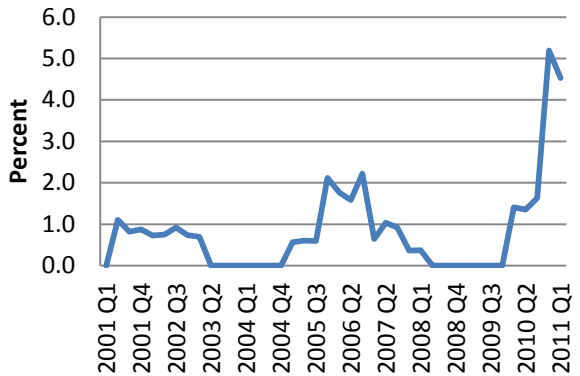
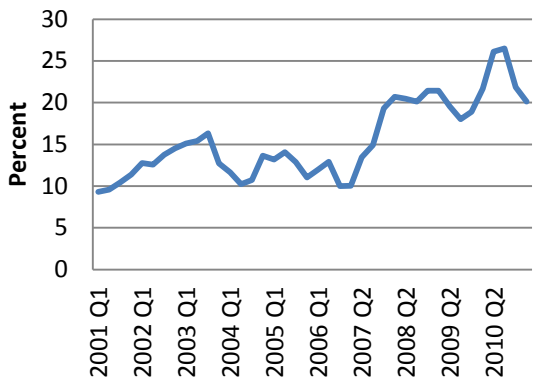


(w) Unemployment of Medicine and Related STEM Graduates, North West (%)



(x) Inactivity of Medicine and Related STEM Graduates, North West (%)



(y) Employment of Medicine and Related STEM Graduates, North East (%)	(z) Unemployment of Medicine and Related STEM Graduates, North East (%)	(aa) Inactivity of Medicine and Related STEM Graduates, North East (%)
		

3.1.6 Trends in the Labour Market Status of Core STEM Graduates in the Nine English Planning Regions

The employment rates of the nine English planning regions follow trends similar to England as a whole. The employment rate of STEM graduates is high prior to the recession (between 87 and 93 per cent depending on the region), drops to a low (from 77 to 86 per cent) then picks up a bit before dropping off again in the last couple of quarters. Prior to the recession, employment of STEM graduates was highest in East Midland and lowest in the West Midlands. At the height of the recession, the South West, West Midlands and North East has the lowest employment rates at the height of the recession (under 80 per cent) and South East had the highest (86 per cent). However, some of the regions that dropped the most like the South West, picked up quickly after the recession. The current employment rates range from the low 80s in North west and West Midlands to high 80s in South West and East of England.

The inactivity rates for the nine planning regions reflect the overall trends in the employment rates and inactivity rates and have increased in all regions as a result of the recession. Current levels range from around 11 to 14 per cent, so the regional variation is small.

Unemployment rates in the regions have jumped around a bit and seem to show the affects of the recession a bit later than the employment rates. Unemployment of STEM graduates is around three to four per cent in most of the regions. London seems to have been hit particularly hard, with a peak unemployment rate of 6 per cent and a current rate over 5 per cent.

3.1.7 Trends in the Labour Market Status of Non STEM Graduates in the Nine English Planning Regions

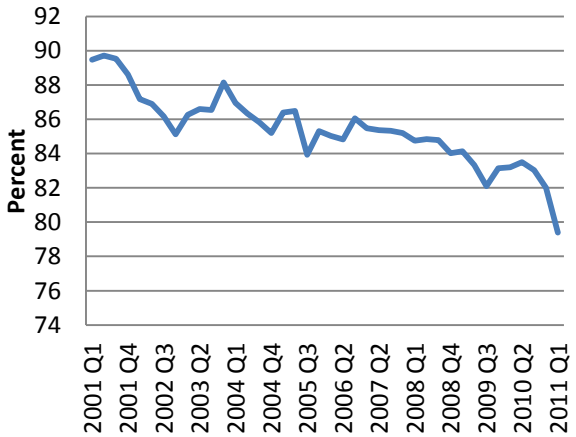
The shape of the employment graphs leading up to the recession until 2011 is very similar for almost all of the planning regions. Employment drops as a result of the recession, reaches a low around 2009 and then picks back up again. Prior to the recession, the employment rate of non STEM graduates was around 86 or 87 per cent for almost all of the regions (two regions were higher than this: 89 per cent in East Midlands and 90 per cent in Yorkshire and the Humber). At the peak of the recession in 2009, employment dropped to around 80 to 82 per cent in the regions before picking back up to the low to mid 80s in 2011. The trends were slightly different in the West Midlands, in which employment has not increased from its low of 80 per cent and Yorkshire and the Humber in which the employment rate has started to drop back down again over the past few quarters.

The trend in activity rates in most regions is similar to that as England as a whole (but the data does jump around more in the regions due to a smaller sample size): inactivity increases with the recession, peaks around 2009 and then is dropping down again. Prior to the recession, the inactive rate in the regions was around 10 per cent, then increased to around 15 per cent and then has dropped down again. The West Midlands is an exception to this trend, the inactive rate was around 10 to 11 per cent prior to the recession, then it has increased to 15 per cent and the trend has not stopped yet. The North East inactively rates started to come down after the recession, but have started to climb back up again.

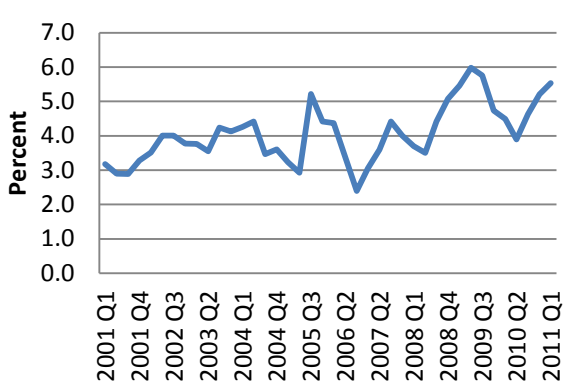
The trends in unemployment rates of non STEM graduates vary more among the regions than the trends in employment and activity rates. In England, unemployment increased in response to the recession and then levelled off, a similar trend is seen in the South West. In most of other the planning regions, the unemployment rates have not levelled off after rising with the recession. In some regions, such as East of England and Yorkshire and the Humber, they are still increasing. In the South East and West Midlands, unemployment rates increased with the recession, started to decrease and now are increasing again. The West Midlands was hit particular hard, and unemployment shot up to a high of six per cent before dropping down to three per cent in 2009 but is now on the rise again. In East Midlands and the North West, the unemployment rates are now decreasing. The current unemployment rate in the regions ranges from around two per cent in the North East to 4.5 per cent in London and Yorkshire and the Humber. The unemployment rate for non STEM graduates is 3.5 per cent for England as a whole.

Figure 5 Employment, Unemployment and Inactivity Rates for Core STEM Graduates in the Nine English Planning Regions, 2001-2011

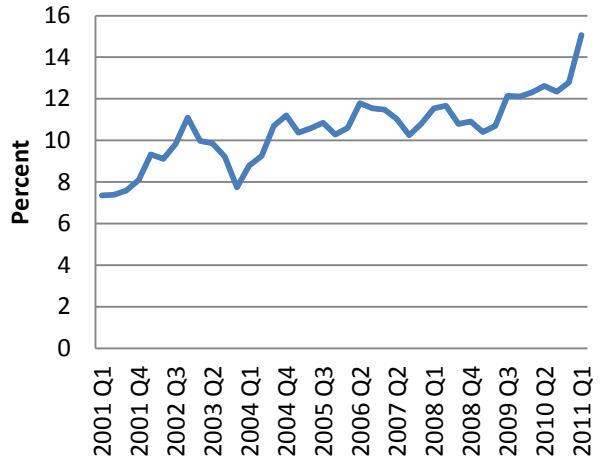
(a) Employment of Core STEM Graduates, London (%)



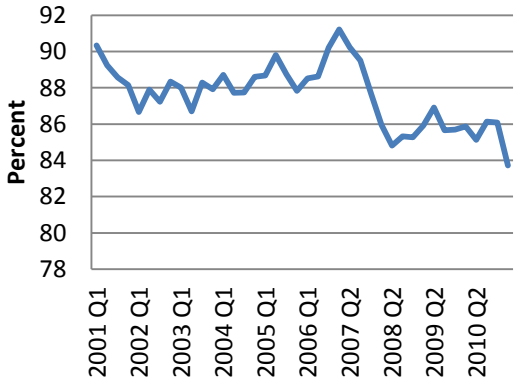
(b) Unemployment of Core STEM Graduates, London (%)



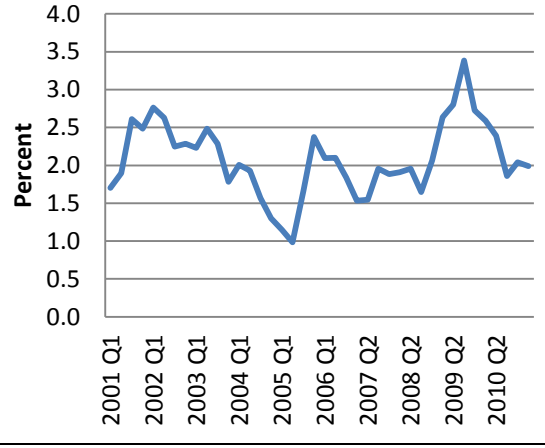
(c) Inactivity of Core STEM Graduates, London (%)



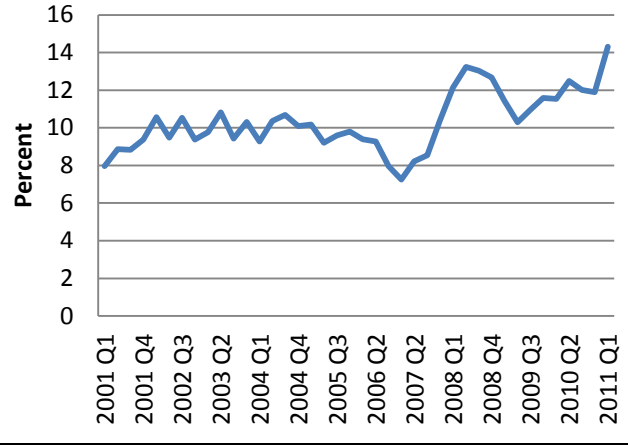
(d) Employment of Core STEM Graduates, South East (%)



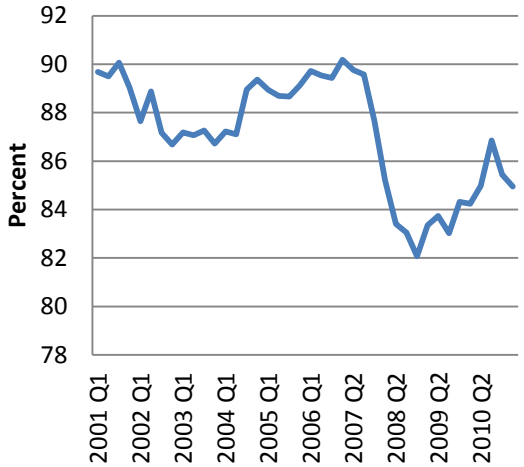
(e) Unemployment of Core STEM Graduates, South East (%)



