The Cambridge High Tech Cluster
Facing the Downturn of 2008-2010

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Abstract

Policy makers are counting on export-oriented technology based firms for economic renewal. The most recent data analysed here reveals some degree of resilience among the Cambridge cluster of technology firms during the financial crisis of 2008-2010. Jobs in the Cambridge technology cluster were down by 4.0% over 24 months from 2008, but during this time GNP fell by 6%. Cambridge tech firm numbers were down by 8.1% with closures concentrated among the smallest firms and fewer start-ups. New firms founded during the period of economic downturn showed higher survival rates than firm cohorts founded during economic boom of the mid 2000s. The fall in start-up rates and in firms growing to midsize reduces the pool of firms eligible for growth. However there is evidence that newly emerging sectors in the Cambridge cluster – such as optoelectronics and environmental technologies – expanded employment during the crisis, signalling continuing potential for renewal in the regional innovation system.

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The Cambridge, U.K. High Tech Cluster
during the Period of the Financial Crisis 2008-2010

1. Introduction

A recent report by NESTA outlines a recovery strategy for Britain in the aftermath of the financial crisis of 2008 and the subsequent global economic recession. The report sets out two scenarios as the most plausible drivers of the U.K.'s economic recovery: a resurgence of high-technology manufacturing and/or an increase in the innovative performance of the U.K. economy at large. The Cambridge, U.K. cluster is home to innovative young companies at the forefront of their field and to small high-technology manufacturing firms. The experience of firms in this cluster of technology firms during the difficult period between 2008 and 2010 is thus instructive beyond the regional level.

2. Background

2.1. The Cambridge Technology Cluster

The Cambridge technology cluster gathered momentum during the 1970s, when, without government or corporate involvement, academic and other entrepreneurs found ways to meet international demand for expertise emanating from research at the University of Cambridge (Garnsey and Heffernan, 2005; Drofiak and Garnsey, 2009). The success of early ventures stimulated further spin-off activity as well as serial enterprise, which were supported by an influx of specialist service firms (Garnsey and Heffernan, 2005; Drofiak and Garnsey, 2009). These dynamics transformed a small university and market town into an agglomeration of internationally-oriented technology based firms (Mohr and Garnsey, 2010). Depending on definitions used, technology-based firms numbered around 1500 in 2008, employing around 43,000. By 2010 there were around 1400 tech based firms, employing around 41,000.[1]

2.2. Methodology

This study draws on the Cambridge Technology Enterprise Dataset, a database covering all the employment by technology-based firms in the area between 1988 and 2010. The database has been developed by the University of Cambridge and the Cambridgeshire County Research

[1] The database is a working document updated as tech based firms are identified. In 2008 there were 1520 firms, employing 42,588 people. By 2010 around1400 tech based firms in Cambridge region, employed about 40,888 people. The decline in firms numbers was mainly among the smallest firms. Definitions are discussed in detail in related working papers available on: http://www.ifm.eng.cam.ac.uk/ctm/publications/w_papers/

Unit (CCRU) during a collaboration of over twenty years. The database, which has been extended by archival and financial sources, including nearly 200,000 press reports, provides for analysis of such issues as clustering effects, growth crisis and regional renewal and the role of rapidly-growing firms in the cluster (Garnsey and Heffernan, 2005; Evans and Garnsey 2009; Mohr and Garnsey, 2010; Mohr, 2011).

3. State of the Cluster in 2010

3.1. Overall Cluster Development

In the period leading up to the financial crisis, the Cambridge cluster was showing recovery after the technological downturn of the millennium. Following a rapid expansion during the economic boom of the late 1990s, the cluster had shown resilience after the end of the dot-com bubble of the early 2000s, with employment numbers rebounding and reaching unprecedented levels by 2008. This paper explores quantitative evidence on the impact of the financial crisis and associated recession on the Cambridge cluster. From 2008 to 2010 the cluster experienced the sharpest decline since the start of this series of records in 1988, with employment and firm numbers falling to levels of the early 2000s. Nevertheless, these high tech firms have in some respects been more resilient than the rest of the economy.

