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**EMPLOYMENT MOBILITY IN HIGH-TECHNOLOGY
AGGLOMERATIONS: THE CASES OF OXFORDSHIRE AND
CAMBRIDGESHIRE**

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Abstract

This paper examines labour market behaviour of the highly skilled in high-tech local economies, taking the UK examples of Oxfordshire and Cambridgeshire as case studies. It reports on data from a survey of members of three scientific institutes to compare rates of employee mobility in the two locations and considers the likely explanations and implications of those patterns.

Key words: Oxfordshire and Cambridgeshire, employment mobility, postal survey, high-tech economies, agglomeration economies, labour markets

Introduction

An extensive literature exists on the benefits of spatial proximity and agglomeration to the process of innovation and thereby economic development (see Kitson et al 2004 for an overview). Various theoretical expositions list the factor conditions that contribute to the competitiveness of particular locations in particular sectors and to also functional specialisations through co-location. Relatively neglected in recent times are the classic Marshallian agglomeration economies of the development of a local pool of specialised labour which maximises the job matching opportunities between the individual worker and the individual firm (see Gordon and McCann, 2000, 516). Yet labour markets are a crucial component in the explanation of economic growth in particular territories. This is because growth lies not just in the accumulation of stocks of human capital (Florida 2002) but also in the effectiveness of the labour market as a means of supporting the flow of knowledge (sometimes called collective learning or knowledge spillovers) through mobility of staff between firms. It is expected to be faster in the case of functional agglomerations and that this is to the benefit of the agglomeration (as the unit of analysis) (Storper and Christopherson 1987). These authors argue that mobility is also likely to be faster in high-tech economies, the focus of this paper, because the demand for the highly skilled in clusters drives higher than normal rates of staff turnover, providing greater job opportunities for the individual.

Against this background, the paper examines the labour market experience and rates of turnover exhibited by scientists and engineers working in the high technology local economies of Oxfordshire and Cambridgeshire. The empirical observations are contrasted with the situation that would be predicted on the basis of theoretical accounts and other studies.

High-tech labour markets, stocks and flows of people and knowledge

The literature on the contribution of the highly skilled to the competitiveness of regions makes a number of observations about the behaviour of these workers. Crucially, Keeble *et al* (1998, 20) emphasise the importance of the movement of the highly skilled between local employers arguing that the 'local inter-firm movement of skilled staff plays an important role in the intra-regional transmission of expertise and fostering of inter-firm links'. Storper and Scott (1990, 582) note that the 'the speed of rotation of workers through the local job system is likely to correlate positively with the size of the local labour market, and periods of unemployment are likely to be relatively frequent, but relatively short. This proposition would seem to apply particularly to those categories of upper tier workers where skills are more sector and agglomeration specific rather than firm specific'. Carnoy *et al* (1997) and Storper and Christopherson (1987) likewise argue that the demand for the highly skilled in clusters drives higher than normal rates of staff turnover. Moreover, despite the international competitiveness of certain high-tech regional economies and skilled labour's operation within national and international labour markets (Keeble *et al*, 1998) the highly skilled appear to be highly mobile within local labour markets and quasi-immobile beyond that (Camagni, 1991).

Against this background, three propositions are considered here. First, high-tech economies will have higher stocks of qualified scientists and engineers than other economies, second, that rates of turnover will be faster than in other economies and

that the local mobility of the highly skilled increases the flow of ideas increasing inter-linkages and economic growth through the spread of knowledge, driving paths of development and third that local recruitment is likely to be extensive *within* local high-tech economies.

First, studies in which more explicit attention has been given to the labour market have separated out the locational influence of stocks of skills from that of other clustering factors. By definition, high-tech firms and hence high-tech economies are based on the highly skilled (see Butchart 1987 and see Chadwick et al 2003 for a review of definitions). It is the demand for talent that creates the momentum for further accumulation of skills and leads to increased levels of creativity and productivity (Dicken and Malmberg 1999, 357). For example, Glaeser (2000) found that access to common pools of labour is what underpins the tendency of firms to cluster together in regional agglomerations, rather than inter-firm linkages (in Florida 2002, 743). In the new growth theory, the connection is made between knowledge, human capital and economic growth whereby the stocks of ideas resident in the science base and the local labour market determines the rate of creation of new ideas. Moreover, the size of the labour force engaged in the production of ideas also determines the rate of the production of ideas (Romer in Engelstoft et al 2002). Other studies have suggested that workers are more productive when they locate around others with high levels of human capital (Black and Henderson 1999). Hence, the ability to attract these creative people and to nurture creativity is a central factor in regional development (Desrochers 2001 in Florida 2002).