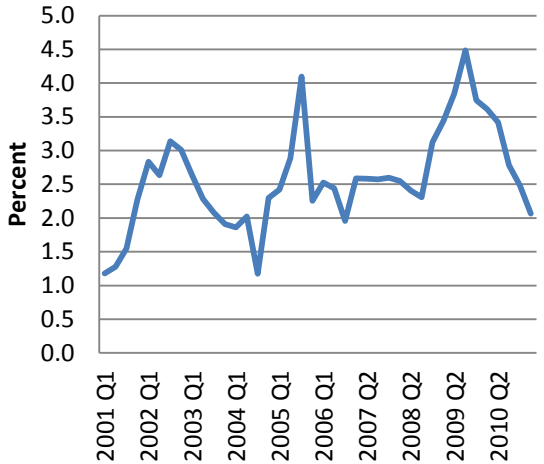
(f) Inactivity of Core STEM Graduates, South East (%)



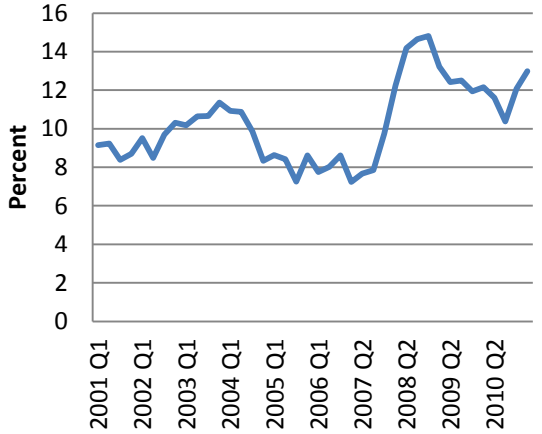
(g) Employment of Core STEM Graduates, East of England (%)



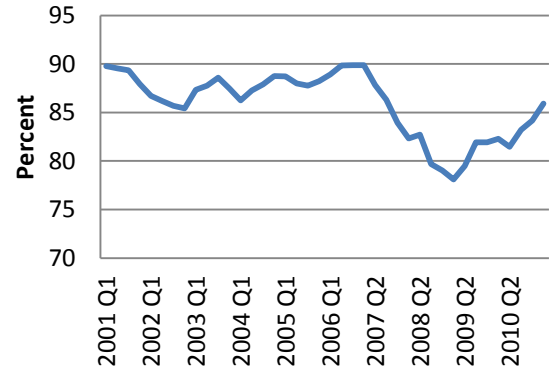
(h) Unemployment of Core STEM Graduates, East of England (%)



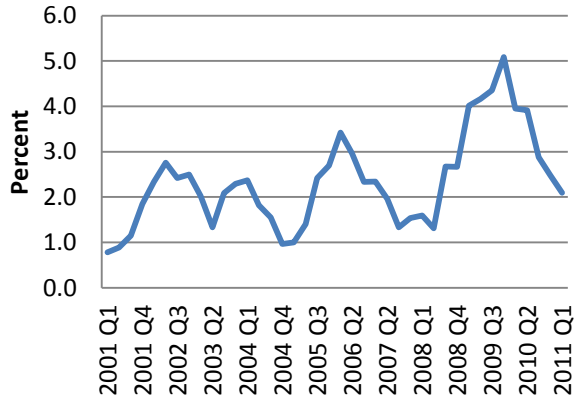
(i) Inactivity of Core STEM Graduates, East of England (%)



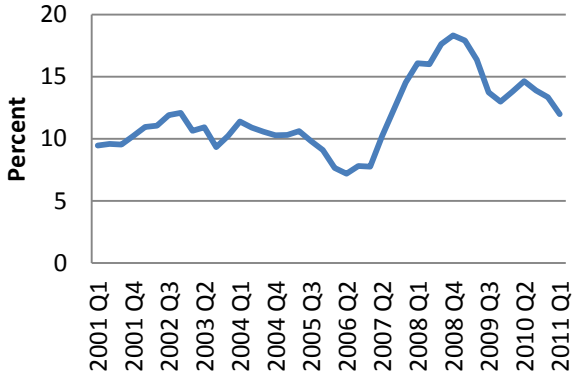
(j) Employment of Core STEM Graduates, South West (%)



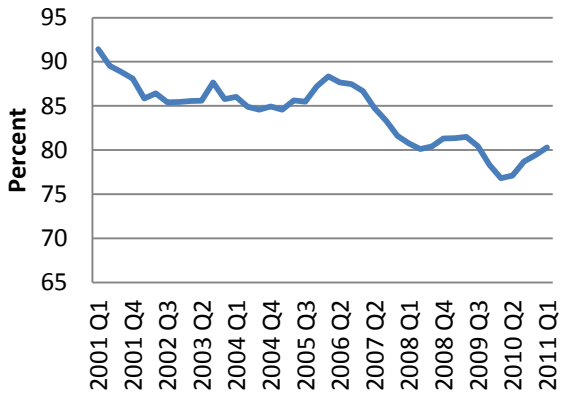
(k) Unemployment of Core STEM Graduates, South West (%)



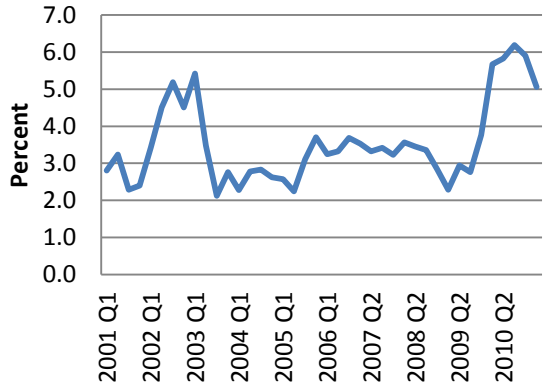
(l) Inactivity of Core STEM Graduates, South West (%)



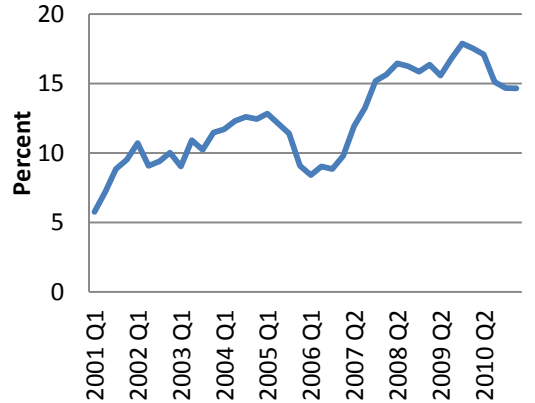
(m) Employment of Core STEM Graduates, West Midlands (%)



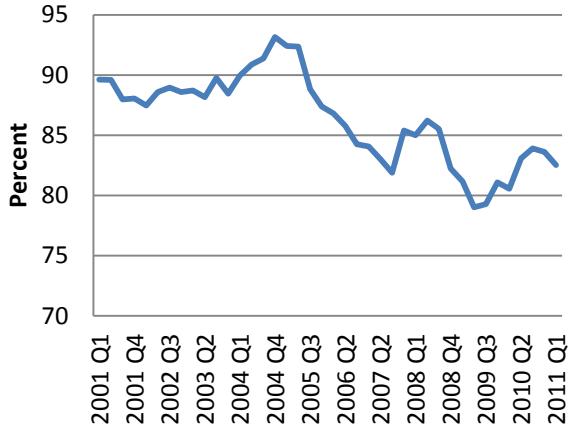
(n) Unemployment of Core STEM Graduates, West Midlands (%)



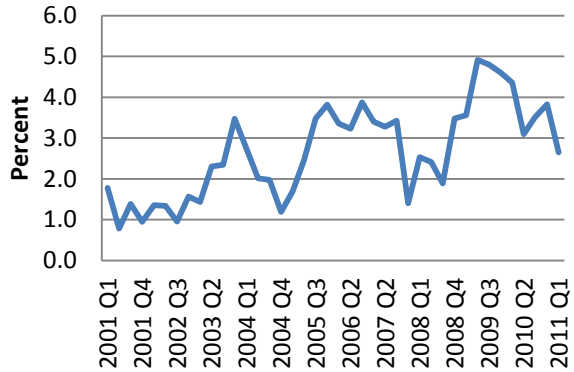
(o) Inactivity of Core STEM Graduates, West Midlands (%)



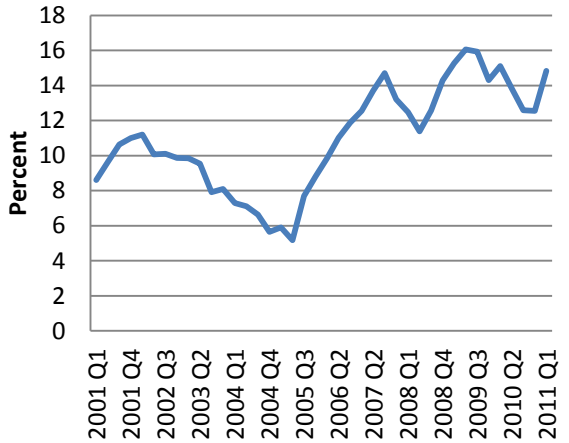
(p) Employment of Core STEM Graduates, East Midlands (%)



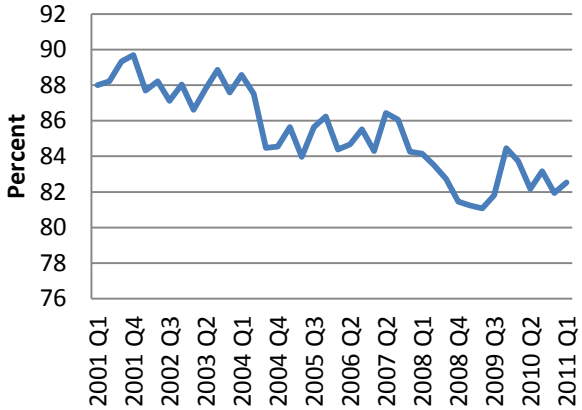
(q) Unemployment of Core STEM Graduates, East Midlands (%)



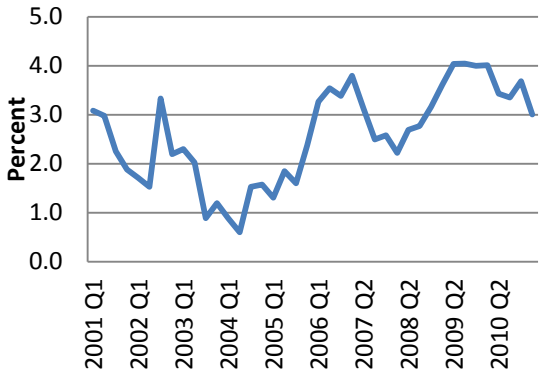
(r) Inactivity of Core STEM Graduates, East Midlands (%)



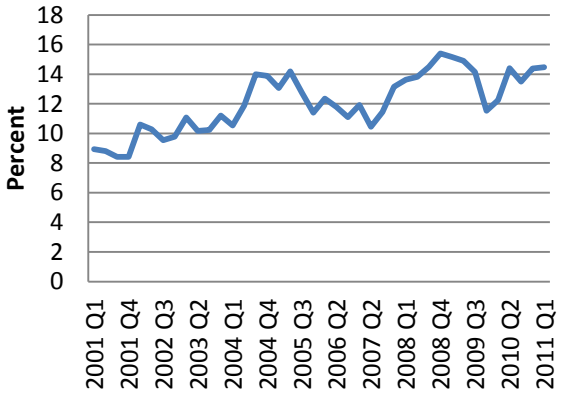
(s) Employment of Core STEM Graduates, Yorkshire and the Humber (%)



