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Clusters, human capital and economic development in Oxfordshire and Cambridgeshire

by

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Abstract

Oxfordshire and Cambridgeshire are two of the most high tech economies in the UK (see for example DTI, 2002 and Garnsey and Lawton Smith, 1998). They are home to world class research universities and public and private research laboratories as well as a full range of business and professional services which support the development of their clusters. Building on previous work (Lawton Smith and Waters, 2011) this paper draws on national datasets to review the continued development of these economies. The paper considers issues such as new firm formation, sectoral composition and gross value added and relates them to social inclusion and worklessness. The paper draws on literature which emphasises the endogeneity of processes within regions, but also on studies which show that there are different kinds of high tech regions with varying industrial structures. Conclusions are drawn on the extent to which the presence of successful clusters (Spencer et al, 2010) influences outcomes for the local economy more generally, and how Oxfordshire and Cambridgeshire have performed over the last ten years.

Keywords: high tech economies, Oxfordshire and Cambridgeshire, employment, social inclusion
JEL classification: O30, O15, R11

1. Introduction

The theme of this paper is why clusters of high tech firms might be expected to create social and economic inequalities within regions and the counter arguments as to why they might not. It has been extensively argued that the superior economic performance of high tech economies is associated not only with skilled-based technological change in clusters of innovative firms (Porter 1990, 1998, 2000, Spencer et al 2010) but also with the rate of growth. Indeed Spencer et al (2010) find on the basis of Canadian data, that, when industries locate in an urban region with a critical mass of related industries, they tend to generate both higher incomes and rates of employment growth.

Here we focus on why it be might be the case that equity is linked with endogenous growth within high tech economies, using the Spencer et al (2010) framework as a basis for analysis. We are particularly interested in variations in equality within high tech regions, for example between the city and its surrounding areas. We consider how these relate to economic issues such as new firm formation, unemployment, industrial structures, skill profiles, sectoral composition, employment in the public sector and gross value added to social inclusion. Oxfordshire and Cambridgeshire, two of the most important knowledge economies in the UK, are used as exemplars to discuss why even what might appear to be similar economies show different patterns of inter and intra-regional inequalities. We should note that, although the two locations are characterised by clusters of high tech activity, those are insufficient in themselves for these economies to outstrip performance in the rest of the UK.

The analysis also draws on previous research on the two economies dating back to the 1980s (Lawton Smith 1990, Garnsey and Lawton Smith 1998, Waters and Lawton Smith 2008, Waters 2010), and from statistical data from official sources.The paper examines how patterns change over time and highlights problems associated with time frames of analysis. We argue that labour markets are the key to understanding what is happening and provide the link between various conceptualizations of growth in knowledge economies.

The paper first discusses explanations of growth in clusters, particularly in university city-regions such as Oxford and Cambridge. It then relates these to high tech industries and inequality using evidence from the two counties. Finally some conclusions are drawn.

2. High tech regions, clusters, inequality and issues of growth

Explanations of why some regions become high tech or knowledge-based have been explored from a variety of perspectives. Here we examine particular features of concentrations of high level knowledge, entrepreneurship and clustering, and economic growth; explaining why a focus on labour markets provides the link between them. We

review the main strands of literature which inform the interpretation of the data from Oxfordshire and Cambridgeshire. These include the knowledge spillover theory of entrepreneurship, clusters and path dependence.

(i) High tech clusters and economic performance

The knowledge spillover theory of entrepreneurship (Audretsch and Keilbach 2005) relates economic performance to higher investments in new knowledge such as in university cities, where related entrepreneurs exploit the intellectual property of local institutions. The explanations relate to rates of entrepreneurial activity based on new knowledge as a source of opportunity in different contexts, comparing high knowledge contexts with impoverished knowledge contexts, arguing that high knowledge contexts generate more entrepreneurial opportunities. Entrepreneurship is an endogenous response to opportunities provided by investments in new knowledge. Their l*ocalisation hypothesis* is that knowledge spillover entrepreneurship will tend to be located within close geographic proximity to the source of knowledge e.g. universities. This gives the *Entrepreneurial performance hypothesis*: that the performance of knowledge-based start-ups should be superior when they are able to access knowledge spillovers through proximity to knowledge sources such as universities. Finally, they propose a g*rowth hypothesis*:that for a given level of knowledge investment and severity of the knowledge filter, higher levels of economic growth should result from greater entrepreneurial activity. Evidence which goes some way to supporting these ideas was provided by a study in the US by Lendel (2010) who finds that the presence of research universities in metropolitan regions helps ameliorate effects of recessions.

Breschi and Lissoni (2001, 978) earlier proposed a social capital explanation which highlights the importance of the labour market in the importance of proximity to sources of new knowledge. They suggest that 'innovators' spatial proximity, when found to be significant, may not depend on any intrinsic feature of knowledge, such as its degree of 'tacitness' but on a much more complex interplay between the economics of knowledge commodification, the labour market for scientists and technologists, and the innovators' appropriation strategy.'

A three stage process for successful regions (Feldman and Francis 2006) goes from latent activity, to high levels of entrepreneurship to fully grown entrepreneurial systems which have a supportive infrastructure. In such locations, new industries emerge and grow, and clusters evolve, renew and enter new growth phases (Trippl and Todtling 2008). These ideas are linked conceptually to path dependency theory. Path dependence is a function of two inter-related and reinforcing processes: positive feedback represented by increasing returns to scale, and lock-in economic agents remaining within particular paths of accumulation (Clark et al 2002). On growth Boschma (2007) summarising Arthur (1989, 1994) distinguishes the (1) spin-off model, where the region grows firm-by-firm through spin-off dynamics and (2) the agglomeration-model – whereby the more start-ups enter a region, the stronger the growth. As Boschma points out, citing Martin and Sunley (2006) 'path dependence should not only produce space (industries creating space), but places also impact on path dependence processes (making it a place-dependent process).' There

is also place specific knowledge embodied in particular customs and practices (Clark et al 2002). A possible further, fourth stage in Feldman and Francis' (2006) process is that where regions cease to grow and a once supportive environment fails to adapt to new local and wider conditions, and its firms do not enter new growth phases.

Returning to the theme of growth, the argument that clusters contribute to regional economic development has been explored in detail by Spencer et al (2010) using extensive sets of data from Canada. They defined a cluster as: specialisation in employment in an industry that is not geographically ubiquitous; co-location between specialised industry and other related industries; scale or critical mass (absolute total employment); specialisation in employment relative to the nation; and scope or breadth across the range of industries comprising the cluster. They found that when industries locate in an urban region with a critical mass of related industries, then they tend to generate both higher incomes and rates of employment growth. The overall prevalence of clustering within a city region is positively related with income levels and employment growth, unemployment tends to be lower. Places with multiple clusters tend to perform better. They also found some variations by types of cluster, particularly manufacturing including biomedical and ICT, with those sectors performing better.