Second, flows of employees within high-skill labour markets are considered effective means of transferring knowledge – the so-called ‘knowledge spillovers’ - and in increasing performance (see for example Scott 1988, Angel 1991, Saxenian 1994, Henry and Pinch 2000). In the US, high job and labour turnover regimes are seen as a sign of a healthy and adaptive local economy (Davis et al 1996). This point has also been made in the UK context. As Allen and Henry (1997) show, it is within the dynamic regions and localities of the economy that the growth of high turnover of peripheral employment is most marked. Skilled labour in this view accounts for much of the local collective learning process and creates a dynamic of increasing local labour market size through the reinforcing effects of the arrival of new firms and the extra employment opportunities so created. An example of how this works is the UK’s pan-regional motorsport cluster ‘Motorsport Valley’ which is heavily concentrated in Oxfordshire, and includes neighbouring counties of Northamptonshire, Berkshire, and Buckinghamshire. Henry *et al* (1996, 32) found support for the notion of the prioritisation of the labour market in the dissemination of knowledge across the territory: ‘one reason for the rapid diffusion of ideas is the fact that drivers, designers and engineers move from team to team, taking with them considerable knowledge of how things are done in rival teams’. Further study of the cluster is reported in Henry and Pinch (2000) where the authors’ similarly note ‘one of the most important ways in which knowledge is spread within the Motorsport industry, is by the rapid and continual transfer of staff between the companies with the industry’ (page 128). Henry and Pinch found that the average job tenure was only 3.7 years among leading designers and engineers.

On the other hand, there is not universal support for the idea that high rates of mobility are good for all firms, especially those that lose key staff. Traore and Rose

(2003) comment that staff turn-over is detrimental to biotech utilisation in the human health sector in Canada and that policies geared towards limiting the mobility of biotech personnel will help the sector improve its use of biotechnologies (see also Martin and Sunley 1999. Likewise Carnoy et al (1997, 43) argue 'from the standpoint of high-tech company managers, then, the problem is an undesirably high rate of turnover among their most skilled (and valuable) employees rather than a sense that their labour force is not flexible enough'. Moreover, they also suggest that, 'Middle- and lower-end labour may well want much *more* job security than high-tech firms want to give, while highly skilled workers want *less* job security than is optimal to the firms' These notes of caution beg the question of whether rate of turnover might be too fast for firms to extract *enough* utility from each worker before they move on.

Third, previous studies of labour market activity in high technology local economies have demonstrated a strong relationship between locality and recruitment. Angel (1991) found that semiconductor firms in Silicon Valley fill at least 85 per cent of their vacancies from within the cluster, regardless of occupation, he argues this demonstrates that: 'labor-market activity in Silicon Valley is dominated by a localized dynamic of interfirm worker mobility in which experienced workers move from one firm to another as labor demands change and new employment opportunities arise..... Rather than hiring workers at the entry level and generating skills in-house, semiconductor firms in Silicon Valley are able to respond swiftly to changing labor demands by hiring experienced workers from the local labor market'. This ease with which experienced workers can be recruited from the local labour market is, for Angel, one of the "central advantages attracting semiconductor producers to Silicon Valley".

This incredibly high percentage is not matched in other studies. For example, Keeble *et al* (1998) in their study of 50 firms in each of Oxford and Cambridge, found exactly one third (33 per cent) of all research staff recruitment reported by respondents came from within the regional milieu concerned. For management staff, the respective regional proportion was not far short of this, at 30 per cent. 'Bearing in mind the 'footlooseness' of highly-qualified staff and the small size of the local labour market ... these findings are noteworthy in demonstrating the existence of considerable localised flows of research and managerial staff within these technology-based regions, in addition to the spin-off and mobility of entrepreneurs and new firm founders' (1998, 19). That study showed that the labour markets although similar, are constructed from different sources. A slightly higher proportion of firms in Oxford (18 per cent) than in Cambridge (14 per cent) recruited research staff from their respective universities. The most important difference was that Cambridge firms more frequently recruited both research and managerial staff from other local firms and organisations, indicated a closer association between theory and practice in Cambridge than in Oxford. In both places recruitment of research staff was twice as high from non-local - and often overseas - universities and firms/organisations. Management staff were overwhelmingly recruited from outside the region. The survey also reveals that far more Oxford firms (72 per cent) had an explicit policy to recruit locally than is the case in Cambridge (48 per cent). In Cambridge, local recruitment is more often justified in terms of region-specific factors such as high quality or having appropriate skills. These results are somewhat short of Angel's findings for a specific sector. They also show a high degree of openness in the

economies which is argued to be closely associated with innovation (see Gambardella *et al*, 2003).

Against this background of general enthusiasm for the positive view of rapid mobility and the few dissenting voices, we now consider the national pattern of mobility in the UK followed by evidence from studies of employment in high-tech economies. These provide context and benchmarks to the examination of the findings of the survey which follow.