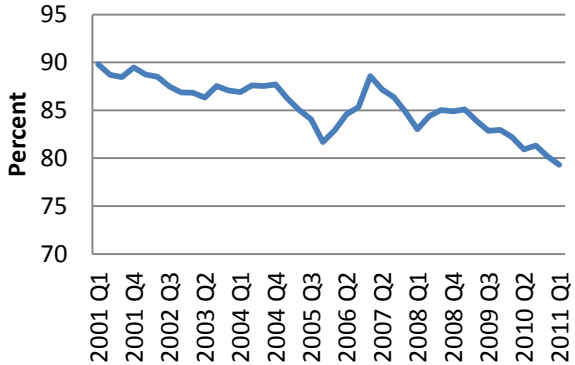
(t) Unemployment of Core STEM Graduates, Yorkshire and the Humber (%)



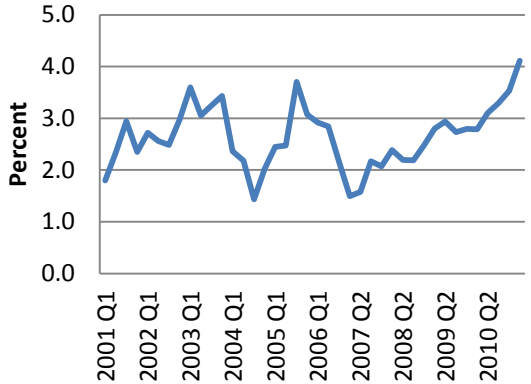
(u) Inactivity of Core STEM Graduates, Yorkshire and the Humber (%)



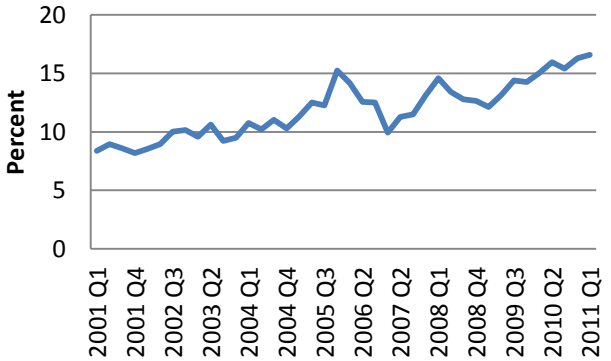
(v) Employment of Core STEM Graduates, North West (%)



(w) Unemployment of Core STEM Graduates, North West (%)



(x) Inactivity of Core STEM Graduates, North West (%)



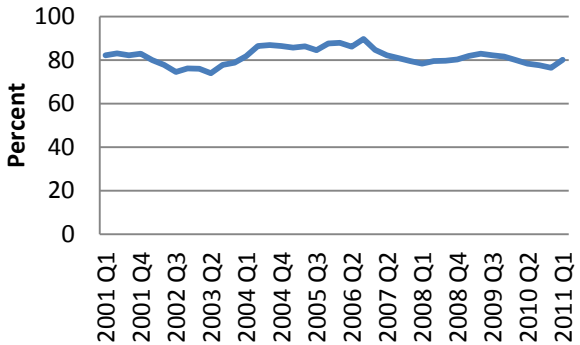
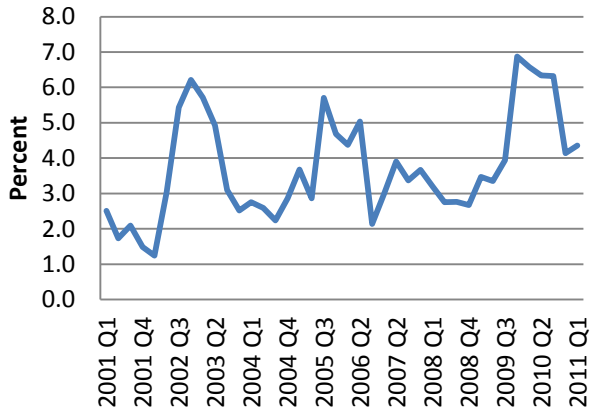
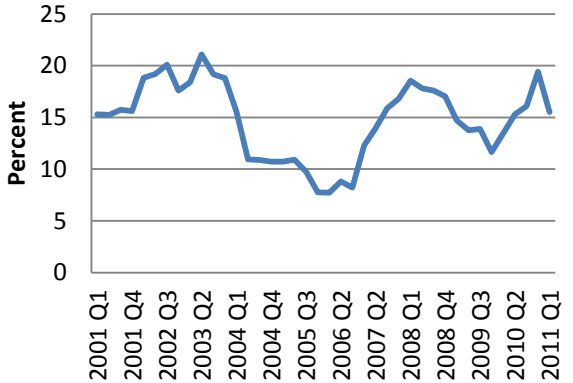
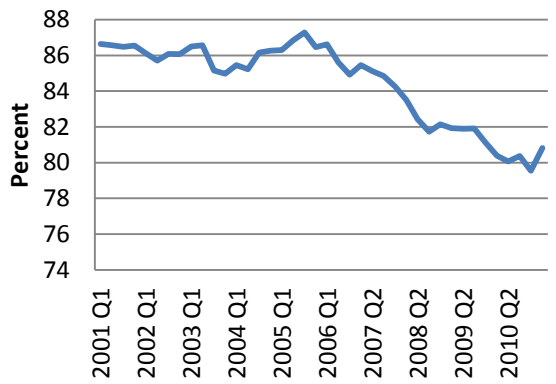
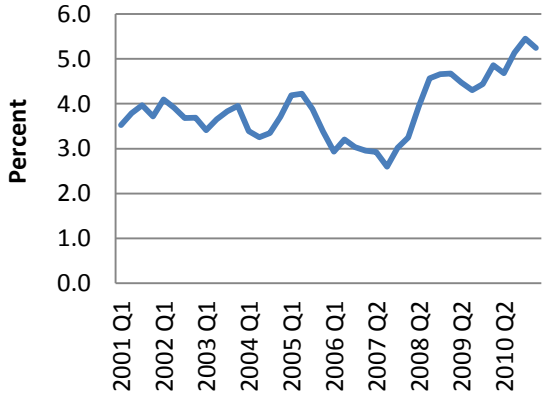
(s) Employment of Core STEM Graduates, North East (%)	(t) Unemployment of Core STEM Graduates, North East (%)	(u) Inactivity of Core STEM Graduates, North East (%)
		

Figure 6 Employment, Unemployment and Inactivity Rates for Non STEM Graduates in the Nine English Planning Regions, 2001-2011

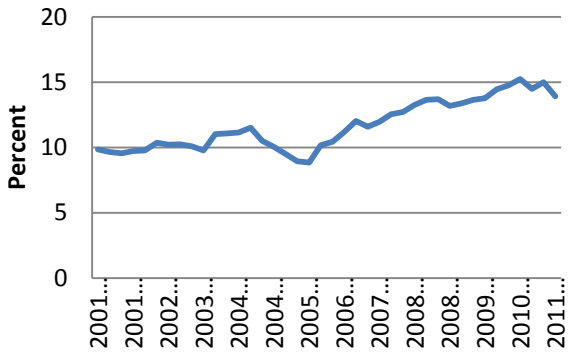
(a) Employment of Non STEM Graduates, London (%)



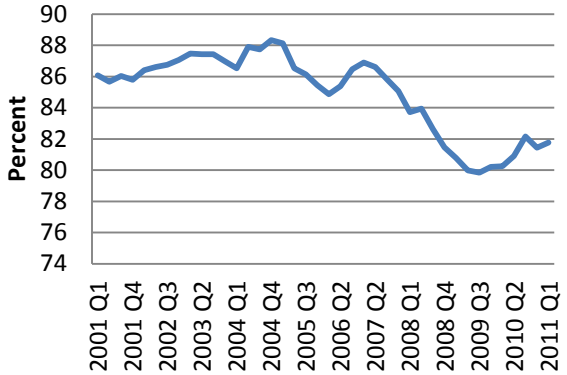
(b) Unemployment of Non STEM Graduates, London (%)



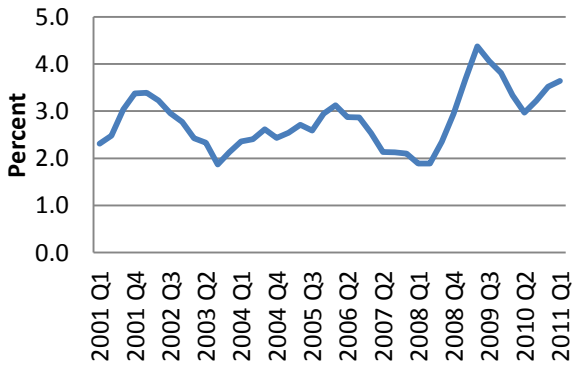
(c) Inactivity of Non STEM Graduates, London (%)



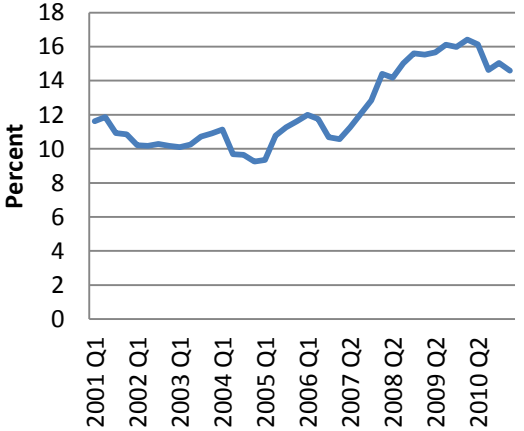
(d) Employment of Non STEM Graduates, South East (%)



(e) Unemployment of Non STEM Graduates, South East (%)

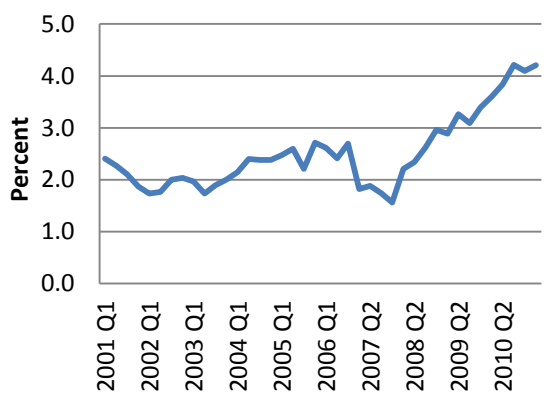


(f) Inactivity of Non STEM Graduates, South East (%)

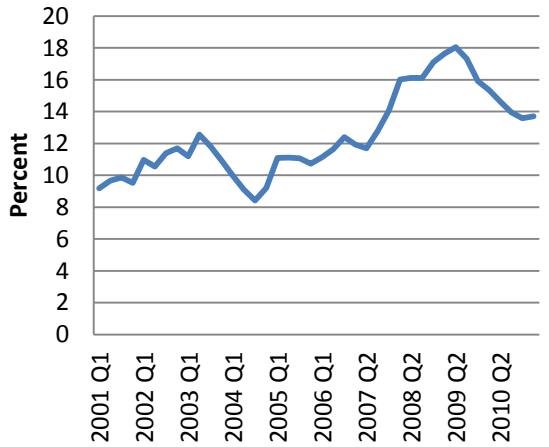


(g) Employment of Non STEM Graduates, East of England (%)

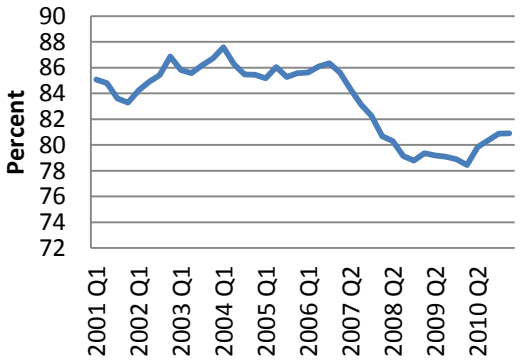
(h) Unemployment of Non STEM Graduates, East of England (%)