Top clusters or 'islands of innovation' (Hilpert 1992, 2010) are centres of science-based innovation which receive a high share of public R&D expenditures. In these places there is a co-existence of scientific and industrial expertise and flows of expertise in and out of regions. More recently Hilpert has characterised such regions in the US as old industrial regions, leading high tech islands of innovation, diversified islands of innovation, post-industrial agglomerations, global islands of innovation and Silicon Valley (Hilpert 2011). For each he examined relative balance of manufacturing and service activities. He found that Silicon Valley had double the amount of manufacturing and contribution to GDP compared with even global islands of innovation and diversified islands of innovation. This shows that manufacturing is a dominant feature in that economy's success, and this might be an explanatory factor of why other islands of innovation vary individually in their growth trajectories.

An important question is whether there is a limit to growth in high tech economies or does the principle of increasing returns (Romer 1997) apply because of the supply of new knowledge from the R&D base (firms, universities and research institutions)? In other words, it would be expected that innovation would be embedded in the system and so attrition where firms fall out of the system (cease trading, depart to other locations or through merger or acquisition) would be replaced by new ones in different markets. However, even if there is evidence that some high regions go through a downturn, is this evidence that they will become 'old industrial agglomerations' at worst or post-industrial agglomerations at best – a possible Feldman and Francis (2006) stage four scenario?

(ii) High tech economies and inequality

Recent studies have begun to explore the link between high tech economies and inequality using such indicators as unemployment, job vacancies, housing costs, and

wage levels. Pastor and Benner (2008) studied 326 metro areas in U.S. 1990-2000. They compared 'strong market' and 'weak market' regions found that inequality was negatively correlated with growth: city/suburb poverty; poverty concentration; income distribution, black-white segregation. They found that equitable regions are better positioned for economic growth. They therefore argued that equity must be included within economic strategy.

Benner (2011) in a development of the 2008 study listed key measures of growth as: a change in earnings and employment and equity as the change in percent below poverty and 80/20 household income ratio. Measures of a diversified economy were: public sector employment, construction. He identified that manufacturing size as a proportion of employment was negatively correlated with a diversified economy. He found strong regional government/governance as a factor in the amelioration of inequalities in Jacksonville, Nashville City/County Mergers and Kansas City MARC. A significant finding was that small portions of poorly educated population are better predictor of 'just growth' i.e. more equitable growth than high portions of highly educated population. This is consistent with Markusen and Shrock (2003)'s argument that metropolitan occupational profiles are a possible way of assessing growth potential. Further support for that argument is the finding in a study in Germany that regional wage differentials are partly attributable to localised human capital externalities (technological and pecuniary externalities). It is education that, 'influences the degree to which workers of different education levels substitute for each other in the face of local supply shocks' (Heurmann 2011, 141), and the effect is particularly pronounced in manufacturing rather than in service sectors.

Human capital has also been highlighted as being the key factor in whether a region is entrepreneurial and innovative. Fritsch and Schindele (2011) argue that a high education level of the regional workforce and the wide availability of labour are positively related to the contribution of new businesses to regional employment. Rodríguez-Pose and Comptour (2011), in discussing whether clusters generate greater innovation and growth, identify three basic explanatory variables or filters. These are the R&D filter, the 'social filter', and the clusterisation filter. The social filter refers to attributes of the population and workforce as reflecting socio-economic conditions that make a region innovation prone or innovation averse. The attributes include (i) local labour market rigidities including long term unemployment, (ii) demographic aspects, (iii) education, skills, and human capital, and (iv) the scientific base of the region. Having a good level of education, a strong endowment of skills or a workforce with high tech skills is crucial to generating and absorbing innovation, but as a way of promoting greater economic growth.

Benner (2011) finds that the main policy implication of the findings on inequalities is that there is a need to build 'diverse epistemic communities' which will bring together resources to address problems of growth and inequality. These are 'like-minded networks of professionals whose authoritative claim to consensual knowledge provides them with unique source of power in decision-making processes.' Processes of interaction (interpretation, knowledge generation, action) can be institutionalized when there is a

need for repeated interactions over extended periods of time. Hence the resilience as well as the growth of clusters has to be understood in relation to the state and policy at several spatial levels (Hassink 2010).

In sum all of these approaches are linked by the thread of human capital. This takes the form of people who exploit knowledge - the entrepreneurs (Audretsch and Keilbach 2005) and people who invest in knowledge, acquire, absorb and use knowledge - their absorptive capacity (Cohen and Levinthal 1990). This ability is in turn linked to education levels (Heuermann 2011). Collectively, human capital is an outcome of the interaction of people who create knowledge externalities within their local economies (Breschi and Lissoni 2001, Heuermann 2011), and who are attracted to particular places. Moreover, skill profiles are a way of assessing growth potential (Markusen and Shrock 2003).

We next pick up on these themes in the interpretation of the data from Oxfordshire and Cambridgeshire.

3. High technology in Oxfordshire and Cambridgeshire

The study

This study replicates part of the methodology from Spencer et al (2010) in order to examine the link between clusters and regional economic performance. It uses only some of the indicators in that study. This is because not all of the information on the UK is currently available from official statistics or from local sources. Here we have used Office of National Statistics (ONS)[1] data together with data drawn from previous studies in the two counties.

Earlier studies have shown that high technology clusters in Oxfordshire and Cambridgeshire are well established (see for example Lawton Smith, 1990, Lawton Smith & Garnsey, 1998 Keeble et al 1999, Waters 2010 and Lawton Smith and Waters, 2011). Table 1 shows the distribution of firms, employment and national ranking of high technology industry in both counties.

[1]http://www.statistics.gov.uk/default.asp

Table 1 High Technology in Oxfordshire and Cambridgeshire, 2007

	Firms			Employment		
	No	%	Rank	No	%	Rank
Cambridgeshire	**3,700**	**13.6**	**3**	**37,300**	**13.6**	**1**
Cambridge	900	15.6	15	11,600	13.7	30
East Cambridgeshire	400	11.3	104	1,800	7.5	137
Fenland	300	7.5	308	1,100	3.4	350
Huntingdonshire	1,000	13.0	58	6,700	9.4	89
South Cambridgeshire	1,200	16.7	8	16,100	26.0	3
	-			-		
Oxfordshire	**3,900**	**12.3**	**6**	**35,500**	**11.2**	**5**
Cherwell	**700**	11.1	111	**6,100**	9.0	101
Oxford	**600**	11.1	112	**8,100**	7.9	124
South Oxfordshire	**1,000**	13.5	44	**5,600**	10.4	60
Vale of White Horse	**800**	14.8	23	**11,400**	21.1	7
West Oxfordshire	**600**	10.9	122	**4,400**	11.4	48
	-			-		
East	**27,100**	**11.2**	**2**	**194,100**	**8.2**	**2**
South East	**48,400**	**12.5**	**1**	**392,300**	**10.6**	**1**
Great Britain	**243,200**	**10.2**	**-**	**1,984,700**	**7.5**	**-**

Source: ABI, ONS, 2008

Both counties are examples of global islands of innovation (Hilpert 2011) but have different economic structures. Traditionally Oxfordshire has had a higher level of manufacturing (in high-tech and traditional industries such as motor manufacture) and as a consequence has had larger firms such as Oxford Instruments. Cambridge reputedly has had a more service orientated economy and smaller firms (Garnsey and Lawton Smith 2008).