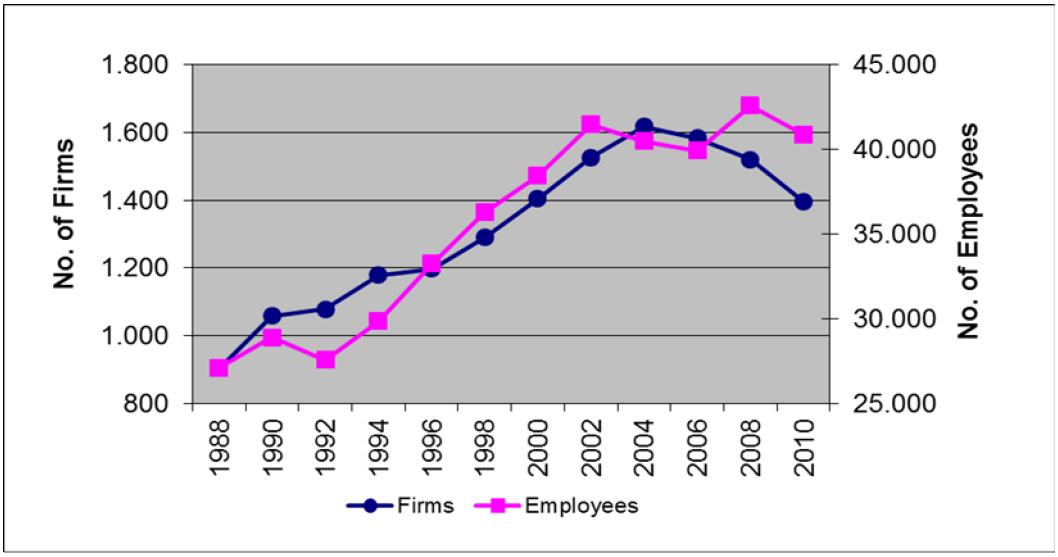


Figure 1 – Total Number of Firms and Total Employment in the Cambridge Technology Cluster 1988-2010

The impact of employment reductions varied across the different regions constituting the cluster. Figure 2 shows that while high-technology employment in the city of Cambridge itself and Eastern Cambridgeshire remained stable, Southern Cambridgeshire and Huntingdonshire experienced notable reductions in high-technology employment, although

together with the city of Cambridge, they remain the most significant areas of high-technology employment.