Labour market stocks and flows

To reiterate, the three central propositions of this paper are that high-tech economies have higher stocks of qualified scientists and engineers than other economies, that rates of turnover will be faster and that local recruitment is likely to be high. This section examines the first two of these propositions, the third will be considered in the following section which reports on the survey.

The first task is to introduce the survey populations establishing that Oxfordshire and Cambridgeshire are centres of high-technology activity and do in fact have higher stocks of qualified scientists and engineers. The second task is to compare how rates of turnover in the two high-tech regions compare with the national average.

The survey populations

The two counties, although not the largest concentrations of high-tech activity in the UK, are among the fastest growing centres and have dense populations of research activity and highly skilled people. Their importance in the UK's 'knowledge-economy' as a whole and in particular sectors such as bioscience has been recognised by central government (see for example Sainsbury 1999; Trends Business Research for the DTI 2001 and the Lambert Review 2003).

The two counties are both located about 50 miles from London, Cambridgeshire to the North and Oxfordshire to the West. They are similar in size and population. Cambridgeshire covers 1300 square miles and has a population of 684,000; Oxfordshire's area is 1000 square miles with a population of 598,000. Both have historic and influential universities and the residential attractions of cultural centres. Scientific and technological resources are concentrated in their university and government laboratories, providing centres of knowledge capable of supporting high-tech commercial activity.

Comparisons of levels of employment in high-tech economies depend on the definition of high-tech. For example Chadwick *et al* (2003), using the Eurostat definition finds that Oxfordshire has 54,600 employees in 1,936 firms in 2002. However, using a more realistic and narrower Butchart-based approach using official statistics – for example excluding motor vehicle manufacture, but including Motorsport, 36,682 were employed in 1,400 firms, accounting for 12 per cent of employment in the county. Using their own broad definition but based on Eurostat, the estimate for Cambridgeshire for the end of 2001 is 48,300, about 13 per cent of employment. There were an estimated 1,526 'establishments'. The method of selecting firms on a case-by-case basis and non basic sectors such as wholesale and

retail are discarded hence the Eurostat definition is not followed exactly (Personal communication Cambridgeshire County Council 2002). Chadwick et al using their second approach, demonstrate that a difference between the two counties is in the rate of growth. Oxfordshire had the highest percentage rate of growth in high-tech employees of all English counties in the period 1991-2000 (141 per cent) compared to Cambridgeshire which was eighth with an increase of 53 per cent.

Each county has high and growing concentrations of indigenous high-tech firms formed by local, often academic, entrepreneurs in diverse sectors, but are both leading growth centres for the UK's biotechnology industry. The number of firms and employment in key high-tech sectors in Oxfordshire in descending order is Software, Web/internet and other computer Services (635, 7,900), Other R&D activities (44, 5,900), Instruments, Medical and Optical Equipment (112, 5,000), Biotech, Pharmaceuticals & Medical Diagnostics, (73, 3,300) and Technical Consultancy and Testing (317, 3,300). Similarly the IT sector is the predominant sector in the Cambridge Cluster (160 companies, 4,200 employees), with Biotechnology (153, 5,300) and Electronic Equipment & Instruments (106 3,000) the second and third largest number of firms (Library House 2003). Hence both locations are dominated by computing/physics/engineering/chemical skills They differ in that there is a higher proportion of small firms in the Cambridge region and a higher proportion of larger firms in Oxfordshire; Cambridge is more service-orientated while Oxford has a greater orientation to manufacturing and Cambridge has a concentration of technical consultancies while there are none in Oxford. Cambridge has retained the position it held in the 1970s and early 1980s as a leading centre for the personal computer and software sectors (Keeble and Kelly, 1986), although Oxfordshire is home to the largest UK manufacturer of educational computers (Research Machines). With regard to the research base, Oxfordshire has a greater density of public sector research laboratories, for example in atomic energy (UKAEA Culham) and scientific research (CCLRC Rutherford Appleton Laboratory) while Cambridge has a higher number of multinational research laboratories than Oxford. In Cambridge they include Schlumberger, SmithKline Beecham, Toshiba, Sony and Microsoft, and in Oxford, Sharp, Dow Elanco and Esso.

Stocks of human capital

Not surprisingly given the proportion of high-tech activity, both Oxfordshire and Cambridgeshire have high proportions of well-qualified residents compared to the rest of England & Wales. Table 1 shows that 27 per cent of Oxfordshire residents and 25 per cent of Cambridgeshire residents are qualified to degree level (NVQ level 4+) to rank as the 2nd and 6th most qualified counties respectively in England and Wales. These figures mask the range of performance recorded for the local authorities that make up the counties. Cambridge City is the strongest performer with 41 per cent of residents qualified to degree level to rank 8th of the 376 local authorities of England and Wales while in Oxford City the proportion is 36.8 per cent to rank 12th.