For this study, further clusters in the case study areas, including computer manufacture, computer programming and publishing activities, have been identified by applying the first stage of Spencer *et al*'s (2010) methodology at the 2 digit level of the UK's 2007 Standard Industrial Classification (SIC) using data from the Business Register and Employment Survey compiled by the UK's Office for National Statistics (ONS). The full list of sectors with a local quotient greater than one in fewer than 40 per cent of Great Britain's 206 upper tier local authorities is presented in Table 2 for Oxfordshire and Cambridgeshire.

Scientific research and development is the sector with the highest location quotient in both case studies and the counties rank 10th and 2nd respectively in Great Britain behind Bracknell Forest in the Thames Valley. When location quotients (LQs) are applied to Glasson *et al*'s definition of high technology, Cambridgeshire and Oxfordshire rank 12th and 22nd respectively among Great Britain's 212 upper tier authorities, while the cities of Cambridge and Oxford rank 3rd and 6th respectively (see Table 1).

Cambridgeshire has a higher LQ for manufacture of computer, electronic and optical

products than Oxfordshire, but Oxfordshire has a higher density of 'other manufacturing' but less in pharmaceuticals and leather. Oxfordshire's strong presence in motor vehicle manufacturing (the BMW Mini plant at Cowley in Oxford) is shown. Taking all of the manufacturing together, the distribution of manufacturing activity differs between the counties, with each specialising in different sectors. Overall, however, unexpectedly Cambridgeshire has more employment (+2000) in manufacturing than Oxfordshire. Oxfordshire has a strong cluster in publishing, with three times as much employment in that sector than Cambridgeshire.

As well as hosting these clusters, firms in Oxfordshire and Cambridgeshire can be expected to be concerned with the most knowledge intensive aspects of these industries. Cambridgeshire has the 4th highest proportion of residents employed in managerial, professional and technical occupations at 52.2%, with Oxfordshire ranking 5th at 51.3%, compared to 44.0% across Great Britain. For professionals alone Cambridgeshire and Oxfordshire rank 1st and 2nd respectively.

Clustering is identified in 59 of the 85 2 digit sectors in the SIC codes across Great Britain and in 17 of those are in Oxfordshire and 21 are in Cambridgeshire, with 11 being common to both. In Oxfordshire there are 65,500 people working in clusters, representing 19.9 per cent of total employment, compared to 76,500 (26.9 per cent) in Cambridgeshire. In Great Britain, over 11 million are employed in clusters, representing 39.9 per cent of all employment.

Oxfordshire and Cambridgeshire are therefore less clustered than the UK as a whole, but both clusters are very strong in sectors such as scientific research and development (particularly in Cambridge), much of it on the public sector. Manufacturing of computer, electronic and optical products is significantly over-represented, while the same is true in Oxfordshire for publishing. However, since education (2007 SIC 85) is spread comparatively evenly across the country and so does not represent a cluster in this analysis, but accounts for 12.1 per cent of all employment in Cambridge and 14.3 per cent in Oxfordshire, and similarly strong showings are recorded for human health activities (2007 SIC 86), accounting for some of the missing employment in clusters.

Table 2: Clusters Identified in Oxfordshire and Cambridgeshire by 2 digit SIC code, 2009

	Oxfordshire		Cambridgeshire	
	LQ	Employment	LQ	Employment
18 : Printing and reproduction of recorded media	1.2	1,800	1.1	1,500
26 : Manufacture of computer, electronic and optical products	2.0	2,900	3.4	4,300
32 : Other manufacturing	2.4	2,500	1.8	1,600
37 : Sewerage	1.5	300	1.4	300
58 : Publishing activities	3.3	6,200	1.2	2,000
62 : Computer programming, consultancy and related activities	1.3	7,400	1.7	8,400
71 : Architectural and engineering activities; technical testing and analysis	1.5	8,100	1.9	8,700
72 : Scientific research and development	3.8	5,300	8.9	10,700
74 : Other professional, scientific and technical activities	1.6	3,100	1.3	2,200
82 : Office administrative, office support and other business support activities	1.1	4,200	1.2	3,800
94 : Activities of membership organisations	1.0	2,600	1.1	2,400
08 : Other mining and quarrying	1.6	300	0.9	200
29 : Manufacture of motor vehicles, trailers and semi-trailers	2.3	3,800	0.4	500
63 : Information service activities	1.7	1,200	0.4	300
70 : Activities of head offices; management consultancy activities	1.8	11,600	0.8	4,400
73 : Advertising and market research	1.7	3,000	0.4	600
90 : Creative, arts and entertainment activities	1.1	1,200	1.0	900
17 : Manufacture of paper and paper products	0.4	300	2.1	1,200
23 : Manufacture of other non-metallic mineral products	0.5	500	1.5	1,400
27 : Manufacture of electrical equipment	0.8	700	1.4	1,100
30 : Manufacture of other transport equipment	0.2	200	1.3	1,800
36 : Water collection, treatment and supply	0.1	-	2.3	700
15 : Manufacture of leather and related products	0.0	-	2.8	200
21 : Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.5	200	2.7	1,000
31 : Manufacture of furniture	0.7	700	1.0	900
46 : Wholesale trade, except of motor vehicles and motorcycles	0.9	12,500	1.1	12,600
78 : Employment activities	0.8	7,100	1.2	8,800
Total Employment		**329,200**		**284,700**

Source: BRES, ONS, 2010

The implications of clustering are that "industries perform better on indicators of employment growth, income and unemployment when they are situated within a cluster" (Spencer *et al* 2010, 707), albeit with considerable variation by industry. Analysis of national data appear to demonstrate this link as it shows that Oxfordshire and Cambridgeshire's local economies are among the most productive and prosperous in Great Britain and Europe, exhibiting degree level attainment, remuneration and employment rates well above the national level, combined with lower unemployment and deprivation as shown in Table 3 below, where red indicates performance below and green performance above the national level.