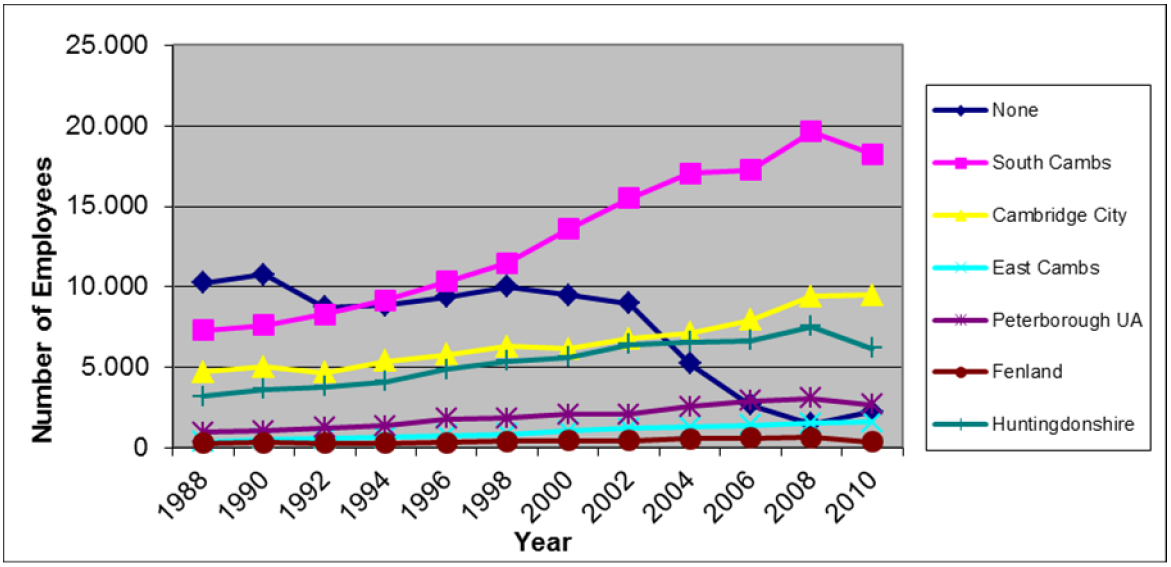


Figure 2 – Number of Employees in Cambridge Technology Cluster by Area

3.2. Sector

It is possible to disaggregate the overall cluster development by sector in order to gain a closer understanding of the trends facing a particular type of company. Here, we employ SIC codes to focus on the manufacturing and IT firms, two types of firms that have in the past been critical to the development of the cluster. The use of SIC codes is not unproblematic. On the one hand, "[t]he Standard Industrial Classification…gives more weight to manufacturing than its share in UK output would warrant" (HM Treasury, 2004). On the other hand, several production-intensive activities that one would normally consider to form part of the manufacturing sector are not included under the SIC definitions. Acknowledging these issues, Figure 3 provides trends for the development of different sectors operating in the Cambridge cluster. Most of the high-technology sectors experienced employment reductions, although the effects differed in magnitude. As Figure 3 reveals, employment in R&D firms was relatively stable. In contrast, biotechnology firms, which had been a key driver of the earlier recovery, experienced a notable reduction in employment. Similarly, IT software employment declined slightly from 2008, while manufacturing employment in instrumentation continued on the downward trajectory that began during the late 1990s.

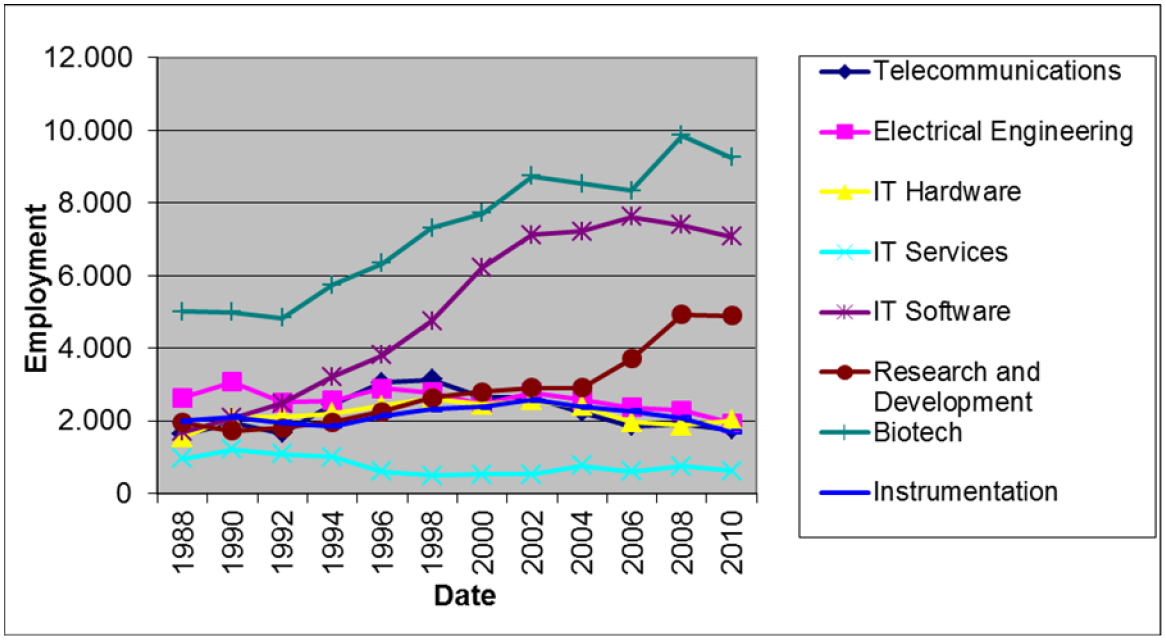


Figure 3 – Employment Development by Sector 1988-2010

While IT software employment remained relatively stable, Figure 4 reveals that the total number of firms in the IT sector declined to the levels of late 1990s and below the long-term trend discernible in the number of IT firms (Drofiak and Garnsey, 2009). This sector includes a large proportion of vulnerable micro firms with fewer than five employees.