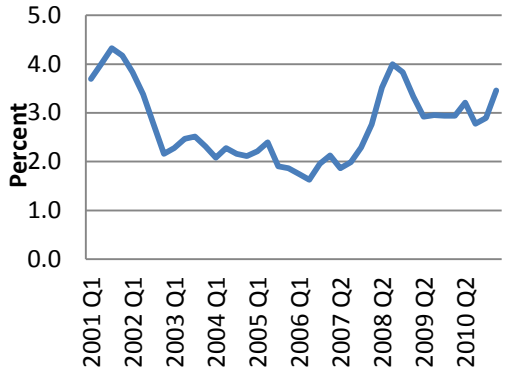
(i) Inactivity of Non STEM Graduates, East of England (%)



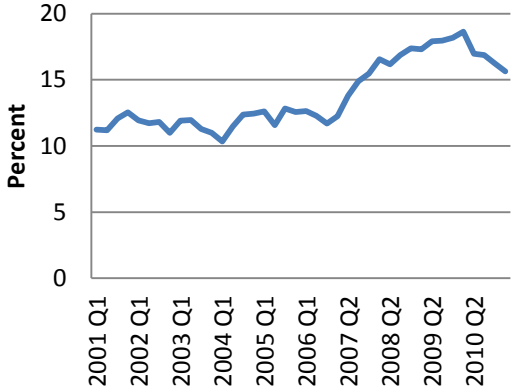
(j) Employment of Non STEM Graduates, South West (%)



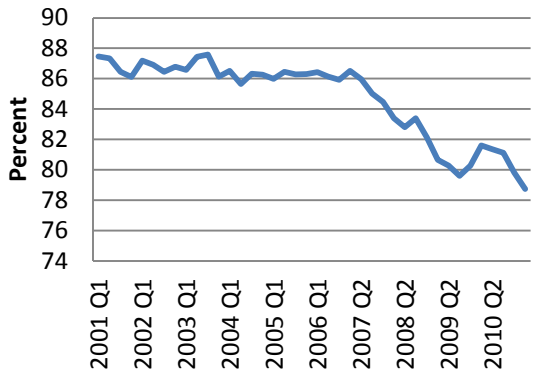
(k) Unemployment of Non STEM Graduates, South West (%)



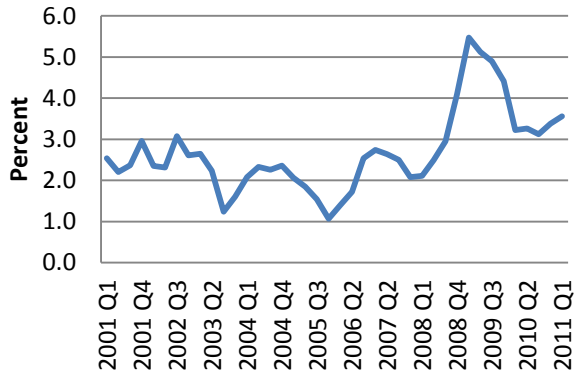
(l) Inactivity of Non STEM Graduates, South West (%)



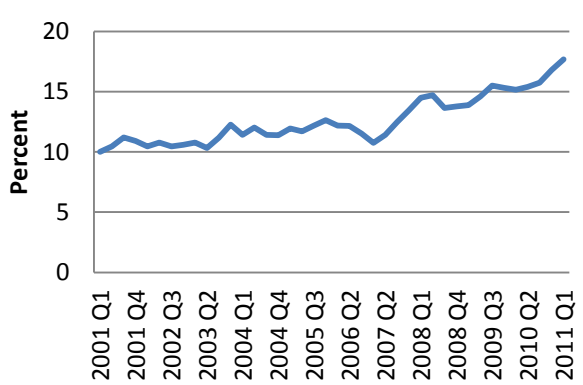
(m) Employment of Non STEM Graduates, West Midlands (%)



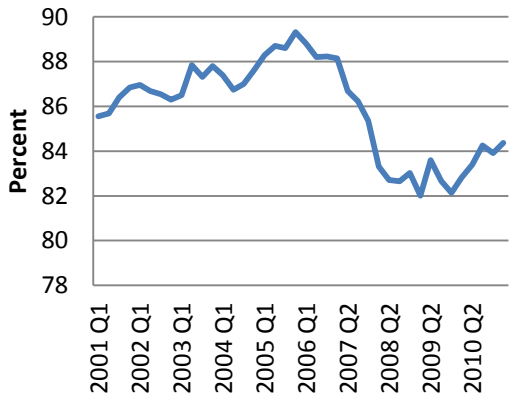
(n) Unemployment of Non STEM Graduates, West Midlands (%)



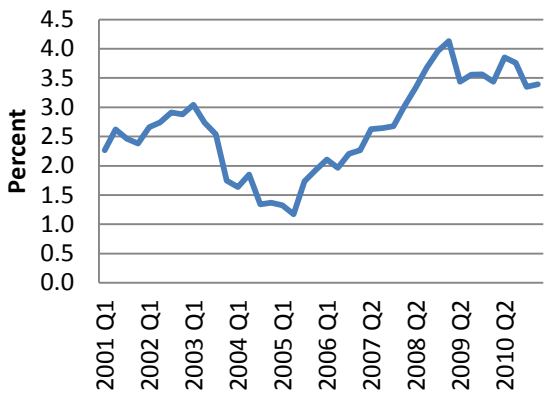
(o) Inactivity of Non STEM Graduates, West Midlands (%)



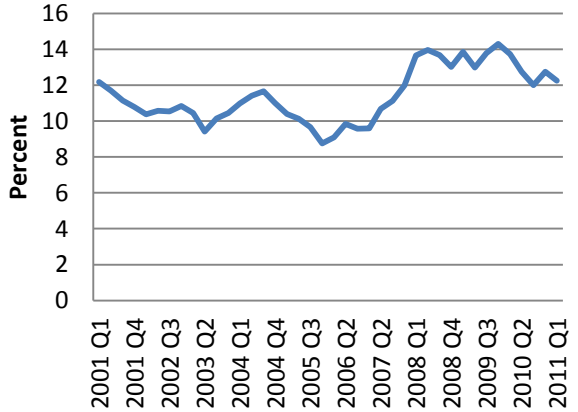
(p) Employment of Non STEM Graduates, East Midlands (%)



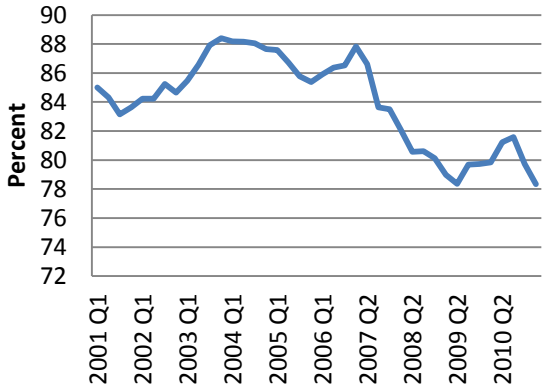
(q) Unemployment of Non STEM Graduates, East Midlands (%)



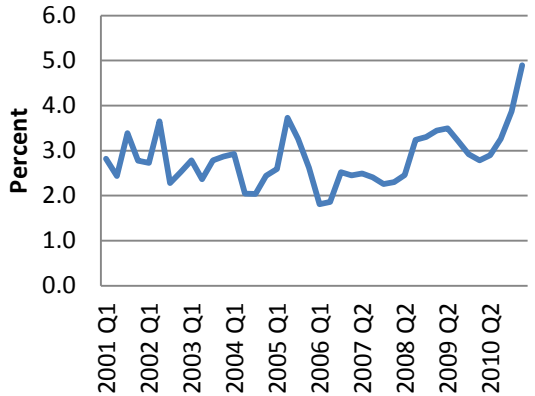
(r) Inactivity of Non STEM Graduates, East Midlands (%)



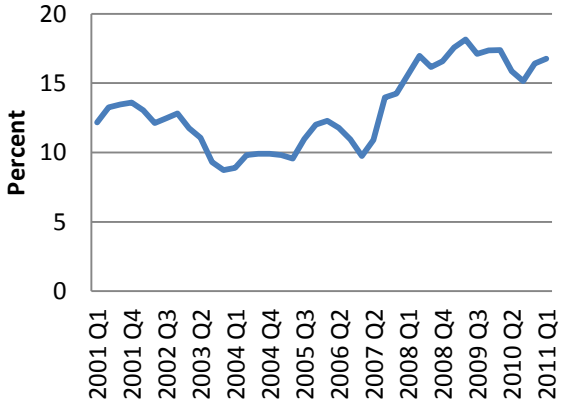
(s) Employment of Non STEM Graduates, Yorkshire and the Humber (%)



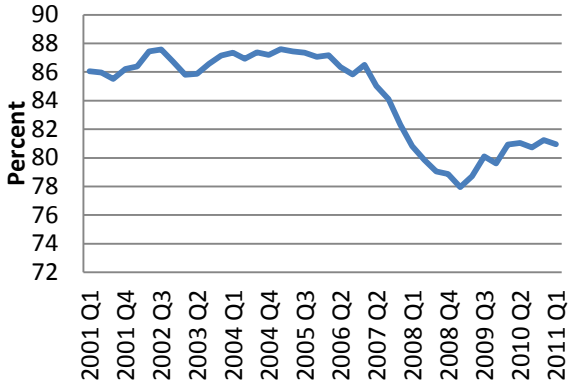
(t) Unemployment of Non STEM Graduates, Yorkshire and the Humber (%)



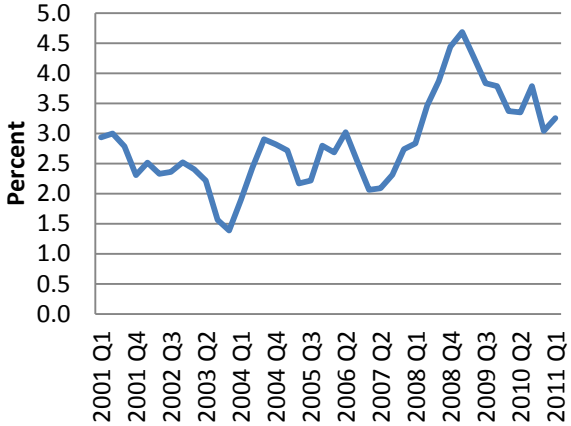
(u) Inactivity of Non STEM Graduates, Yorkshire and the Humber (%)



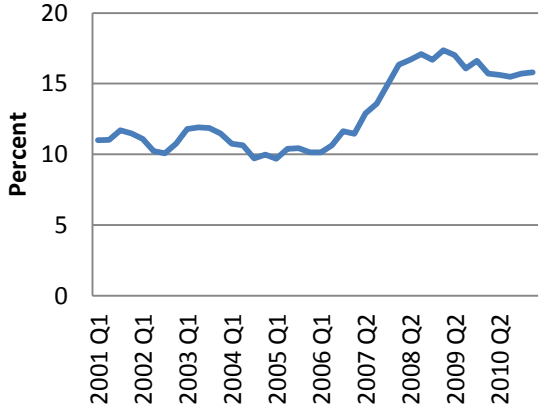
(v) Employment of Non STEM Graduates, North West (%)