At the county level, Oxfordshire and Cambridgeshire outperform the country as a whole on every selected indicator, with the exception of new firm formation in Cambridgeshire. Similarly, the districts perform well compared to the national level with the exception of Fenland in Cambridgeshire. These data present a picture of Oxfordshire and Cambridgeshire as prosperous and enterprising places with highly educated, economically active residents.

Table 3: Selected indicators

	Earnings				Educational Attainment				Enterprise		Employment			
	Workplace Annual Full Time Median (£), 2010	Rank (of 380)	Residence Annual Full Time Median (£), 2009	Rank (of 380)	Working Age Population Qualified to NVQ4+ (%), 2009 (NI165)	Rank (of 353)	Working Age Population With No Qualications (%), 2009	Rank (of 353)	New Business Registration Rate (per 10,000 residents), 2009	Rank (of 353)	Working Age Employment Rate (%), Year to Sept 2010	Rank (of 380)	Working Age Unemployment Rate (%), Year to sept 2010	Rank (of 380)
Cambridgeshire	**27,819**	**5 of 27**	**28,739**	**5 of 27**	**39.5**	**2 of 27**	**7.5**	**17 of 27**	**48.5**	**9 of 27**	**75.1**	**10 of 27**	**5.3**	**5 of 27**
Cambridge	28,544	56	30,609	57	63.4	2	4.2	329	42.6	181	74.3	130	2.1	2
East Cambridgeshire	24,135	186	28,123	99	32.3	148	5.0	314	51.0	109	82.2	3	4.2	41
Fenland	19,980	356	22,775	298	13.7	351	13.7	65	36.6	276	69.2	270	7.1	175
Huntingdonshire	25,903	124	29,072	83	35.1	108	8.9	193	49.9	114	73.8	147	7.4	191
South Cambridgeshire	32,068	24	32,380	34	40.8	51	6.8	258	58.3	66	77.5	59	5.3	85
Oxfordshire	**28,383**	**2 of 27**	**29,612**	**4 of 27**	**37.9**	**4 of 27**	**6.4**	**22 of 27**	**54.9**	**4 of 27**	**76.2**	**4 of 27**	**2.9**	**1 of 27**
Cherwell	27,378	81	29,993	64	26.1	238	7.8	232	58.3	65	79.5	25	4.5	47
Oxford	29,015	47	26,511	140	49.5	16	8.7	201	37.5	260	68.9	276	3.9	36
South Oxfordshire	26,270	110	31,507	42	34.8	113	4.3	328	67.3	37	78.8	32	1.8	1
Vale of White Horse	30,361	34	31,234	45	44.7	32	5.2	308	52.0	102	79.6	22	-	-
West Oxfordshire	25,272	142	30,380	60	29.3	195	4.4	325	64.2	46	77.6	54	-	-
England	26,250	-	26,268	-	32.0	-	10.8	-	49.6	-	70.5	-	7.8	-

Sources: ASHE, ONS, 2010, BIS, 2010, Business Demography, ONS, 2010, APS, ONS, 2011

When considered by lower tier local authority, Oxfordshire and Cambridgeshire are among the least deprived parts of England[2], with South Cambridgeshire, West Oxfordshire, Vale of White Horse and South Oxfordshire scoring well on all domains to rank among the 20 least deprived local authorities in England. Both Oxford City and Fenland are the most deprived local authority districts in the case studies ranking 216th and 233rd respectively.

In Oxfordshire, while South Oxfordshire, Vale of White Horse and West Oxfordshire have very low levels of deprivation with only one Super Output Area (SOA)[3] featuring in the national lowest quartile there are 8 such SOAs in Cherwell (of 91) and 17 in Oxford City (of 85). Similarly in Cambridgeshire, there are only 2 SOAs in the national lowest quartile in East Cambridgeshire, Huntingdonshire and South Cambridgeshire, but 10 (out of 54) in Fenland and 8 (out of 68) in Cambridge City. This means that within the counties there are steep variations in where poverty is located. In Oxfordshire, this problem is highest in the city of Oxford and in districts to the north of the city rather than in the wealthier districts where there are concentrations of the high technology activity shown in Table 1. A similar pattern is found in Cambridgeshire.

Furthermore, both display an industrial structure with strong representation in the sectors the Government's Plan for Growth (2011) identifies as being crucial in growing and rebalancing the UK economy. This is demonstrated in Figure 1 below. It shows that life

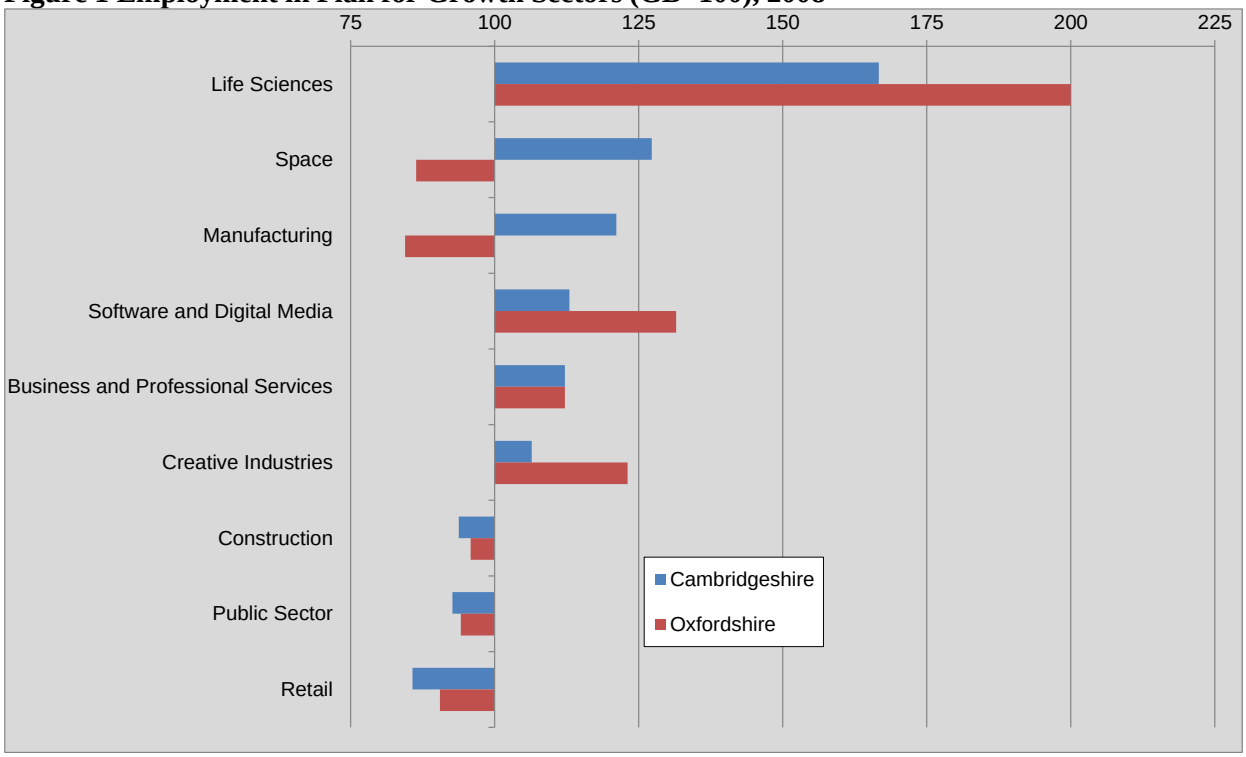
[2]Using the Indices of Multiple Deprivation, 2010, published by the UK Government's Department for Communities and Local Government in March 2011.