Outside the cities, South Cambridgeshire, which surrounds Cambridge City, also has a highly qualified workforce, ranking 29th in England and Wales with 29.8 per cent of residents holding degree level qualifications, East Cambridgeshire is the next strongest performer in the county with a national ranking of 136th. In Oxfordshire, the fall is not so sharp between districts, with all of the counties local authorities scoring above the national figure. Oxford City and Cambridge City rank respectively 1st and

2nd in England and Wales for the proportion of residents qualified to NVQ level 3 with 19.0 per cent and 18.0 per cent respectively.

Although the proportions show the bias in favour of ‘knowledge workers’, it is important, however, to put these proportions into perspective. The actual numbers are less impressive than the proportions and are a truer reflection of scale than proportions. Other counties such as Berkshire, Hampshire and the London region have more very highly skilled people.

Table 1: Educational Attainment in Cambridgeshire and Oxfordshire

	NVQ Level 3	NVQ Level 3 Rank (of 376)	NVQ Level 4/5	NVQ Level 4/5 Rank (of 376)	NVQ Level 3	NVQ Level 3 Rank (of 376)	NVQ Level 4/5	NVQ Level 4/5 Rank (of 376)
East of England	7.9	4 (of 9)	18.1	4 (of 9)	308,581	4 (of 9)	704,743	4 (of 9)
Cambridgeshire	9.5	4 (of 49)	25.2	6 (of 49)	38,458	21 (of 49)	102,528	17 (of 49)
Cambridge	18.0	2	41.2	8	15,324	40	35,145	45
East Cambridgeshire	7.2	210	20.2	136	3,842	313	10,712	278
Fenland	5.0	370	9.5	370	3,014	339	5,681	358
Huntingdonshire	8.0	142	20.0	140	9,096	111	22,726	98
South Cambridgeshire	7.6	176	29.8	29	7,182	152	28,264	67
South East of England	9.2	2 (of 9)	21.7	2 (of 9)	530,682	1 (of 9)	1,253,917	2 (of 9)
Oxfordshire	10.8	1 (of 49)	27.7	2 (of 49)	48,177	15 (of 49)	123,323	14 (of 49)
Cherwell	7.7	169	20.0	139	7,329	147	19,169	128
Oxford	19.0	1	36.8	12	19,763	21	38,301	38
South Oxfordshire	8.8	95	28.3	40	8,222	129	26,261	76
Vale of White Horse	8.7	106	28.2	41	7,234	151	23,576	87
West Oxfordshire	8.2	131	23.3	79	5,629	213	16,016	169
England	7.9		18.8		2,962,282		7,072,052	
England & Wales	8.3		19.8		3,110,135		7,432,962	

Source: Census, ONS, 2001

Table 2 shows the occupational structure of the two counties based on Standard Occupational Classifications (SOC)¹. Again, reflecting the level of high-tech activity and the presence of a public research activity, Oxfordshire and Cambridgeshire rank 2nd and 3rd respectively of the England and Wales NUTS 2 regions, behind Inner London of the 376 local authorities in England and Wales for the proportion of residents employed in Professional Occupations (SOC2). Again, strongest performance is observed in the cities, with Cambridge City and Oxford City ranking 2nd and 3rd of the England and Wales local authorities behind the City of London with 28.0 per cent and 23.4 per cent of residents respectively employed in professional occupations compared to the national average of 11.2 per cent. When workplace

¹ SOC1: Managers and Professionals

SOC 2: Professional occupations

SOC 3: Associate professional and technical occupations

For a full explanation see www.statistics.gov.uk/methods_quality/soc/structure.asp

figures² are used the results are even more striking, with 34.5 per cent of Oxford's workforce being employed in professional (SOC2) occupations and 33 per cent in Cambridge. In both cases these are well above the national average of 12 per cent. Table 2 does however highlight the relative shortage of associate professional and technical workers in both local economies.