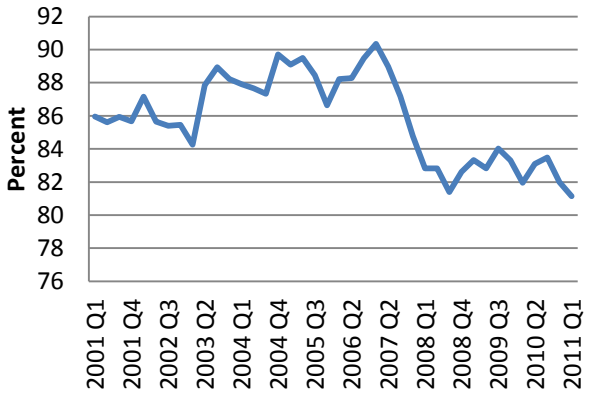
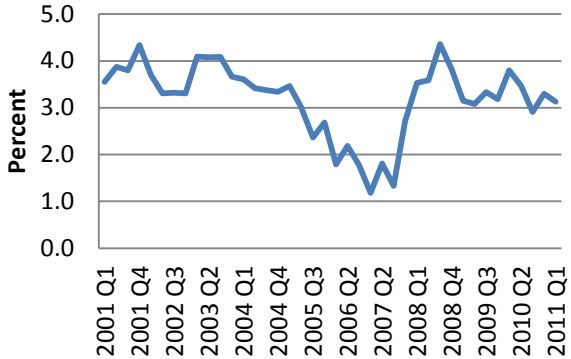
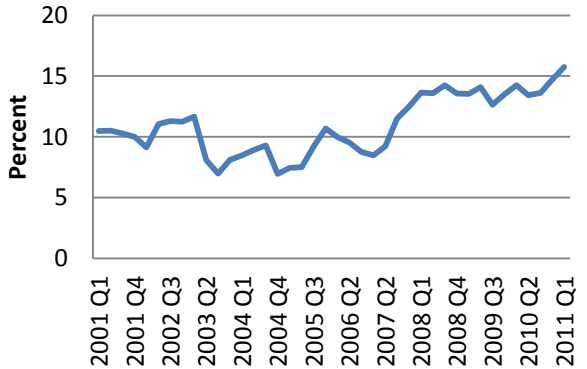


(w) Unemployment of Non STEM Graduates, North West (%)



(x) Inactivity of Non STEM Graduates, North West (%)



(y) Employment of Non STEM Graduates, North East (%)	(z) Unemployment of Non STEM Graduates, North East (%)	(aa) Inactivity of Non STEM Graduates, North East (%)
		

3.2 Commuting and Labour Supply

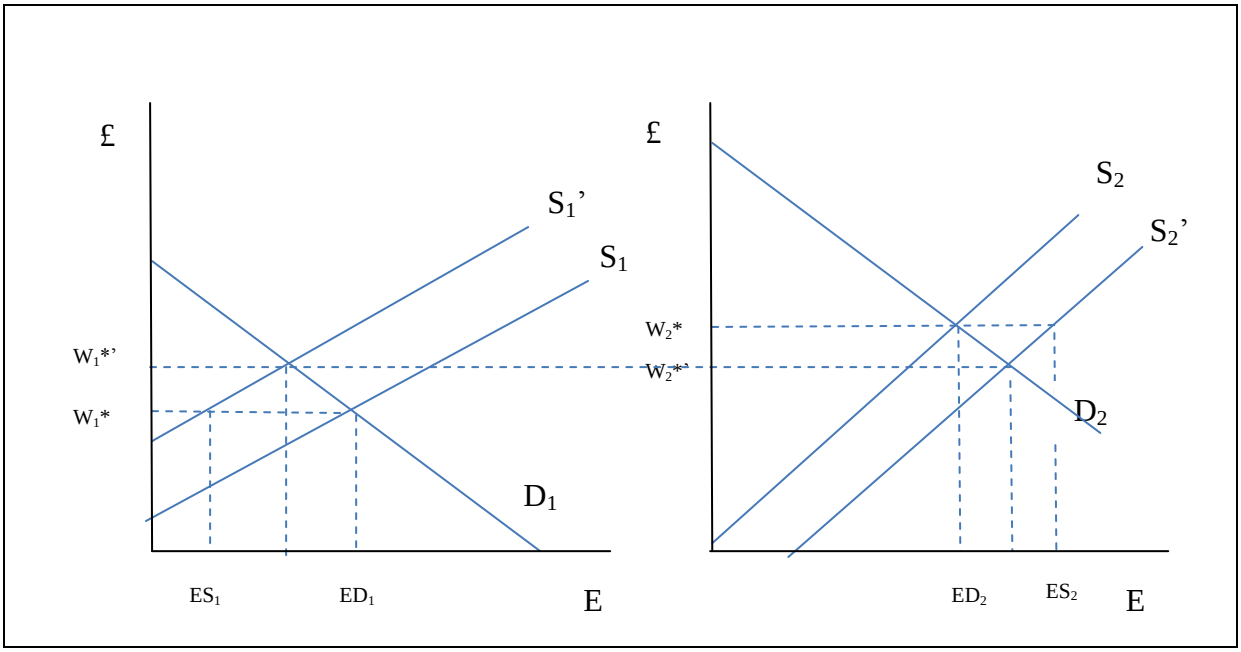
3.2.1 Implications of mobility: conceptual issues

It is important to have an understanding as to what supply and demand mean at the national and regional levels because individuals, particularly more qualified individuals, are mobile and can migrate across national and regional boundaries. Thus, while for many employers, the location of their jobs is relatively regionally fixed, this is more rarely the case in terms of labour supply. The implication of this is that each employer will have a larger labour supply than those available within the region, but, at the same time, each employer will be competing for that larger labour supply with employers from other regions.

Take a simple, two region case (regions 1 and 2): (i) supply to region 1 can be denoted S_1 plus $\alpha_{21}S_2$ where α_{21} is the proportion of region 2's supply willing to move to region 1 in each period; (ii) likewise, supply to region 2 can be denoted S_2 plus $\alpha_{12}S_1$ where α_{12} is the proportion of region 1's supply willing to move to region 2 in each period. As a consequence, only employers in region 1 compete over $(1-\alpha_{12})S_1$ and only employers in region 2 compete over $(1-\alpha_{21})S_2$, while both sets of employers compete over $\alpha_{12}S_1+\alpha_{21}S_2$.

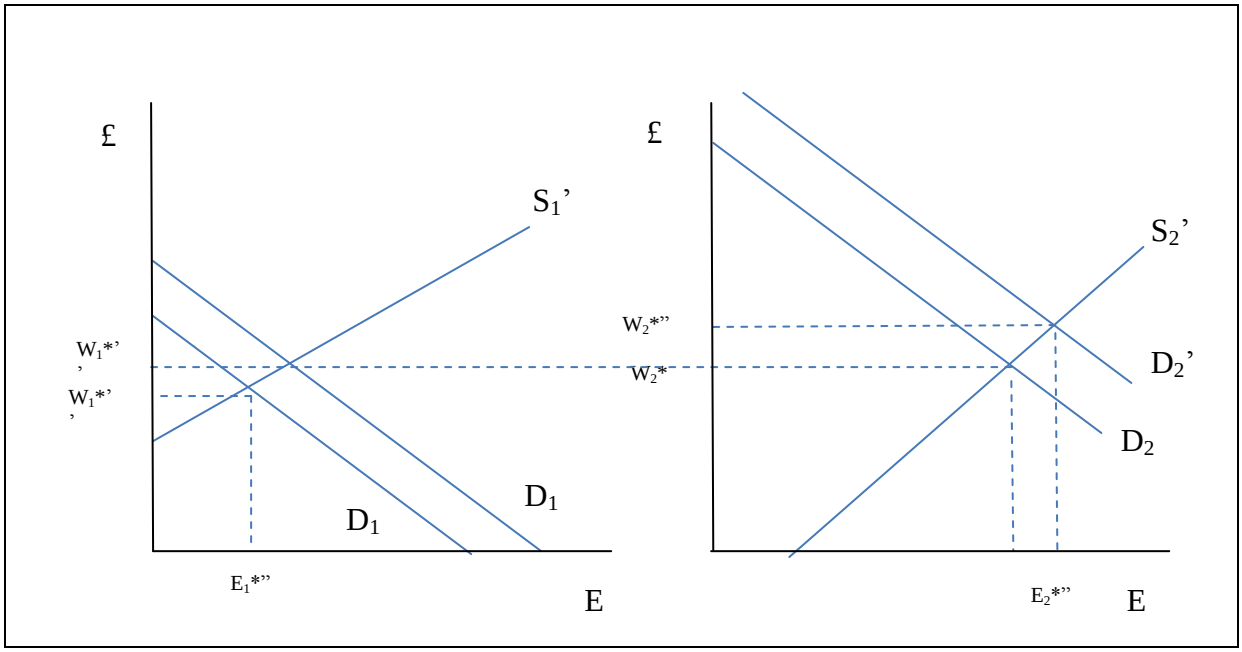
Figure 6 shows the traditional market outcome, where there are two regions: one with a high wage market equilibrium, $S_2=D_2$, with a wage w_2^*; the other with a low wage equilibrium, $S_1=D_1$, with a wage w_1^*. In this case, employers in region 2 can out-compete those in region 1 and $\alpha_{12}S_1$ individuals will flow from region 1 to 2 at a rate of $\alpha_{12}S_1$ per year. Thus, in each year, other things equal, S_1 shifts inwards and S_2 shifts outwards, wages fall in region 2 and rise in region 1. This continues until $S_1'=D_1$ and $S_2'=D_2^{*'}$, at wages $w_1^{*'}=w_2^{*'}$. Region 1 is characterised by skill shortages during the transition and region 2 by skill surpluses. This can be illustrated by looking at what would have happened if all the adjustment had taken place in a single period, which would have given rise to an initial shortage of ED_1-ES_1 in region 1 and surplus of ES_2-ED_2 in region 2.

Figure 6 Effects of migration on STEM markets, standard neoclassical model



However, in the case of STEM supply and demand in the two regions, there is also the issue of what impact the increasing level of employment of STEM in region 2 has on the demand for STEM and what effect the falling level of STEM has on the demand in region 1. If larger numbers of STEM increase the range and quality of products produced and, thereby, general productivity and growth, then this will further increase the demand for STEM. This is illustrated by the outward shift in the demand curve, period by period in the second half of Figure 7, and is associated with a higher wage (w_2*"> w_2*'). In contrast, if the loss of STEM to region 1 results in a loss of competitiveness and a stagnation in demand, the demand for STEM is likely to fall, shown by the shift from D1 to D1' in the first half of Figure 7. This sets up the ability of region 2 to grow continuously, creating new demand for STEM and region 1 to decline continuously, always with net migration into to the dominant region.

Figure 7 Effects of migration on STEM markets with endogenous growth



3.2.2 Population projections, international and internal migration

National and regional population projections have to take into account international and internal migration associated with the relocation of individuals as they move into the labour market or change jobs. Both of these are extremely difficult to "forecast", so ONS make it very clear that their projections are estimates based upon past trends. The pure demographics (births, aging and deaths) also have to be estimated.

ONS (2012) produce population projections by region that are consistent with the 2010 national projections; these are shown in Table 6. It is estimated that, for England as a whole, the overall population will grow from approximately 53 million to just under 58 million, with London growing the fastest over the 10 year period (14.2 per cent), followed by East England (10.2 per cent) and the South East (9.3 per cent). However, with the exception of London, the growth in the population of working age looks very different – while it grows by 12.1 per cent over the ten year period in London, the growth in East England is down to 4.2 per cent and in the South East to 3.5 per cent. Projected growth in the North East and North West for 16-64 year olds is negative. The strength of the demographic effects can be seen by the stronger growth of the 0-15 year old group and, in particular, by the very strong growth in the 65 and older group.