[3] SOAs are smaller than wards and are the smallest unit of analysis for deprivation

sciences, to the right of the national level line, is particularly over represented in both counties, especially so in Oxfordshire. Software and digital media, the creative industries and business and professional services are also performing well. The big surprises are that manufacturing is performing badly in Oxfordshire, compared to the national average and to Cambridge, as is the Space industry in spite of the concentration of expertise at the Rutherford Appleton Laboratory in the Vale of White Horse District, including the site of the National Space Centre.

Although the public sector is under-represented in both Oxfordshire and Cambridge, accounting for 19.2% of employment in Oxfordshire (27.2 per cent in Oxford City) and 18.9% in Cambridgeshire (22.2% in Cambridge City), this does not include higher education, which accounts for almost 1 in 5 jobs in Oxford and more in Cambridgeshire. Based on Lendel's (2010) analysis both cities should show economic resilience because the multiplier effects of their universities would mean that they are not exposed to the same level of vulnerability as places without such large institutions. The policy of reducing employment in public sector currently being pursued in the UK, can therefore be expected to have less impact in Oxfordshire and Cambridgeshire than in the county as a whole, reflecting Government's decisions on where to award Regional Growth Funds, as the public sector is comparatively small, but bolstered by very substantial education sectors that are not expected to see large reductions in employment.

Figure 1 Employment in Plan for Growth Sectors (GB=100), 2008

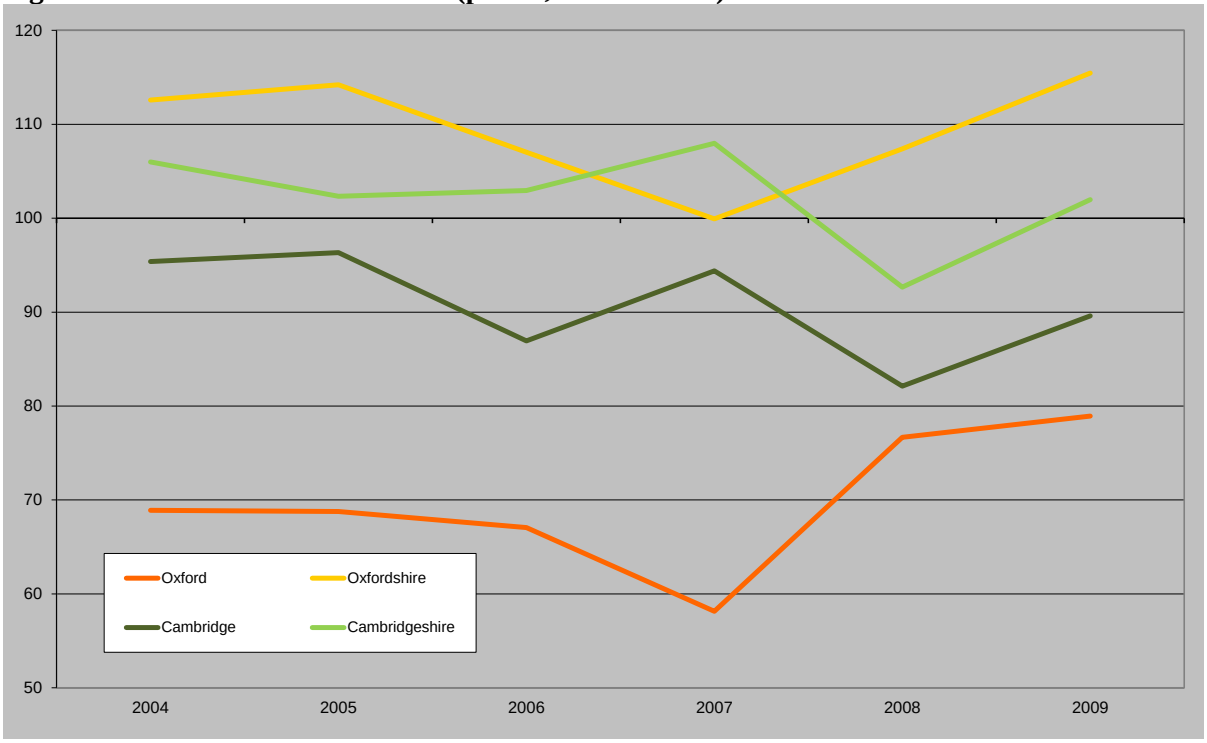


Source: ABI, ONS, 2009, BRES, ONS, 2010

Moreover, when change over time is considered, the performances of Oxfordshire and Cambridgeshire are closer to the national level. That is to say that although these local economies perform well in absolute terms, their advantages over the rest of the UK economy is being eroded.

The new firm formation rates for both counties are shown in Figure 2. This shows that both the counties and their cities have been on an upward trend since 2008. Oxford and Oxfordshire had suffered a dip in fortunes in 2008, Cambridge slightly before that. At county level Oxfordshire was outperforming Cambridgeshire in 2009 and with a higher rate than the peak in 2005. From 2009, only the counties of Oxfordshire and Cambridgeshire were above the national average, with Oxfordshire considerably outperforming Cambridgeshire. The city of Cambridge, however, had a higher new firm formation rate than the city of Oxford. This shows both inter- and intra-regional variations and also the importance of taking a longer term perspective than just a snap-shot. Moreover, the pattern for the years either side of 2007 are interesting and require further investigation – Oxfordshire and Cambridge, and Cambridgeshire and Oxford are mirror images.