Table 2: Occupational Structure

	SOC1 (%)	SOC1 Rank (of 376)	SOC2 (%)	SOC2 Rank (of 376)	SOC3 (%)	SOC3 Rank (of 376)	SOCs 1-3 (%)	SOC3 Rank (of 376)
East of England	16.3	3 (of 9)	10.8	3 (of 9)	13.5	4 (of 9)	40.6	6 (of 9)
Cambridgeshire	16.4	15 (of 42)	14.7	3 (of 42)	13.8	14 (of 42)	44.9	7 (of 42)
Cambridge	13.1	275	28.0	2	14.2	116	55.3	15
East Cambridgeshire	17.3	93	10.9	156	12.7	223	40.9	140
Fenland	12.8	285	6.7	355	10.7	349	30.3	348
Huntingdonshire	18.1	70	10.5	169	14.7	95	43.2	113
South Cambridgeshire	18.2	68	16.6	21	14.9	88	49.7	42
South East of England	17.4	2 (of 9)	12.1	2 (of 9)	14.6	2 (of 9)	44.2	2 (of 9)
Oxfordshire	17.4	7 (of 42)	15.0	2 (of 42)	15.2	6 (of 42)	47.5	4 (of 42)
Cherwell	16.9	103	10.3	182	14.4	101	41.7	127
Oxford	12.8	284	23.4	3	15.8	51	52.0	31
South Oxfordshire	20.8	24	14.3	49	15.4	63	50.6	35
Vale of White Horse	18.6	64	15.6	32	14.3	107	48.5	48
West Oxfordshire	17.4	87	11.4	137	16.0	43	44.8	86
England	15.3		11.2		13.8		40.3	
England & Wales	15.1		11.2		13.8		40.1	

Source: Census, ONS, 2001

Rates of turnover exhibited in the UK labour market as a whole.

The pace of employment turnover in the UK overall is increasing. In their study of job tenure, Gregg and Wadsworth (1999) found that the average job in Britain lasts for a little over 5 years. They additionally found that the average new job lasts for 15 months – that is to say that workers can be expected to continue to move between jobs before finding an appropriate job match. More recently, the Chartered Institute of Professional Development (CIPD) Labour Turnover Survey for 2000 (CIPD, 2001) recorded an average overall turnover rate for full time workers of 21 per cent (giving an average job tenure of 4.8 years). A comparison of average job tenures from recent studies is presented in Table 3 overleaf.

² Labour Force Survey, ONS, 2001

Table 3: Comparative mean job tenures

Territory	Average Job Tenure (Years)
UK overall (2001)	6.7
UK SOC 2	4.6
UK IT & high technology (2001)	5.1
Motorsport Valley (UK, 2000)	3.7

Source: CBI, 2002, CIPD, 2001, Henry and Pinch, 2000

CIPD data shows average job tenure for professional occupations (SOC2) in 2000 as being 4.6 years. In IT and high-technology sectors CIPD data gives an average job tenure of 5.1 years. The CIPD data therefore shows job tenures in the UK's high technology and IT sector to be longer than for professionals as a whole. In Motorsport Valley, a sectorally specialised cluster which includes Oxfordshire, the level of turnover is the highest recorded suggesting that there are important sectoral variations (Pinch and Henry 2000) and possibly that skills are more easily transferred between very similar firms than between co-located firms even though they might have similarly well qualified workforces. To investigate patterns of labour turnover further, we turn to the results of the survey.

Methodology

Data was collected from three postal surveys of the highly skilled between November 2000 and August 2001. Questionnaires were sent to the members of the Institute of Electrical Engineers (IEE), the Institute of Physics (IOP) and the Royal Society of Chemists (RSC) in the two case study areas. The three institutes were chosen as they are the professional institutes representing scientists and engineers in the case study areas. As far as we were able to ascertain, a biological sciences institute does not exist and as much of the science behind biological sciences is chemistry-based, for example bio-chemistry, many working in that field belong to the RSC. With regard to defining the clusters, we have defined the cluster as being 'science' and then have mapped the scientists³. A total of 6,099 questionnaires were sent out to institute members in Oxfordshire and Cambridgeshire yielding 831 responses, a response rate of 14 per cent, which might have some implications for representativeness. The questionnaires were distributed by postcode of home residence.

With regard to the theme of this paper, the questionnaire asked for general information about the employee and his/her employer, the employee's education and employment history including firm location and dates employed. The calculation of

³ This is because SIC codes do not adequately cover the sectoral specialisms discussed here and work on Location Quotients is based on SICs, which is a much less satisfactory method since they still (are manufacturing based which does not reflect the UK economy. –

turnover was based on a list of previous jobs and the dates of employment (i.e. length of employment divided by number of jobs). The limitation of this approach, however, is that it takes little account of the duration of the current job, which could be one day or 20 years but still count as one job in the calculation.

Reflecting national statistics for the two regions and the criteria for membership of the institutes, the sample is very highly skilled (Table 4). In Oxfordshire, over 91 per cent of the sample held an undergraduate degree, with over 53 per cent holding PhDs, in Cambridge over 87 per cent held first degrees with 44 per cent holding PhDs, representing a considerable stock of knowledge and experience in science and engineering.