Table 6 Population change in regions by age group, 2011 to 2021

	Population (thousands)		Percentage population change by age group			
	mid-2011	mid-2021	All ages	0-15	16-64	65 and over
North East	2,596	2,724	4.9	7.9	-0.7	22.7
North West	7,056	7,364	4.4	9.0	-1.1	20.3
Yorkshire and The Humber	5,288	5,657	7.0	9.3	2.4	22.2
East Midlands	4,537	4,928	8.6	11.7	2.8	27.2
West Midlands	5,609	5,989	6.8	10.3	1.8	21.3
East England	5,862	6,458	10.2	14.9	4.2	26.6
London	8,204	9,371	14.2	19.0	12.1	18.7
South East	8,653	9,453	9.3	12.8	3.5	26.5
South West	5,301	5,743	8.3	12.9	1.8	25.3
England	53,107	57,688	8.6	12.6	3.7	23.6

Source: ONS (2012). Statistical bulletin: Interim 2011-based subnational population projections for England. Office of National Statistics. http://www.ons.gov.uk/ons/dcp171778_279964.pdf. Accessed October 2013. p.5.

The roles of international and internal migration are provided in Table 7. The totals correspond with those in the previous table and relate to all individuals (not 16-64 year olds). For England as a whole, demographic factors are projected to be more important than overall migration (5.2 per cent compared with 3.4 per cent). However, the relative importance varies considerably by region, for example, net inward migration in the South West exceeds the growth attributable to the difference between births and deaths, while, in London, overall migration is very low compared with the other demographics. However, London is a very special case, where internal outflows from the region nearly off-set the international inflows (9.2 per cent projected outflow and 10.9 per cent inflow).

Table 7 Percentage population growth between mid-2011 and mid-2021

		Due to:		Of which:	
	Total	Difference between births & deaths	Migration and other changes	Internal migration	International migration
North East	4.9	2.3	2.6	-0.1	2.7
North West	4.4	3.8	0.6	-0.3	0.9
Yorkshire and Humberside	7.0	4.2	2.8	-0.1	2.9
East Midlands	8.6	3.7	5.0	1.9	3.1
West Midlands	6.8	4.9	1.9	-1.0	3.0
East England	10.2	4.4	5.8	3.7	2.0
London	14.2	12.4	1.7	-9.2	10.9
South East	9.3	4.3	5.0	2.9	2.1
South West	8.3	2.4	6.0	5.3	0.7
England	8.6	5.2	3.4	0.0	3.4

Source: ONS (2102). Statistical bulletin: Interim 2011-based subnational population projections for England. Office of National Statistics. http://www.ons.gov.uk/ons/dcp171778_279964.pdf. Accessed October 2013. p.6.

Note: Figures may not sum due to constraining methods and rounding. Cross-border migration is included with international migration.

3.2.3 Commuting

Based upon LFS data on travel to work times, the ONS (2011, p. 4) reports that "… working full-time rather than part-time, and working in a high-skill (manager and professionals) rather than low-skill (elementary) occupations are associated with long commutes to work"[3]. Consistent with this is the fact that wages and earnings are higher for those travelling longer, particularly those who commute to London (see Table 8).

Table 8 Median hourly earnings by travel time, London and Rest of the UK, October-December, 2009, United Kingdom

	£	
	London	Rest of UK
1-15 min	10	8
16-30 min	13	10
31-45 min	17	12
46-60 min	16	12
60+ min	19	14

Source: ONS (2011, p. 4).

The LFS offers some further insights about commuting because it contains both the region of residence and the region in which the individual works.

Tables 9 to 11 illustrate the commuting activities of Med STEM, Core STEM and non STEM graduates, respectively in 2011. The row for each region or nation illustrates the share of the employed group that works in the region. For instance, Table 9 shows that 89 per cent of Med STEM graduates living in London also work in London. The columns for each nation represent the share of each other region's graduates that work in the region. For instance, the row for London in Table 9 indicates that 6.9 per cent of the South East's Med STEM work force and 12.4 per cent of East of England's worked in London in 2011.

[3] Source: ONS (2011). Commuting to Work, 2011. Office of National Statistics. http://www.ons.gov.uk/ons/dcp171776_227904.pdf. Accessed October 2013. p. 4.

Tables 9 to 11 show that a higher proportion of London's residents are likely to work in London than the residents of the South East, East of England or East Midlands are to work in their home regions. For example, 89 per cent of Core STEM graduates living in London work in London compared to 80 per cent, 82 per cent and 83 per cent for the South East, East of England and East Midlands, respectively). At the same time, while some of the South East's residents are commuting into London (16 per cent of those Core STEM graduates living in the South East), some of the individuals that live in London are commuting out to the South East (6.4 per cent of those living in London). As the South East has a larger population than London, the flows in terms of numbers of individuals from the South East into London will significantly exceed the flows from London to the South East

Tables 9 to 11 (and corresponding matrices for all NQF4&5 graduates and non graduates) were used to estimate net flows among the nations and regions for 2020. In order to construct a matrix for 2020, matrices were constructed for the years 2002-2011 using LFS data for the STEM groups. Cells for a 2020 matrix were constructed using the forecast function in Excel on the historical data. These matrices were used with forecasted population data to estimate future net commutes. See Table 12 for the 2020 matrix for Core STEM degree holders.

Table 9 Geographical Distribution of the Employers for Each Region's Residents, 2011 (Med STEM)

	Place of Work													
	London	South East	East of England	South West	West Midlands	East Midlands	Yorkshire & Humber	North West	North East	Wales	Scotland	Northern Ireland	England	Total
London	89.01	5.79	4.17	0.00	0.00	0.70	0.00	0.00	0.00	0.00	0.33	0.00	99.67	100
South East	6.88	89.61	1.27	1.09	0.00	0.27	0.00	0.44	0.00	0.00	0.45	0.00	99.55	100
East of England	12.44	2.30	85.01	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	99.75	100
South West	0.00	2.01	0.00	97.04	0.65	0.00	0.00	0.00	0.00	0.30	0.00	0.00	99.70	100
West Midlands	0.00	0.81	0.47	1.47	94.65	1.38	0.00	1.23	0.00	0.00	0.00	0.00	100.00	100
East Midlands	0.76	1.00	1.82	0.98	0.53	90.81	2.55	0.47	0.00	0.00	1.08	0.00	98.92	100
Yorkshire and Humber	0.00	0.00	0.00	0.00	0.00	2.14	94.75	1.01	2.10	0.00	0.00	0.00	100.00	100
North West	0.35	0.24	0.00	0.00	1.26	0.24	0.57	97.34	0.00	0.00	0.00	0.00	100.00	100
North East	0.00	0.00	0.00	0.00	1.02	0.00	3.22	1.88	93.88	0.00	0.00	0.00	100.00	100
Wales	0.00	0.47	0.00	1.16	1.05	0.00	0.00	1.76	0.00	95.57	0.00	0.00	4.43	100
Scotland	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	98.97	0.00	1.03	100
Northern Ireland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00	100
England	16.05	16.25	9.23	12.27	9.27	7.74	10.32	13.61	4.99	0.06	0.21	0.00	99.73	100

Table 10 Geographical Distribution of the Employers for Each Region's Residents, 2011 (Core STEM)

	Place of Work													
	London	South East	East of England	South West	West Midlands	East Midlands	Yorkshire and Humber	North West	North East	Wales	Scotland	Northern Ireland	England	Total
London	89.22	6.42	2.86	0.29	0.00	0.00	0.00	0.00	0.00	0.29	0.92	0.00	98.78	100
South East	15.84	80.54	1.46	0.95	0.41	0.42	0.10	0.12	0.00	0.16	0.00	0.00	99.84	100
East of England	14.77	2.33	81.86	0.34	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100
South West	0.73	4.01	0.14	93.69	0.37	0.40	0.00	0.00	0.00	0.46	0.19	0.00	99.34	100
West Midlands	0.78	0.74	0.34	2.03	89.96	2.62	0.00	2.00	0.00	1.15	0.37	0.00	98.48	100
East Midlands	1.94	1.89	1.97	1.08	3.74	82.63	3.96	2.62	0.00	0.17	0.00	0.00	99.83	100
Yorkshire and Humber	1.28	0.45	0.00	0.00	0.70	2.00	93.09	2.09	0.39	0.00	0.00	0.00	100.00	100
North West	0.56	0.21	0.15	0.26	1.30	0.61	1.16	93.73	0.00	1.80	0.23	0.00	97.97	100
North East	0.00	0.00	0.00	0.00	0.71	0.00	4.60	0.49	93.17	0.00	1.03	0.00	98.97	100
Wales	0.22	0.56	0.00	4.28	1.98	0.00	0.00	1.81	0.00	91.15	0.00	0.00	8.85	100
Scotland	0.00	0.36	0.12	0.32	0.00	0.00	0.32	0.29	0.00	0.16	98.42	0.00	1.42	100
Northern Ireland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	99.61	0.00	100
England	22.51	19.00	9.70	10.13	8.04	7.06	8.12	10.98	3.73	0.44	0.29	0.00	99.26	100

Table 11 Geographical Distribution of the Employers for Each Region's Residents, 2011 (Non STEM) Non STEM

	Place of Work													
	London	South East	East of England	South West	West Midlands	East Midlands	Yorkshire and Humber	North West	North East	Wales	Scotland	Northern Ireland	England	Total
London	93.25	2.59	1.98	0.45	0.24	0.28	0.13	0.27	0.21	0.10	0.50	0.00	99.41	100
South East	14.16	82.66	1.23	0.47	0.33	0.63	0.21	0.08	0.00	0.07	0.16	0.00	99.77	100
East of England	18.74	3.17	76.21	0.24	0.00	1.14	0.00	0.24	0.27	0.00	0.00	0.00	100.00	100
South West	1.51	2.75	0.24	93.24	0.72	0.00	0.00	0.16	0.00	1.28	0.10	0.00	98.63	100
West Midlands	0.58	0.61	0.17	1.42	92.74	2.07	0.30	1.67	0.00	0.45	0.00	0.00	99.55	100
East Midlands	1.27	2.43	2.50	0.13	3.31	85.57	3.13	1.66	0.00	0.00	0.00	0.00	100.00	100
Yorkshire and Humber	0.67	0.39	0.11	0.18	0.18	1.20	95.63	0.74	0.91	0.00	0.00	0.00	100.00	100
North West	0.41	0.33	0.33	0.09	1.29	0.10	0.95	96.20	0.00	0.19	0.12	0.00	99.69	100
North East	0.64	0.00	0.00	0.00	0.00	0.48	2.50	0.00	96.16	0.21	0.00	0.00	99.79	100
Wales	0.00	0.35	0.00	2.41	1.98	0.00	0.00	3.30	0.00	91.96	0.00	0.00	8.04	100
Scotland	0.54	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.10	98.82	0.00	1.08	100
Northern Ireland	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.51	0.49	100
England	27.91	15.43	8.47	8.93	7.88	7.13	8.45	11.54	3.86	0.22	0.17	0.00	99.61	100

Table 12 Commuting patterns, core STEM, 2020 (proportion of the resident individuals working in own-region and other regions)