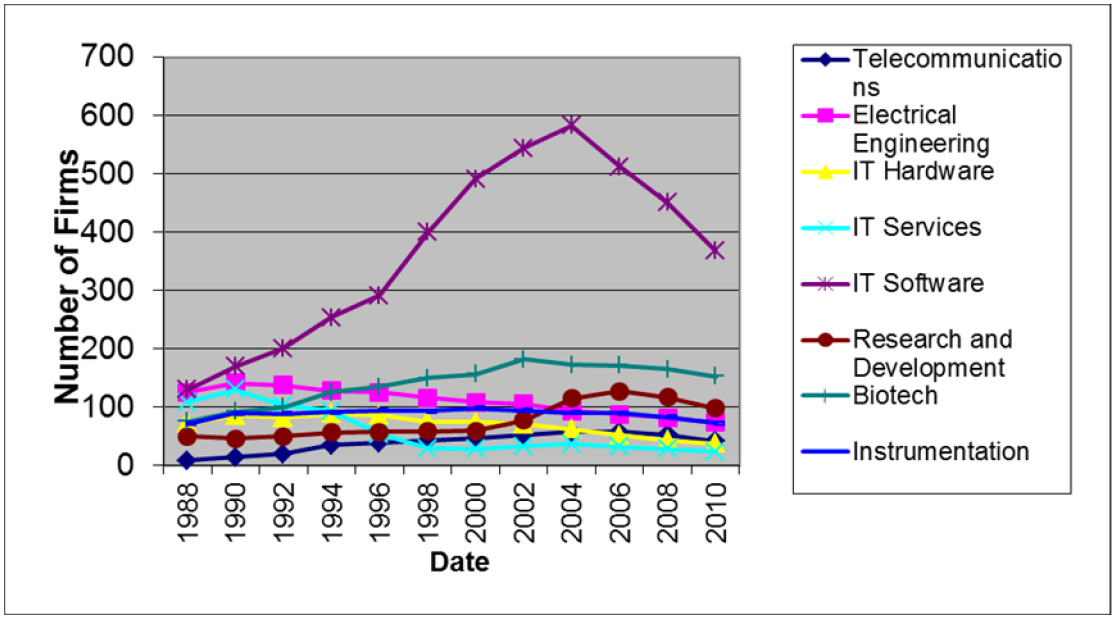


Figure 4 – Firm Development by Sector 1988-2010

Encouragingly, however, it appears that firms starting up during the 2004-2006 period exhibit relatively high survival rates despite the financial crisis. Figure 5 shows that the four year

survival rate of the 2006 cohort of firms (top left) is comparable to that of the 1992 cohort of firms and notably higher than those of the 2002 and 2004 of firms, perhaps because in a period of downturn, firms must have good prospects in order to start up at all.

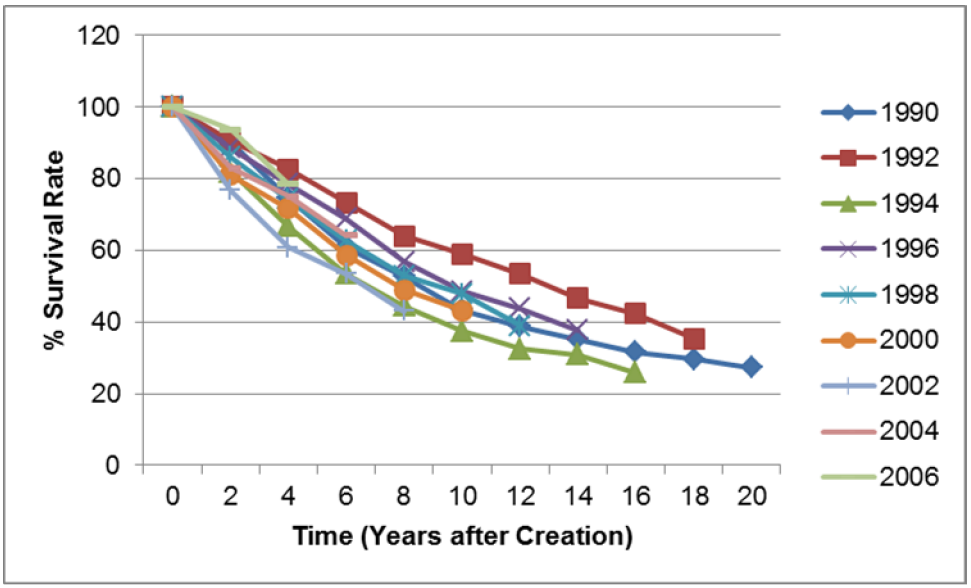


Figure 5 – Survival Rate by Cohort 1990-2006

3.3. Entry and Exit

Underlying the patterns summarised in the previous figures, were industrial dynamics as firms expanded, declined, entered and exited the cluster. This form of "creative destruction" provides an important source of resource reallocation (Schumpeter, 1934; Henkreson and Johansson, 2010; Stangler, 2010; Dejardin and Fritsch, 2011). Henrekson and Johannson stress that:

> "a prerequisite for the growth of [...] firms is also that the process of creative destruction functions so that efficient new and expanding firms can attract resources from inefficient firms, resources that are released through contraction and exits. Without this dynamic reallocation the growth of firms will be hampered […]" (2010, p. 240).