Figure 2 New Firm Formation Rate (per 10,000 residents)

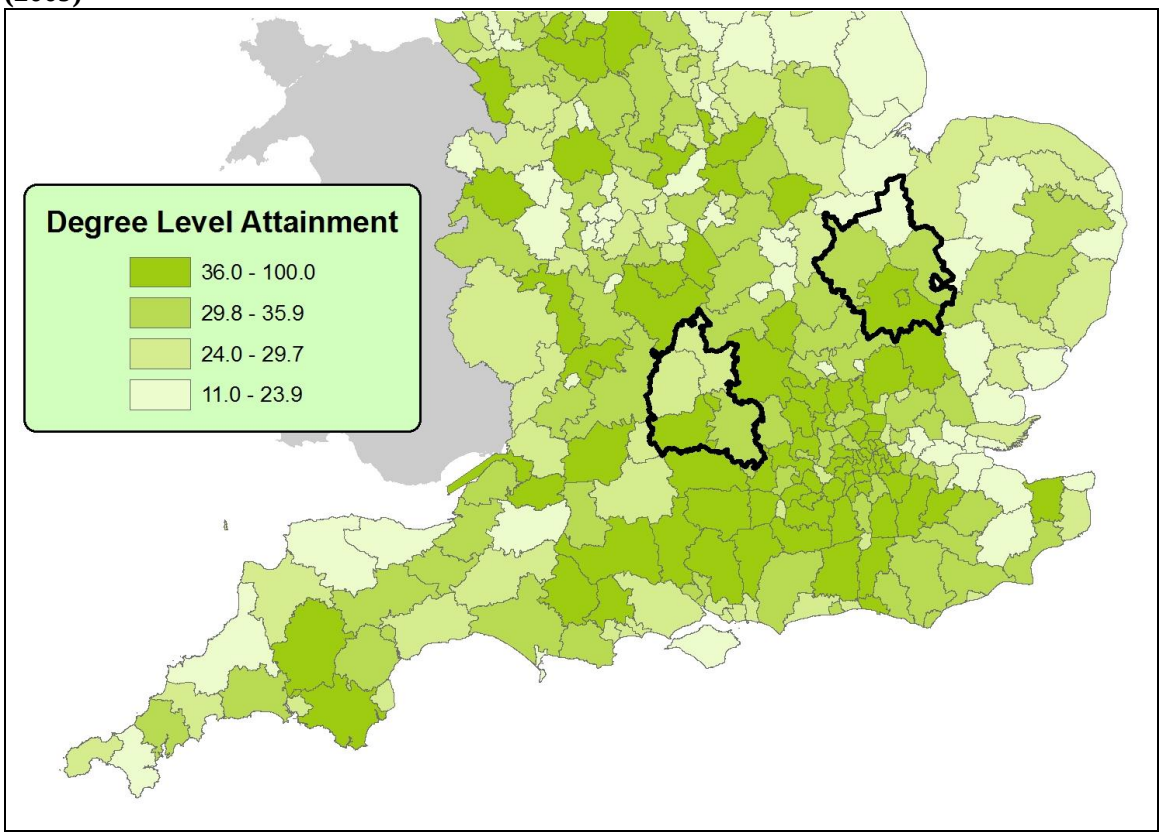


Source: Business Demography, ONS, 2010

Educational attainment is one of the prime indicators of high tech economies and locations of the clusters. Figure 3 shows the concentrations of the highly skilled in the two counties. This shows that the two case studies are located within two of the densest concentrations of the highly skilled in the country.

Cambridgeshire and Oxfordshire have the 2nd and 4th highest proportions of residents qualified to degree level of all county council areas in England at 39.5 and 37.9% respectively, with the cities performing particularly strongly with the 63.4% of residents holding degree level qualifications in Cambridge ranking it second of all 353 local authority districts in England (Oxford 49.5% to rank 16th). There are marked differences in educational attainment within the counties, most notably in Cambridgeshire, where only 13.7% of residents are educated to degree level, the third lowest proportion in England.

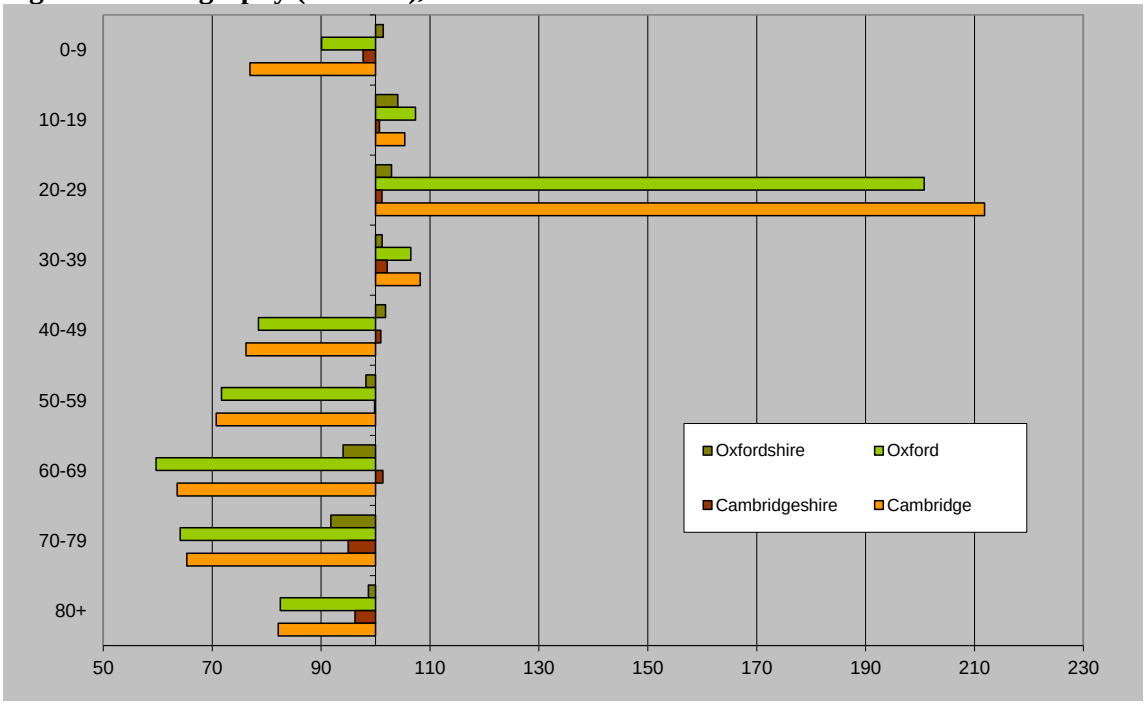
Figure 3: Educational Attainment (% of Working Age) in Oxfordshire and Cambridgeshire (2009)



Source: LFS, ONS, 2010

Another aspect of the potential vitality of regions is the percentage of young people. Figure 4 shows that both Oxford and Cambridge have very high proportions of people in their twenties. This is of course is related to their status as university cities (both have a premier university and a post-1992 university) as well as a dense concentration of research activity in the public and private sectors. The presence of a high proportion of people in their twenties, when they are most likely to be in tertiary education, allows a strong connection to be made between employers and education providers, facilitating the delivery of a demand-led labour market in both areas. This opens up the possibility of these workers continuing their careers in the local economy.