Table 4: Qualifications profile of the survey population (percentage)

Oxfordshire				Cambridgeshire			
Degree	Masters	PhD	Total	Degree	Masters	PhD	Total
22.8	14.6	53.7	91.1	21.6	21.6	44.2	87.3

Source: Author's survey 2000 / 2001

Analysis of job turnover is based on individuals rather than firms as has been the case in previous studies. This focus on the individual, as human capital, allows a consideration of career trajectories which are hidden in firm-level studies carried out through human resource departments. Firm-level analyses have reported the proportion of the labour force of any single firm has left in the previous year. To allow comparison we have divided 100 by this job turnover percentage to generate the average job tenure that will lead to replacement of the entire work-force of a firm in that number of years.

The results on the rate of turnover are presented in Table 5. This shows that the two counties differ in that average job tenure is consistently shorter in Cambridgeshire than in Oxfordshire. Yet, although the average job tenure of scientists and engineers in Cambridgeshire is shorter than the rate for the UK overall, the highly skilled in Cambridgeshire hold each job for longer than that the national average compared to the CIPD's figure for SOC 2 employment. In the case of Oxfordshire the high-technology labour markets exhibits longer average job tenures than all of the comparisons given in Table 3. Instead of a higher rate of turnover compared to the UK average, it is in fact lower. Moreover, the rate of turnover varies by occupation. The biggest difference is in the rate of turnover of chemists, and the least for engineers. Overall, the rate of turnover is slower than expected, being below some of the national metrics and is surprising given that theory suggests it should be faster.

Table 5: Individual job tenure by institute and location in years (%)

	Cambridgeshire	Oxfordshire
IEE	4.96 (20.2)	5.36 (18.7)
IOP	6.26 (16.0)	7.92 (12.6)
RSC	5.79 (17.3)	8.23 (12.2)
Total	5.78 (17.3)	7.62 (13.1)

Source: Authors' Survey, 2000 / 2001

Table 6 shows results for those employed only in the case studies (excluding those in their first jobs). This shows that tenure is longer than for the overall figure - which includes those who have dipped in and out as well as those who have either remained or moved to each location. There is also a marked difference in the pattern for engineers in Cambridgeshire which have much the shortest duration of tenure.

Table 6 length of tenure by location and institute

	Oxfordshire	Cambridgeshire
IEE	6.94	5.13
IOP	7.61	7.22
RSC	7.21	7.19

Source: Authors' Survey, 2000 / 2001

We now consider two factors which might account for the differences: firm size and location. Both firms and government laboratories were larger in Oxfordshire than Cambridgeshire). Table 7 shows the size of firms included in the sample and Figure 1 job tenure by firm size in each location.

Figure 1 shows that in this sample, firm size is related to average job tenure and varies by location. The most striking feature is that with the exception of firms employing 11-25 staff, scientists employed in Oxfordshire firms have a longer average job tenure than in Cambridgeshire firms. In this analysis then, it is location more than firm size that is associated with differences in job tenure. At the same time there appear to be some size effects. The longest job tenures are to be found in firms employing less than five people, perhaps an effect of self-employment, followed by firms of between 251 and 500 employees. In the case of large firms it is expected that movement within the internal labour market will remove the necessity for movement between firms, acting to reduce knowledge flow by keeping knowledge stocks within that company (see

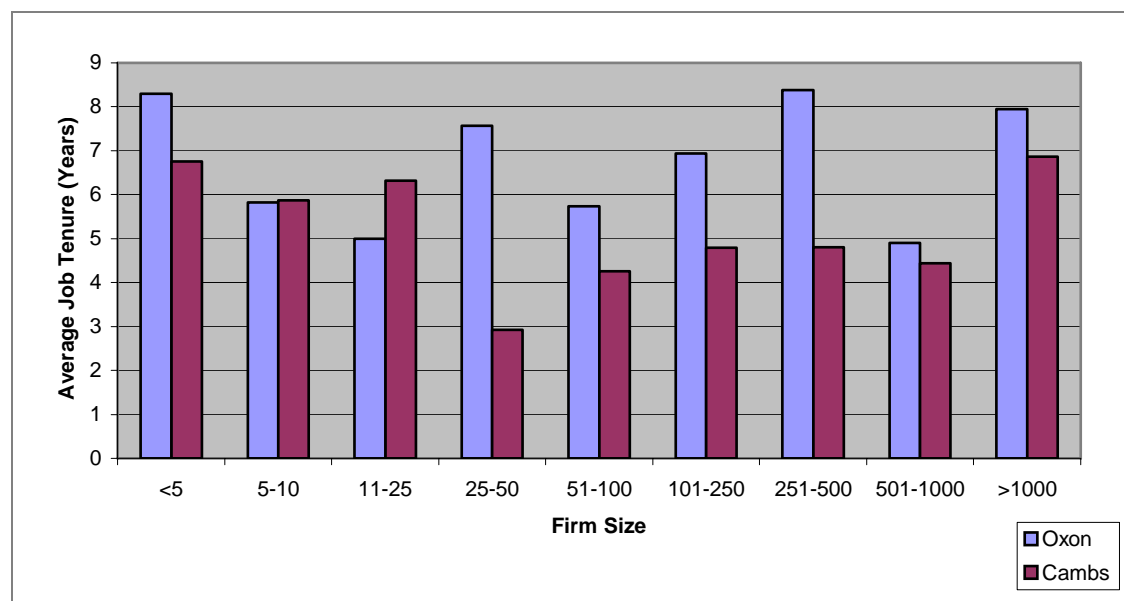
Angel 1991 on this point). The highest rate of churn is recorded for firms of between 26 and 50 employees in Cambridge.