Figure 6 and Figure 7 trace the entry-exit behaviour relative to jobs and firms in the Cambridge cluster. Figure 6 disaggregates the net decrease in firm numbers discernible in Figure 1. The net exit of firms in the cluster continued from the 2006-2008 period to the 2008-2010 period, mostly as a result of a continued scarcity of new entries. Presumably

potential entrepreneurs were unable to secure funding for new companies or saw fewer opportunities during the financial crisis. The number of firm closures nearly doubled between 2008 and 2010, resulting in a net decrease in firm numbers. Figure 7, in turn, illustrates the employment effect of these firm entries and exits alongside jobs that were created or lost as firms expanded or declined. The figure reveals that while the job losses resulting from firm closures were comparable to previous years, the majority of employment losses occurred as constituent firms in the cluster reduced their size. In contrast, the number of jobs created by expanding firms declined in comparison to 2008, but was nonetheless similar to the expansion between 2002 and 2006. New jobs generated by newly established firms, however, reached an all-time low, suggesting that newly established firms were mostly micro-firms. The following section expands further on firm size issues.

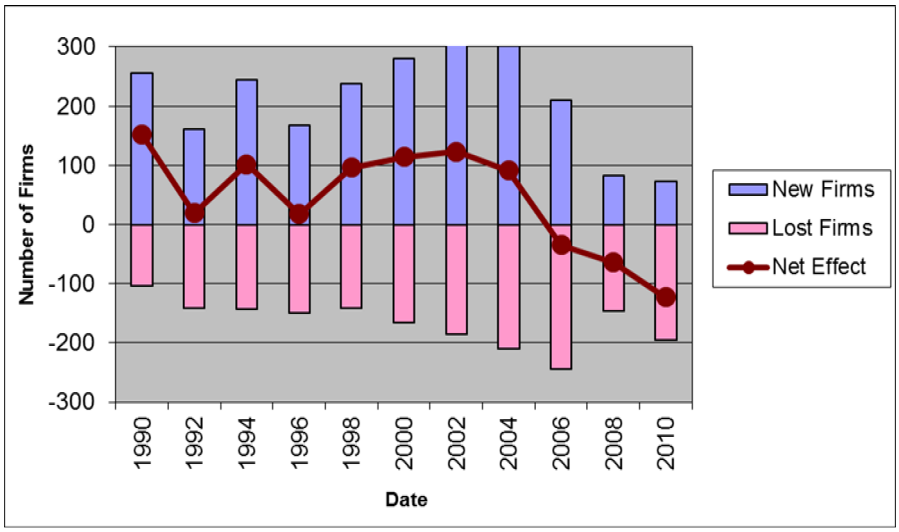


Figure 6 – Constituents of Net Firm Stock Changes 1990-2010

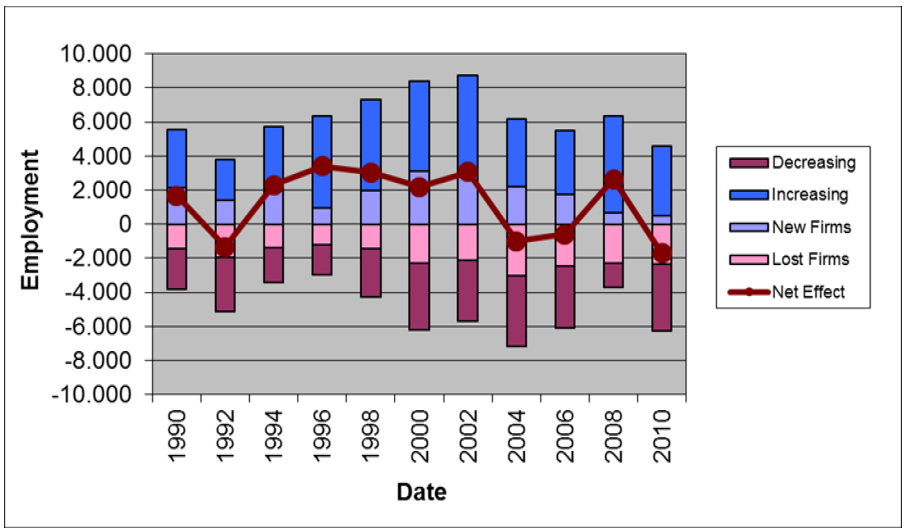


Figure 7 – Constituents of Net Employment Changes 1990-2010

3.4. Firm Size

Changes in job numbers were driven by changes to the average size of high-technology firms in the cluster. Figure 8 illustrates this issue by comparing the mean firm size and the number of firms in the cluster between 1988 and 2010. Between 2008 and 2010, the mean size of firms continued to increase, albeit at a reduced rate when compared to the increases between 2006 and 2008, reaching the levels of the late 1980s.