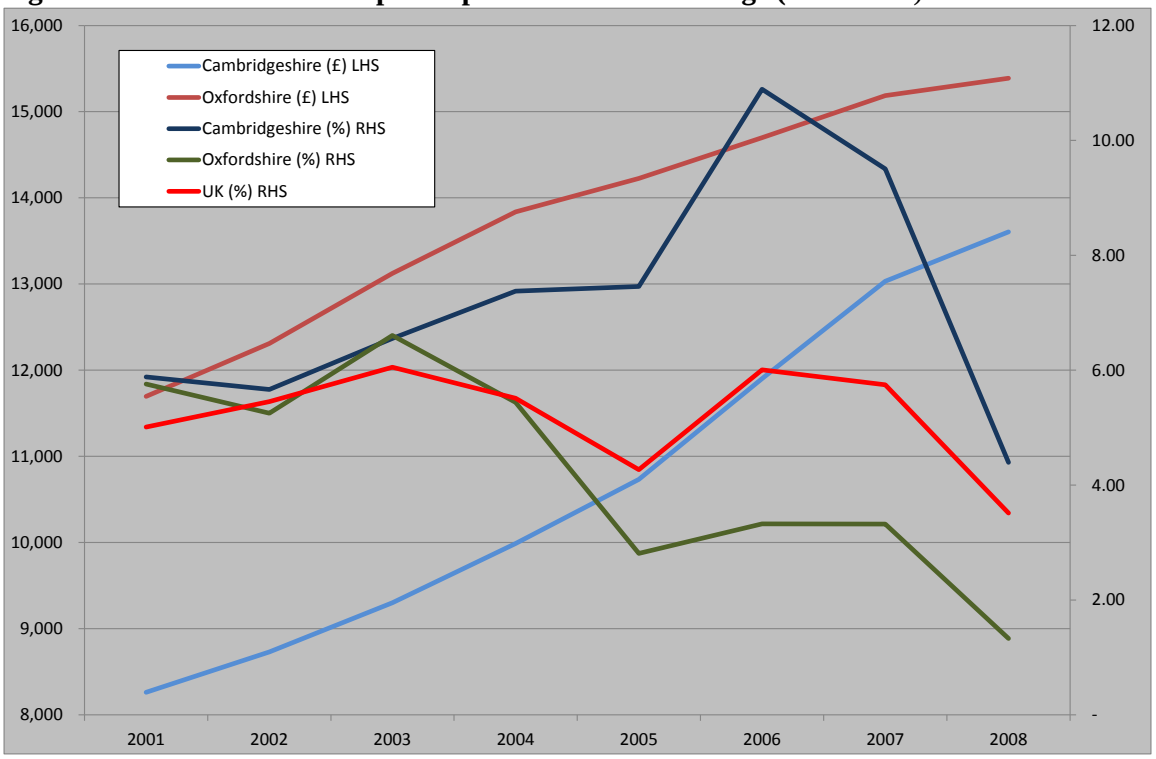
Figure 4: Demography (GB=100), 2009



Source: MYPE, ONS, 2010

GVA is an indicator of productivity in particular locations**.** In both counties, ouput per capita has increased over time as it has for the country as a whole. However, although still exhibiting lower GVA per capita than Oxfordshire, Cambridgeshire has shown stronger growth than Oxfordshire since 2001, increasing at over twice the national rate in 2008. However, Oxfordshire, despite its concentration of clusters and its world-class science base, only matched national increases in GVA per capita to 2004 and has displayed markedly lower rates of growth since then (Figure 5).

Figure 5: Gross Value Added per Capita and Annual Change (2001-2008)



Source: ONS, Regional Accounts, 2010

The figures for jobs Growth 2008-2009 are shown in Table 4. This shows that although Oxfordshire lost 1.6% of employee jobs in 2009, this was still the 11th strongest growth of all 27 county council areas. Cambridgeshire's loss of 4.4% ranked the county 25th of 27 with a national fall of 2.9%. The fortunes of the cities showed greater variation. Oxford lost only 0.6%, Cambridge lost 5% and was ranked 297th of the 380- local authority districts in Great Britain. Oxfordshire's biggest job losses were in the rural areas, excluding the district Vale of White Horse which has the government laboratories and big cluster of firms. Nevertheless, both counties continue to exhibit employment rates well in excess of the national rate.

Table 4 Jobs Growth, 2008-9

	Employees				Total Employment			
		Change				Change		
	Total	No.	%	Rank	Total	No.	%	Rank
Oxfordshire	**310,000**	**-5,000**	**-1.6**	**11**	**329,200**	**-2,600**	**-0.8**	**11**
Cherwell	**67,000**	**-200**	**-0.3**	**90**	**71,100**	**300**	**0.4**	**91**
Oxford	**103,300**	**-700**	**-0.6**	**97**	**106,900**	**-200**	**-0.2**	**111**
South Oxfordshire	**49,500**	**-2,400**	**-4.6**	**287**	**54,100**	**-1,700**	**-3.0**	**233**
Vale of White Horse	**53,200**	**-400**	**-0.8**	**105**	**56,800**	**-100**	**-0.3**	**113**
West Oxfordshire	**36,900**	**-1,400**	**-3.6**	**232**	**40,300**	**-800**	**-2.0**	**178**
Cambridgeshire	**267,400**	**-12,200**	**-4.4**	**25**	**284,700**	**-9,700**	**-3.3**	**23**
Cambridge	**85,000**	**-4,500**	**-5.0**	**295**	**89,000**	**-3,900**	**-4.2**	**294**
East Cambridgeshire	**22,800**	**-500**	**-2.0**	**153**	**25,000**	**-100**	**-0.3**	**115**
Fenland	**29,600**	**-1,200**	**-3.7**	**240**	**31,800**	**-800**	**-2.5**	**203**
Huntingdonshire	**68,200**	**-3,200**	**-4.5**	**281**	**72,800**	**-2,500**	**-3.4**	**263**
South Cambridgeshire	**61,700**	**-2,900**	**-4.5**	**279**	**66,100**	**-2,300**	**-3.4**	**270**
Great Britain	**26,206,100**	**-783,500**	**-2.9**	**-**	**27,970,900**	**-653,200**	**-2.3**	**-**