Table 7: Size of firm employing respondents

Size of firm	Cambridgeshire				Oxfordshire			
	IEE	IOP	RSC	Total	IEE	IOP	RSC	Total
<5	9	6	5	20	6	19	4	29
5-10	3	4	5	12	2	3	1	6
11-25	7	11	4	22	3	11	1	15
26-50	15	4	7	26	6	9	3	18
51-100	19	13	17	49	6	17	8	31
101-250	19	17	20	56	8	29	10	47
251-500	15	16	9	40	6	27	11	44
501-1000	6	7	8	21	6	21	2	29
>1000	14	28	25	67	18	81	22	121
Don't know		19	3	22		11	6	17
Total	107	125	103	335	61	228	68	357

Source: Authors' survey 2000 / 2001

Figure 1: Job tenure by firm size



Source: Authors' Survey, 2000 / 2001

The national laboratories in Oxfordshire may have more stable employment patterns than those in Cambridge due to their larger size and their big-science orientation (see Garnsey and Lawton Smith 1998). In this survey, some 30 people were employed at the CCLRC. Another study (Lawton Smith 2003) reported that at CCLRC securing a position meant 'a job for life'. The findings in the current study on relative immobility in Oxfordshire which has larger high-tech firms than in Cambridge are also consistent with Angel's (1991, 1511) finding that large firms go to some lengths to reduce the turnover rate and insulate their workforce from the external labour

market at large, for example by paying them premium wages, linking wages to tenure within the firm, and by locating R&D sites away from competing firms.

Conclusions

This paper has examined the labour market behaviour of the highly skilled in the high- techneconomies of Oxfordshire and Cambridgeshire. The main aim of the paper has been to compare the situation that theory would lead us to expect to observe with an empirical survey of practitioners working in these two clusters. Oxfordshire and Cambridgeshire have been identified as being high-tech clusters in a number of government reports and academic papers. As national statistics and survey data illustrate very strong densities of the very highly skilled a good fit with theory was anticipated.

The paper, however, has revealed a number of differences between what theory leads us to expect and what can be observed in the case studies and between the case studies themselves, despite the similarities between their composition. In particular the data shows both convergences and divergencies in both locations from national patterns and from each other. The most striking differences are Cambridgeshire appears to be that turnover is above national and SOC2 averages and bears some similarities to patterns found in in Motorsport Valley, whereas in Oxfordshire, rates of turnover are much slower. The task then is to explain Oxfordshire

Three explanations are possible. First the long job tenures of Oxfordshire may be a result of the number of public sector institutions and larger firms in Oxfordshire – where internal labour market movement mask movements between jobs. Job tenure however is also longer than expected in Cambridgeshire for relatively small firm sizes, where a public sector presence is in smaller units and where internal labour market opportunities are likely to be much reduced. Theory suggests that labour market in clusters show greater churn due to agglomeration effects – labour market information, social networks and job openings in fields of expertise and hence rapid transfer of technology associated with faster turnover. Second, the data might be showing up differences in labour market structures. The smaller size of firm in Cambridgeshire is associated with the service-orientated design activities of many of the firms, which might encourage more rapid job-hopping – a similar pattern to that of the Motorsport industry (Henry and Pinch 2000). Third, it might be that in Oxfordshire the high-tech economy is comparatively immature and a critical mass of firms serving similar markets and creating employment opportunities for staff in other firms has not yet developed i.e. turnover is lower because there are in fact insufficient job matching opportunities within the cluster. In this analysis it may be that the Oxfordshire knowledge base is still organised around ‘science’ rather than high-tech sectors and this creates a drag on the mobility of the staff as the interdependencies that give dynamism to Cambridgeshire’s labour market are missing. On the other hand, while longer job tenure could be seen as positive attribute, shorter turnover is not necessarily a good thing for firms – as suggested by Traore and Rose (2003) and Carnoy et al (1997). Further research is needed to investigate the costs and benefits of rates of turnover.