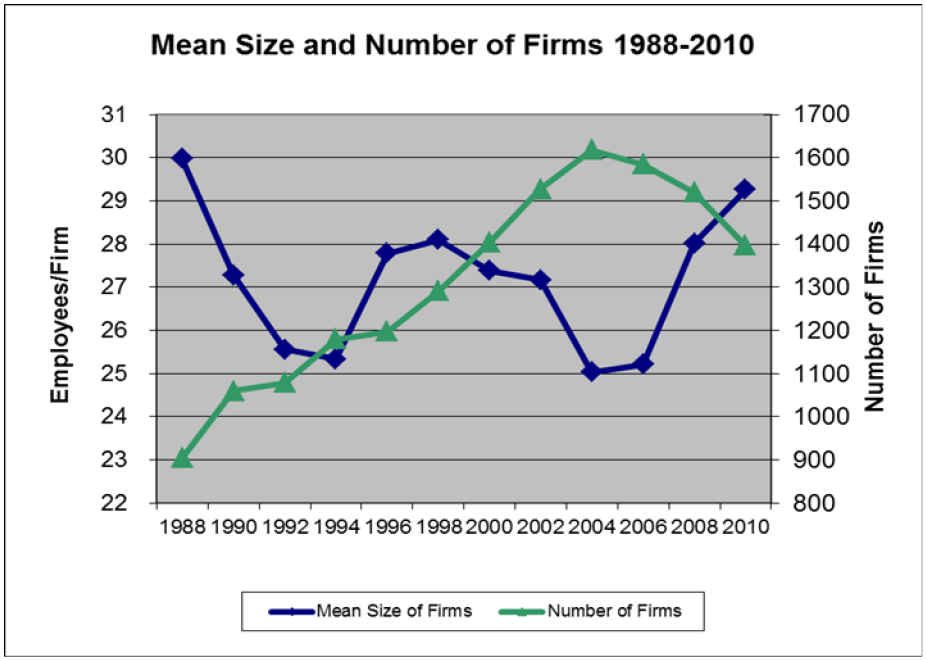


Figure 8 – Average Firm Size in the Cambridge Cluster 1988-2010

Figure 9 provides further information on the average firm size by sector. Increase in mean firm size was driven by notable increases in the average firm size in the research and development sector, and among IT hardware firms, trends had been evident in these sectors since the early-mid 2000s. In contrast, biotechnology firms, whose average size increased notably during the 2006-2008 period, remained relatively stable at levels previously seen during the late 1980s. The number of communications companies in the cluster declined significantly (see Figure 4), while the average size of surviving communications firms continued to increase.