		Place of work												
		LO	SE	EE	SW	WM	EM	YH	NW	NE	WA	SC	NI	
Place of residence	LO	89.57	4.69	3.37	0.84	0.15	0.05	0.31	0.10	0.04	0.04	0.85	0.00	100.00
	SE	17.53	78.38	0.78	0.88	0.50	1.03	0.45	0.07	0.03	0.25	0.09	0.00	100.00
	EE	16.51	1.69	79.24	0.82	0.22	1.19	0.04	0.16	0.00	0.00	0.15	0.00	100.00
	SW	0.22	2.96	0.17	93.48	0.79	0.40	0.03	0.16	0.00	1.31	0.47	0.00	100.00
	WM	1.25	1.12	0.47	2.47	88.48	2.43	0.01	1.56	0.00	1.56	0.64	0.00	100.00
	EM	0.93	0.92	2.48	1.41	2.29	82.64	3.72	5.29	0.00	0.17	0.14	0.00	100.00
	YH	1.91	0.39	0.00	0.00	0.00	0.23	95.09	2.22	0.00	0.00	0.15	0.00	100.00
	NW	0.09	0.15	0.04	0.64	0.38	0.72	1.38	93.03	0.12	2.88	0.57	0.00	100.00
	NE	0.33	0.00	0.00	0.23	0.20	0.00	4.51	0.00	94.48	0.00	0.24	0.00	100.00
	WA	1.31	0.05	0.00	1.06	0.58	0.00	0.18	1.42	0.00	95.40	0.00	0.00	100.00
	SC	0.67	0.19	0.19	0.11	0.00	0.00	0.31	0.26	0.34	0.53	97.40	0.00	100.00
	NI	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	99.71	100.00

4 Supply and Demand

The future supply of STEM graduates is estimated from the projected NQF4&5 population obtained in modelling done for the UK Commission in 2013. This population is allocated to core STEM, med STEM and non STEM based on the share of the graduate population that is forecasted to have a STE M degree. This share is around a third and has remained constant for the 11 years for which LFS data was examined (2001-2011). This estimate of a third was obtained using LFS data on the number of people with degrees by subject. The number of people with a single degree in a STEM subject is summed. Out of the population of people reporting a single degree in any subject, nearly a third reported a degree in a core STEM subject. However, due to non responses, the total number of people listed as having a degree in a specific subject (e.g. core STEM, non STEM and med STEM) does not sum up the total NQF4&5 population. Thus, the total NQF4&5 population is allocated into core STEM, med STEM and non STEM in the same ratios as the population that specified a specific degree. The total NQF4&5 population includes people with dual degrees, which are allocated in the same ratio as those with single degrees. Although data exists on those with dual degrees and the specialisation, this data was not used as the population is small compared to those with single degrees and therefore not as reliable.

4.1 Regression Estimates of Vacancy Densities

There are a range of historical measures of skill needs and skill shortages, mainly collected as a part of the NESS / ESS exercises. Vacancy rates, for example, are constructed as the ratio of vacancies to employment and are an indicator of demand-side imbalance – the extent to which firms wish to expand their workforce. The extent to which vacancy rates translate into problems for employers depends, in part, on the speed with which such vacancies can be filled with sufficiently skilled individuals.[4] But overall demand is employment plus vacancies.

[4] Thus, a more telling measure is that of hard-to-fill vacancies, with higher hard-to-fill vacancy ratios a clearer indicator of demand-side imbalance than higher total vacancy ratios.

Official estimates of vacancy rates, from the ONS Vacancy Survey, are only available by sector. However, the NESS / ESS surveys carried out by the UKCES contain both occupation and sector information, but no direct information about vacancies for STEM and non-STEM degree holders. While many factors may affect vacancy rates, such as economic performance and growth, these lie outside of the scope of the present study. In the present context, the question arises whether there is some form of relationship between STEM densities and vacancy rates.

The occupational labour market data are brought together at the regional level. Occupational data are more likely to identify any relationship between STEM densities and vacancy ratios than sectoral data, as the distribution of STEM across sectors is much more diffuse. NESS 2007, for example, has three digit occupational information about vacancies and skill shortages for the nine planning regions of England (the other nation states are not covered). This gives 81 occupations for each of the nine planning regions of England, with a potential total sample of 729. The corresponding 2011 data also provide data for Scotland, Wales and Northern Ireland.

The results for 2007-11 are set out in Table . The column headings indicate whether the results are based on ordinary least squares regressions (OLS) or logit analysis (Logit). OLS(1) gives the results of regressing the vacancy ratio (the number of vacancies per employee in the occupation and region) on the STEM densities and on a set of regional dummies. The comparator (omitted) group for the three degree subject areas and non-graduates is Core STEM and the comparator group for the regions is London. No restrictions are placed on the sample in OLS(1); it uses all available occupations and regions.

Table 13 Linear and logit vacancy rate regression results, Core STEM, 2007 and 2011

	OLS (1)		OLS(2)		Logit(1)	
	2007	**2011**	**2007**	**2011**	**2007**	**2011**
Constant	6.113 **	4.987 **	6.596 **	5.579 **	2.994 **	3.008 **
MedSTEMDen	-.067 **	-.016	-.073 **	-.023	-.022 **	-.008 *
NonSTEMDen	-.034	-.013	-.057 *	-.030 *	-.013 *	-.008 **
NonGradDen	-.023	-.004	-.027	-.007	-.005	-.002
South East	-1.623 ‡	-.786	-1.505	-.797	-.602 **	-.226
East of England	-1.519 ‡	1.299	-1.463	1.460 ‡	-.684 **	.104
South West	-1.353	-1.087	-1.586	-1.436 ‡	-.807 **	-.521 **
West Midlands	-.211	-1.720 *	.268	-2.060 *	-.879 **	-.691 **
East Midlands	4.534 **	4.871 **	4.411 **	3.893 **	.828 **	.549 *
Yorkshire and Humber	-.292	-.683	.143	-.607	.033	-.207
North West	-1.246	-.581	-1.338	-1.358	-.384 *	-.341 ‡
North East	-2.069 *	-2.055 *	-1.848	-1.728 ‡	-.731 **	-.712 **
Wales		-.903	6.596 **	-1.087		-.524 **
Scotland		-.454		-.366		-.450 *
Northern Ireland		.324		.131		-.402 ‡
$\bar{R}^2$	0.108	0.076	0.075	0.073	0.208	0.087
F	9.998 **	7.263 **	4.722 **	4.991 **	12.605 **	5.604 **

Note: base groups are Core STEM and London

Taken at face value, the results in OLS(1) suggest that the higher the proportion of individuals with Medicine and related, non-STEM degrees and non-graduates in the occupation, the lower the vacancy ratio (relative to the base group of Core STEM). However, of the qualification related variables, only the Medicine and related STEM density coefficient in 2007 is significantly different from zero and the overall explanatory power of the equation is low for both years, although the F statistics are significant at the one per cent level. The coefficients for 2007 are significantly larger in absolute size than those for 2011, suggesting that the recession may have washed out some of the differences between the Core STEM and the other groups (as suggested by the interview responses).

However, taking the whole sample tends to bias the result for each of the three subject areas to different extents. It will particularly bias downwards the result for Medicine and related degree holders as these are concentrated in the fewest occupations and vacancies for them will not appear in the vast majority of occupations. The second group most affected is the Core STEM – while this group is more diffuse across occupations than Medicine and related degree holders, they are less diffuse than non-STEM and even less diffuse than non-degree holders.

The effects of restricting the sample to occupations with positive numbers of core STEM degree holders are shown in the OLS(2) column. The effects of restricting the occupations on the results are not major, but they do increase the difference between the three qualification groups shown and the Core STEM outcome in both years. All three qualification coefficients are negative in both years, with the non-STEM density coefficient now significantly different from zero at the five per cent level in both years. However, the overall explanatory power of the equation remains low, although the F statistics are again significantly different from zero at the one per cent level. It should be borne in mind that this restriction still produces a downward bias for the Medicine and related group.

A logit specification for the dependent variable has the advantage that it controls the vacancy value to always lie between 0 and 100. This specification significantly improves the estimated outcomes, particularly in 2007. The negative signs on the three qualification variables still indicate that the vacancy ratios are lower for all three than for the Core STEM base group. Both the coefficients on the Medicine and Related STEM and the non-STEM groups are significantly different from zero at the five per cent level or higher. While the non-graduate coefficient is always consistent with a lower vacancy rate than the Core STEM group, it still remains insignificantly different from zero in the logit regressions.

Again, focusing on the logit results, the coefficients on the regional dummy variables mainly demonstrate highly significant differences between all of the regions and London. Most of the regions have a lower vacancy ratio than London – the main exception being the East Midlands. As with the earlier findings, London appears to have a very distinct labour market, which is likely to act as a magnet to individuals in other areas of the UK and from abroad. An attempt was made to investigate whether the coefficients on the qualification variables themselves vary by region. This was carried out by including interaction terms between the qualification variables and the regional dummies. However, none of the coefficients on the interaction terms proved to be significantly different to zero at the 10 per cent level.[5]

The estimated coefficients in **Error! Reference source not found.** are used to estimate the vacancy rates (see Technical Report). As the coefficient for the Medicine and related group is almost certainly biased downwards, they are not reported separately, but subsumed in a non-STEM graduate group. The detailed results are reported in **Error! Reference source not found.** below. Again, the result is consistent with significantly higher Core STEM vacancy ratios, particularly in 2007, with the recession washing away some of the difference in 2011. The vacancy ratios are then applied to the projected levels of employment to estimate the numbers of vacancies by qualification type.

4.2 Hard to Fill Vacancies, Regression Results

One historical measure of imbalance is the hard-to-fill vacancy ratio (hard-to-fill vacancies per employee) from NESS/ESS. Again, similar to the overall vacancy ratio, this measure is not broken down by qualification group, but is available by occupation and sector. Hence, in a similar way to vacancies, the hard-to-fill vacancy ratio has been regressed on the qualification group densities. The regression coefficients are shown in Table 14 the Core STEM density is omitted as the base occupation and London as the base region).

[5] The inclusion of particular regions, such as just London, the South East and East of England produced just one significant coefficient at the South East non-graduate interaction term. So this might be an avenue of investigation in future work.

OLS(1) is again the unrestricted sample of all occupations across all regions. Bearing in mind that this sample choice biases downwards the estimated coefficients for Medicine and related and for Core STEM, the results are nevertheless poor, particularly in 2011. However, restricting the sample to those occupations that report employing Core STEM individuals (OLS(2)) shows significant negative signs on the three non-Core STEM qualification groups in 2007. While the coefficients remain negative in 2011, they are much smaller in absolute size and insignificantly different to zero. However, in the logit version, which is preferred on statistical grounds, all three of the qualification coefficients are significant in both 2007 and 2011.

Table 15 translates the regression coefficients into hard-to-fill vacancy rates. In 2007, the estimated UK hard-to-fill vacancy rate for Core STEM is 1.5 per cent, higher than the other two groups and the all-non-core group; non-graduates had the lowest hard-to-fill vacancy rate (0.9 per cent). By 2011, all of the rates were well down on their 2007 values, but particularly Core STEM (0.4 compared to 1.5, a fall of 1.1 percentage points). By 2011, the UK hard-to-fill vacancy ratio for Core STEM is estimated to be slightly lower than all non-core (0.5 per cent) and well down on non-graduate (0.8 per cent). Of the four nation states, Scotland had the highest estimated Core STEM hard-to-fill vacancy rate in 2007 (2.2 per cent), but only the same value as England in 2011 (0.3 per cent).

Table 16 shows that London had the highest hard-to-fill vacancy ratio in 2007 and the equal highest in 2011, nevertheless, the reduction in the ratio during the recession was amongst the highest. The reductions in the hard-to-fill vacancy rate over the 2007 to 2011 period were smallest amongst the non-graduate group, with some regions estimated to have maintained or even marginally increased their hard-to-fill vacancies over this period.