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References

- Allen, J and Henry, N (1997), 'Ulrich Beck's Risk Society at Work: Labour and Employment in the Contract Service Industries' *Transactions of the Institute of British Geographers*, **22**, (2) : 180-196
- Angel, D P (1991) 'High-technology agglomeration and the labor market: the case of Silicon Valley', *Environment and Planning A*, 1991, Vol. 23 pp. 1501 – 1516
- Black, D and Henderson, V (1997) 'Urban Growth' NBER Working Papers 6008, National Bureau of Economic Research, Inc
- Butchart, R., 1987, "A New UK Definition of the High Technology Industries" *Economic Review*, 400: 82-88
- Camagni, R (1991) Local 'Milieu' uncertainty and innovation networks: towards a new dynamic theory of economic space' ch 7, pp 121-124 in Camagni, R (ed) *Innovation Networks: Spatial Perspectives* London:Belhaven Press
- Carnoy, M, Castells, M & Benner, C (1997) 'Labour market and employment practices in the age of flexibility: a case study of Silicon Valley', *International Labour Review* 136, 1 27 – 48
- Chadwick, A, Glasson J, Lawton Smith, H, Simmie, S and Clark, G (2003) *Enterprising Oxford: the Anatomy of the Oxfordshire high-tech Economy* Oxford:Oxfordshire Economic Observatory
- CIPD (2001) *Labour turnover: survey report October 2001*, CIPD, London
- Davis, S J, Haltiwanger, J C and Schuh, S (1996) *Job creation and Destruction* Cambridge.Mass:MIT Press
- Dicken, P and Malmberg, (2001) 'Firms in territories: A Relational perspective' *Economic Geography* 345-363
- Engelstoft, S, Jensen-Butler, C Smith, I and Winther, L (2002) 'The Economics of Industrial Cluster and an examination of their performance in Demark' Paper presented at the Regional Science Association International British & Irish Section 32nd Annual Conference Brighton & Hove August 21-23 2002
- Florida, R (2002) 'The Economic Geography of Talent', *Annals of the Association of American Geographers* 92 , 4 743 – 755
- Gambardella, A Mariani, M Torrasi, S (2003) How 'Provincial' is Your Region? Effects on Labour Productivity in Europe paper presented at Knowledge and Innovation in Creating and Sustaining Regional Growth in a Global Environment (10-12 July 2003, Eindhoven, The Netherlands)
- Gordon, I and McCann, P (2000) 'Industrial clusters: Complexes, Agglomeration and/or Social networks?' *Urban Studies* 37 3 513-532

- Gregg, P and Wadsworth, J (1999) 'Job Tenure, 1975 – 1998' in P Gregg and J Wadsworth (eds) *The State of Working Britain*, Manchester University Press, Manchester
- Henry, N, Pinch, S and Russell, S (1996) 'In pole position? Untraded interdependencies, new industrial spaces and the British Motor Sport Industry' *Area* 28.1, p. 25 – 36
- Henry, N and Pinch, P (2000) '(The) industrial agglomeration (of Motor Sport Valley): a knowledge, space, economy approach' in J Bryson, P Daniels, N Henry & J Pollard (eds) *Knowledge Space Economy* Routledge, London
- HM Treasury (2003) Lambert Review of Business-University Collaboration: Final Report London:HM Treasury www.lambertreview.org.uk
- Keeble, D, Lawson, C, Lawton Smith, H, Moore, B and Wilkinson, F (1998) *Collective Learning Processes and Inter-firm Networking in Innovative High technology Regions*, ESRC Centre for Business Research Working Paper 86
- Kitson, M, Martin, R and Tyler, P (2004) 'Regional Competitiveness: An elusive yet Key Concept' *Regional Studies* 38, 9 991-1000
- Library House (2003) *The Cambridge Cluster Report* Cambridge: Library House Ltd
- Martin, R and Sunley, P (1999) 'Unemployment regimes and regional unemployment disparities' *Environment and Planning A* 31, 523-50
- Sainsbury Report (1999) *Biotechnology Clusters: Report of a team led by Lord Sainsbury, Minister for Science*, London: Department of Trade and Industry
- Scott, A (1988) *New Industrial Spaces*, Pion, New York
- Saxenian, A (1994) *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Harvard University Press, Cambridge, Massachusetts
- Scott, A and Storper, M (1987) 'High technology industry and regional development: a theoretical critique and reconstruction' *International science journal* 112 215-232
- Storper, M & Christopherson, S (1987) 'Flexible specialisation and Regional Industrial Agglomerations: The case of the US Motion Picture Industry', *Annals of the Association of American Geographers* 77(1) pp 104 – 117
- Storper, M and Scott, A J (1990) 'Work organisation and local labour markets in an era of flexible production' *International Labour Review* 129, 573-591
- Traore and Rose (2003) 'The Determinants of biotechnology utilization by the Canadian industry' *Research Policy* Article in Press
- Trends Business Research (2001) *Business Clusters in the UK – a first assessment* Newcastle:Trends Business Research