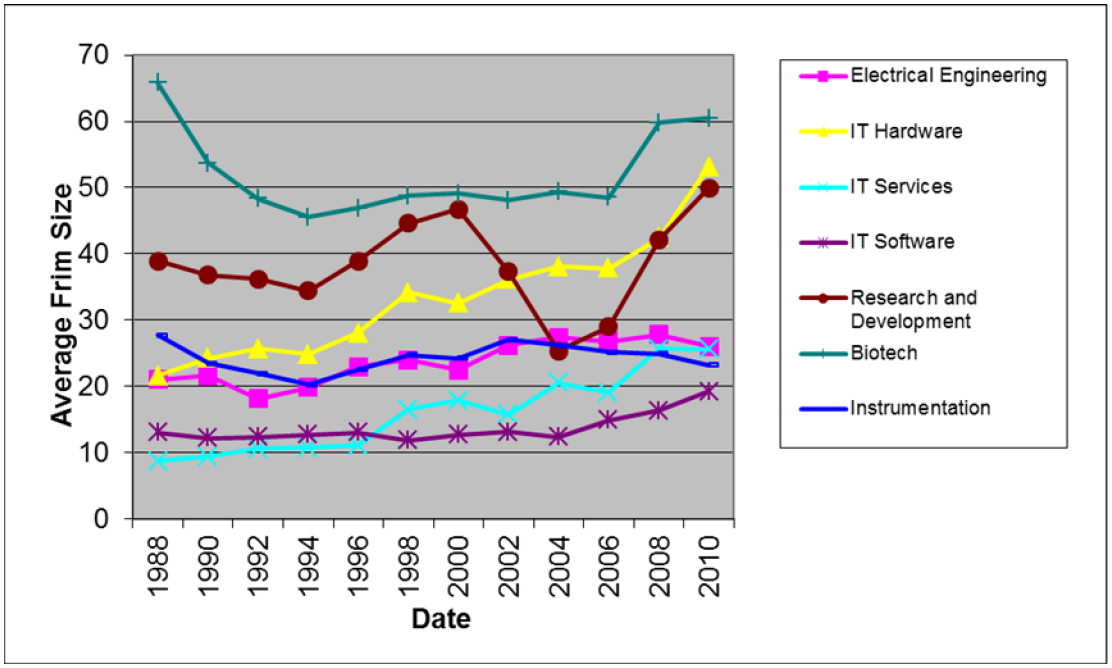


Figure 8 – Average Firm Size by Sector 1988-2010

Underlying the 'average firm' is the distribution of firm by size in the cluster. Figure 10 shows that the share of firms with 10 employees or less, and of firms with more than ten but fewer than 50 employees, declined between 2008 and 2010. The declining share of micro-firms in the cluster that had been characterising this category from 2004 onwards appears to have slowed down during the 2006-2008 period (see Figure 11). In contrast, the share of medium-sized and larger firms increased, though there was still a deficit of firms in the important 50-200 employee category.