Table 14 Linear and logit hard-to-fill vacancy regression results, Core STEM, 2007 and 2011

	OLS (1)				OLS(2)				Logit(1)			
	2007		2011		2007		2011		2007		2011	
Constant	1.621	**	.869		2.210	**	1.271	**	-3.578	**	-4.351	**
MedSTEMDen	-.016	*	-.004		-.022	**	-.007		-.028	**	-.012	**
NonSTEMDen	-.003		-.003		-.014	**	-.007		-.019	**	-.018	**
NonGradDen	-.006		.004		-.012	**	-.002		-.015	**	-.008	**
South East	-.446	‡	-.109		-.365	‡	-.050		-.585	**	.103	
East of England	-.516	*	.361		-.528	**	.419		-.532	*	.362	
South West	-.419	‡	-.369		-.481	*	-.393		-.566	**	-.254	
West Midlands	-.598	*	-.440		-.720	**	-.403		-.881	**	-.236	
East Midlands	1.216	**	1.490	**	.814	**	.435		.725	**	=.413	
Yorkshire and Humber	-.181		.236		-.179		.480		-.315		.159	
North West	-.612	**	.337		-.657	**	-.172		-.861	**	-.160	
North East	-.668	**	-.216		-.610	**	.073		-.776	**	-.019	
Wales			-.049				-.362				-.327	
Scotland			-.149				-.362				-.508	*
Northern Ireland			.144				.389				+.324	
$\bar{R}^2$	0.118		0.017		0.141		0.018		0.172		0.069	
F	9.815	**	2.315	**	8.8542	**	6.574	**	8.967	**	4.262	**

Note: base groups are Core STEM and London; significance levels are ** one per cent, * five per cent and ‡ 10 per cent.

Table 15 Estimated Hard-to-Fill Vacancy Ratios, Regression Results

		LO	SE	EE	SW	WM	EM	YH	NW	NE	EN	WA	SC	NI	UK
2007	Non Grad	1.5	1.5	1.4	1.4	1.1	1.3	1.3	1.2	1.3	0.7	1.0	1.6	0.7	0.9
	Core STEM	1.2	1.2	1.0	1.1	0.8	0.9	1.0	0.9	1.0	1.3	1.6	2.2	1.3	1.5
	Non STEM	0.9	0.9	0.8	0.9	0.6	0.7	0.7	0.6	0.7	1.0	1.3	1.9	1.0	1.2
	All Non-Core	0.9	0.9	0.7	0.8	0.5	0.6	0.7	0.5	0.7	0.7	1.0	1.5	0.6	0.9
	Overall	1.0	1.0	0.8	0.9	0.6	0.7	0.7	0.6	0.7	0.8	1.1	1.6	0.7	0.9
2011	Non Grad	0.4	0.4	0.4	0.3	0.3	0.2	0.5	0.3	0.2	0.7	1.0	0.7	1.2	0.8
	Core STEM	0.1	0.1	0.1	0.0	0.0	-0.1	0.2	0.0	-0.1	0.3	0.6	0.3	0.8	0.4
	Non STEM	0.8	0.8	0.8	0.7	0.7	0.6	0.8	0.7	0.6	0.0	0.3	0.0	0.5	0.1
	All Non-Core	0.4	0.6	0.6	0.5	0.5	0.4	0.7	0.5	0.4	0.5	0.8	0.5	1.0	0.5
	Overall	0.4	0.6	0.6	0.5	0.5	0.4	0.6	0.5	0.4	0.5	0.8	0.5	1.0	0.5
Difference 2011 - 2007	Non Grad	-1.1	-1.1	-1.0	-1.1	-0.8	-1.0	-0.8	-0.9	-1.1	0.0	0.0	-0.9	0.5	-0.1
	Core STEM	-1.1	-1.1	-1.0	-1.1	-0.8	-1.0	-0.8	-0.9	-1.1	-1.0	-1.0	-1.8	-0.5	-1.1
	Non STEM	-0.1	-0.1	0.0	-0.1	0.1	0.0	0.2	0.1	-0.1	-1.0	-1.0	-1.8	-0.5	-1.1
	All Non-Core	-0.5	-0.3	-0.1	-0.3	0.0	-0.2	0.0	-0.1	-0.3	-0.2	-0.2	-1.1	0.3	-0.3
	Overall	-0.6	-0.4	-0.2	-0.4	-0.1	-0.3	-0.1	-0.1	-0.3	-0.3	-0.3	-1.2	0.3	-0.4

Note: data for 2007 are not available outside of England, but interpolated values (in one case an extrapolated value) have been constructed from earlier national skills reports for Wales, Scotland and Northern Ireland (see Technical Report).

Table 16 Estimated vacancy ratios by STEM Group, 2007 and 2011 from Regression

		LO	SE	EE	SW	WM	EM	YH	NW	NE	EN	WA	SC	NI	UK
2007	Non Grad	3.5	3.4	3.0	2.9	2.8	2.5	2.6	2.8	2.6	3.0	3.3	3.5	2.2	3.0
	Core STEM	5.8	5.6	5.2	5.2	5.1	4.8	4.9	5.1	4.9	5.3	5.6	5.8	4.5	5.3
	Non STEM	2.4	2.3	1.9	1.8	1.7	1.4	1.5	1.7	1.5	1.9	2.2	2.4	1.1	1.9
	All non-Core	2.9	2.9	2.5	2.4	2.4	2.1	2.2	2.3	2.1	2.5	2.8	2.9	1.7	2.5
	Overall	3.3	3.2	2.8	2.7	2.6	2.3	2.4	2.6	2.3	2.8	3.1	3.2	1.9	2.8
2011	Non Grad	2.7	3.1	3.1	2.3	2.1	2.4	2.1	2.2	2.2	2.5	2.4	2.1	2.7	2.5
	Core STEM	3.1	3.5	3.6	2.7	2.5	2.8	2.5	2.6	2.6	2.9	2.8	2.5	3.1	2.9
	Non STEM	1.8	2.2	2.3	1.4	1.2	1.5	1.2	1.3	1.3	1.6	1.5	1.3	1.8	1.6
	All Non Core	2.3	2.8	2.9	2.0	1.8	2.1	1.8	1.9	1.9	2.2	2.1	1.8	2.4	2.2
	Overall	2.4	2.9	3.0	2.1	1.9	2.2	1.9	2.0	2.0	2.3	2.2	1.9	2.5	2.3
Difference 2011 - 2007	Non Grad	-0.8	-0.3	0.1	-0.6	-0.7	-0.1	-0.5	-0.6	-0.4	-0.5	-0.9	-1.4	0.5	-0.5
	Core STEM	-2.7	-2.1	-1.6	-2.5	-2.6	-2	-2.4	-2.5	-2.3	-2.4	-2.8	-3.3	-1.4	-2.4
	Non STEM	-0.6	-0.1	0.4	-0.4	-0.5	0.1	-0.3	-0.4	-0.2	-0.3	-0.7	-1.1	0.7	-0.3
	All Non Core	-0.6	-0.1	0.4	-0.4	-0.6	0	-0.4	-0.4	-0.2	-0.3	-0.7	-1.1	0.7	-0.3
	Overall	-0.9	-0.3	0.2	-0.6	-0.7	-0.1	-0.5	-0.6	-0.3	-0.5	-0.9	-1.3	0.6	-0.5

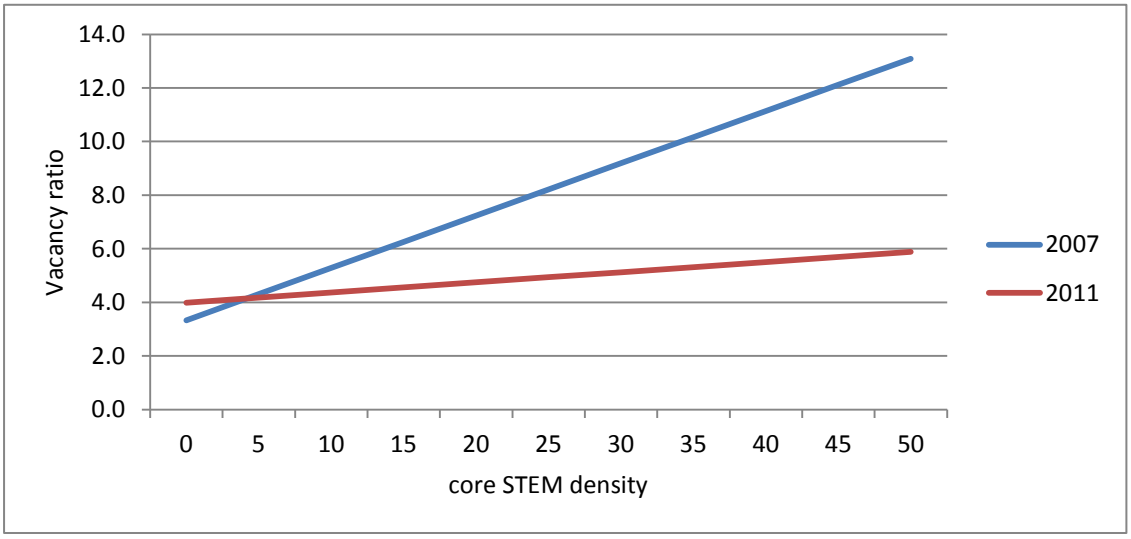
Source: Regression Results Final.xls

Note: data for 2007 are not available outside of England, but interpolated values (in one case an extrapolated value) have been constructed from earlier national skills reports for Wales, Scotland and Northern Ireland (see Technical Report).

There are not only differences between the four qualification groups, but also across regions and time. London has the highest Core STEM vacancy ratio of any area in 2007, but has a slightly lower ratio than the South East and East of England in 2011. The percentage point falls in the vacancy ratio of Core STEM between 2007 and 2011 appear to exceed those of any other qualification group, consistent with the easing of any market shortages during the recession.

The change from 2007 to 2011 can be illustrated by fitting a line relating the estimated vacancy ratio to the Core STEM densities across regions and nation states. The results are shown in Figure 8. The effect of the recession is to both shift the relationship downwards and to make it less steeply sloped. At the lower bound of the various inclusion criteria (15 per cent core STEM density), the vacancy rate is 6.3 per cent in 2007 and 3.1 per cent in 2011; at the middle bound (25 per cent) it is 8.2 and 3.8 per cent respectively; while at the highest boundary (50 per cent) it is 13.1 and 7.5 per cent respectively.

Figure 8 Recession and the Vacancy Ratio/Core STEM Density Relationship



Evidence Reports present detailed findings of the research produced by the UK Commission for Employment and Skills. The reports contribute to the accumulation of knowledge and intelligence on skills and employment issues through the review of existing evidence or through primary research.

All of the outputs of the UK Commission can be accessed on our website at www.ukces.org.uk

UKCES
Renaissance House
Adwick Park
Wath-upon-Dearne
Rotherham
S63 5NB
T +44 (0)1709 774 800
F +44 (0)1709 774 801

UKCES
Sanctuary Buildings
Great Smith St.
Westminster
London
SW1P 3BT
T +44 (0)20 7227 7800

Authors: Derek Bosworth, Clare Lyonette, Rob Wilson - Institute for Employment Research, University of Warwick
UKCES Simon Fathers, Marc Bayliss - UK Commission for Employment and Skills

This document is available at
www.ukces.org.uk
under "Publications"

ISBN 978-1-908418-57-9

Intelligence › Investment › Impact