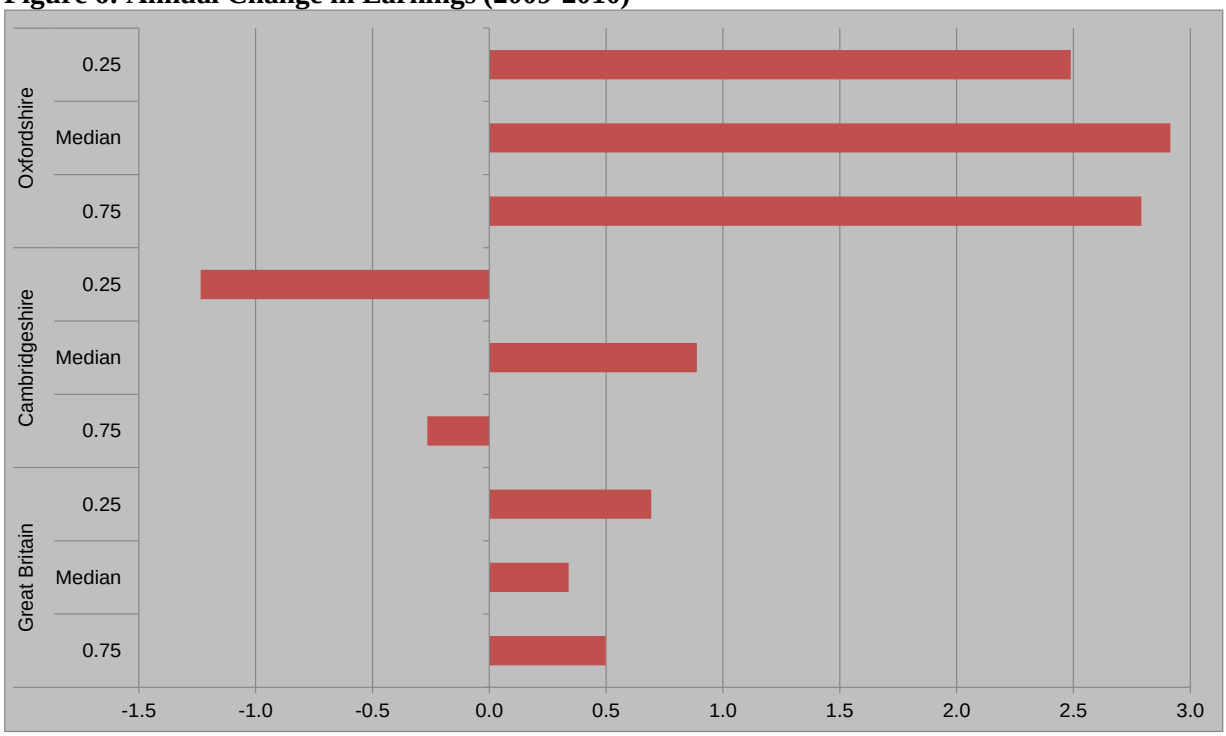
Source: BRES, ONS, 2010

Table 4 shows relatively low levels of job losses over the start of the recession in Oxfordshire compared with the rest of the UK. However, consistent with earlier data on deprivation, the impact in Oxfordshire is on more deprived urban areas of Oxford and areas to the north of the county, including Bicester and Banbury. Moreover, it should be acknowledged that, in addition to the knowledge intensive activities, Oxford has a considerable proportion of low-skilled, low-wage labour in Oxfordshire (Carpenter, 2011), which might be a factor in pulling the county's performance down (c.f. Benner 2011).

Next we discuss change in earnings over the period 2006 – 2010. Across Great Britain, workplace based median annual full time pay increased by 0.3% to stand at £25,993. This rate of growth was exceeded in both Oxfordshire and Cambridgeshire where pay rose by 2.9% and 0.9% respectively to £28,383 and £27,819, the 2nd and 5th highest among the 27 county council areas. Median pay was higher in the cities than the more rural districts.

Earnings at the 25th percentile grew faster than those at the 75th percentile in Great Britain. However, in Oxford the greatest increase in earnings was recorded for those earning most, with the 75th percentile seeing a 2.8% increase compared to 2.5% at the 25th percentile. In Cambridgeshire a similar pattern emerged, but with those at the 75th percentile seeing a smaller decrease that those at the 25th percentile as shown in Figure 6 below.

Figure 6: Annual Change in Earnings (2009-2010)



Source: ASHE, ONS, 2010

These latest data reverse the recent trends where the lower paid have seen their pay grow faster than the better paid, gross annual pay for those working full time in Oxfordshire having risen by 15% at the 25th percentile since 2001 compared to 12% at the 75th, and by 12% compared to 8% in Cambridgeshire. These data suggest that prior to the recession the lower paid had been benefiting from the economic strength of Oxfordshire and Cambridgeshire, but that, as the UK economy contracted, in contrast to the country as a whole, it was the higher paid in Oxfordshire and Cambridgeshire that were better able to defend their standard of living. They also suggest that the benefits of hosting clusters, particularly clusters of knowledge-intensive high technology industries, may accrue chiefly to those employed in the cluster rather than to the broader economy.

4. Conclusions

This paper's theme is the wider benefits of successful clusters in regional economic development. We demonstrate that both Oxfordshire and Cambridgeshire are high performing clusters but that in each case cluster development is insufficient by itself to guarantee that the county's economic growth outperforms that of the national economy.

We show that these are different kinds of high tech regions with varying industrial structures, and that this may account for the differences in performance within and between the two counties. There is an association of cluster and economic performance indicated by where job losses have been felt. Overall, they are economies with clusters do well, both are well known clusters, but rates of growth are not as good aswe would

expect. While Oxfordshire's growth has slowed in the last three years to be closer the national average, Cambridge has slightly outperformed Oxfordshire but from a lower base. What is not clear is whether there is evidence that either cluster-based economy have run out of steam and that there is evidence of a fourth stage in either or both. This study therefore highlights the importance of longitudinal research which monitors trends and their outcomes over time, and that comparisons are made between regions that on the surface seem to have similar characteristics.

We show that while there is some evidence that the economies had been becoming more inclusive, in recessionary times that effect diminishes. The lowest 25% quartile who are not paid as much had appeared to be doing relatively better, especially in Oxfordshire. It could be, however, that the sectors in which the lowest paid are employed were doing better than the ones in high tech sectors – hence counter argument to benefits of clusters.

The strength of the clusters in each county gives some support for the knowledge theory of entrepreneurship Audretsch and Keilbach (2005) – the localisation and endogenous entrepreneurship hypotheses - both are high knowledge centres and high levels of entrepreneurship. There is, however, mixed evidence on regional performance on various indicators.

We have attempted to show that it is the labour market that explains both the vitality of clusters and differences in performance within and between locations (Lawton Smith and Waters 2011).The link between clusters, economic growth and labour market activity of city region economies is, however, complex and requires understanding of occupational profiles and inter-segment recruitment (Markusen and Shrock 2003).

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