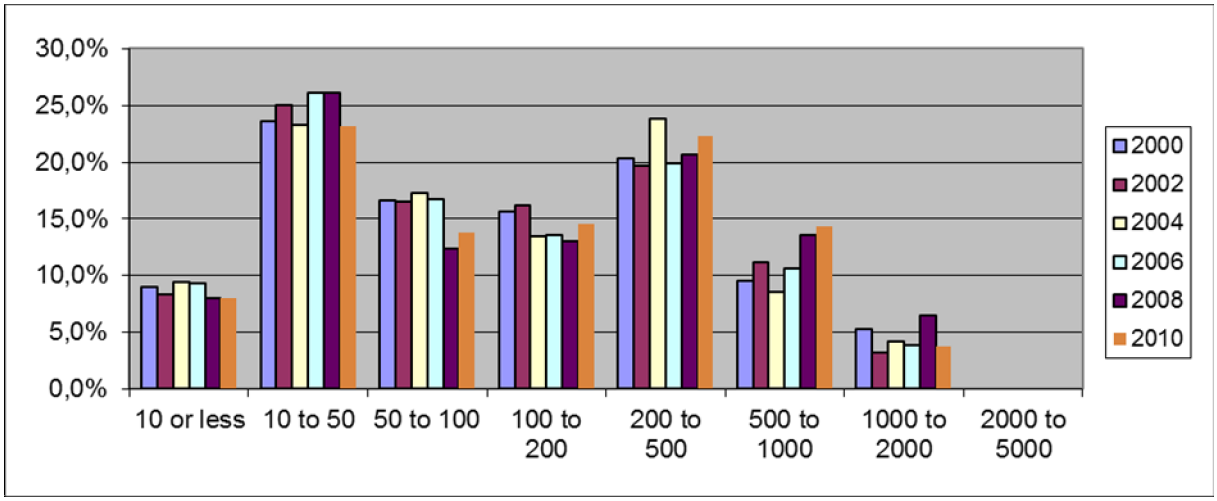


Figure 10 – Firm Size Distribution in the Cambridge Cluster by Year 2000-2010

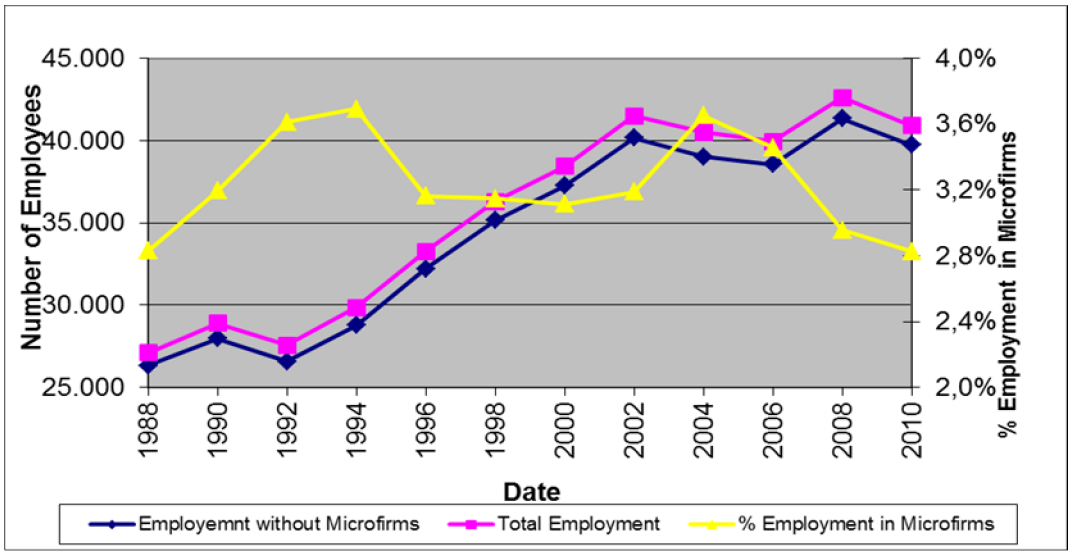


Figure 11 – Employment Contribution of Microfirms 1988-2010

The changes in the size category distribution in Figure 10 is shaped by the number of firms moving between different firm size categories. Figure 12 and 13 analyse these movements for the small and large size categories respectively. The number of firms moving up size categories (shown in Figure 12 and Figure 13) reveals some obstacles to expansion which continued during the 2008-2010 period. Though the number of firms increasing in size from 10-19 to 20-49 employees actually rose between 2008 and 2010, upsizing among all other categories of firms declined after 2008. Figure 12 shows that micro-firms encounter challenges in scaling up to larger sizes, as there was no change in the number of firms in each grouping. Similarly, Figure 13 reveals a similar loss of dynamism among larger firms during the financial crisis, with the majority of firms failing to increase in size.

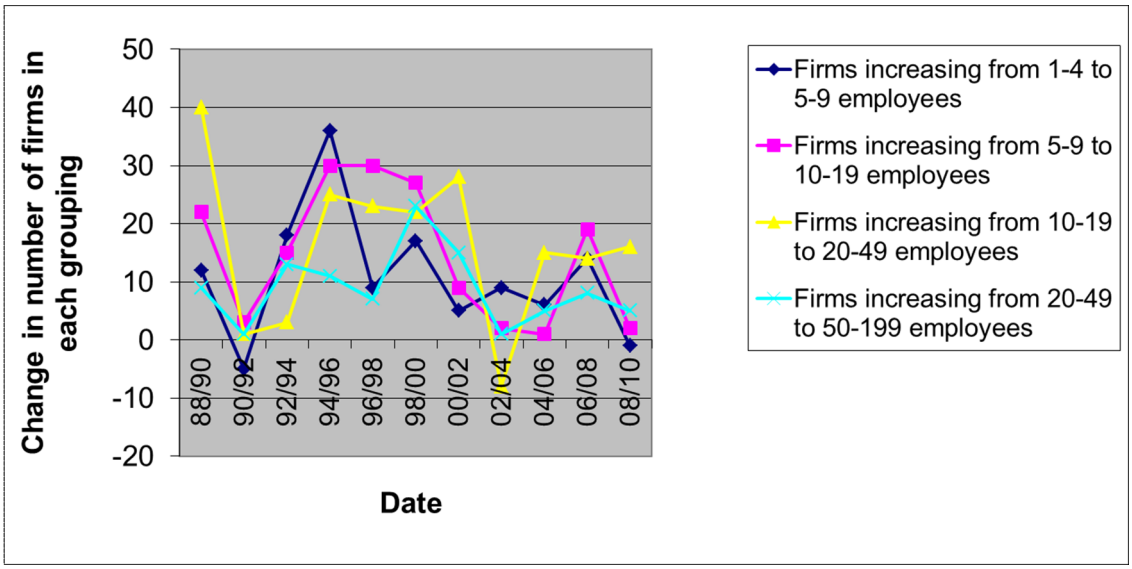


Figure 12 – Number of Firms Moving Between Small Firm Size Categories 1988-2010

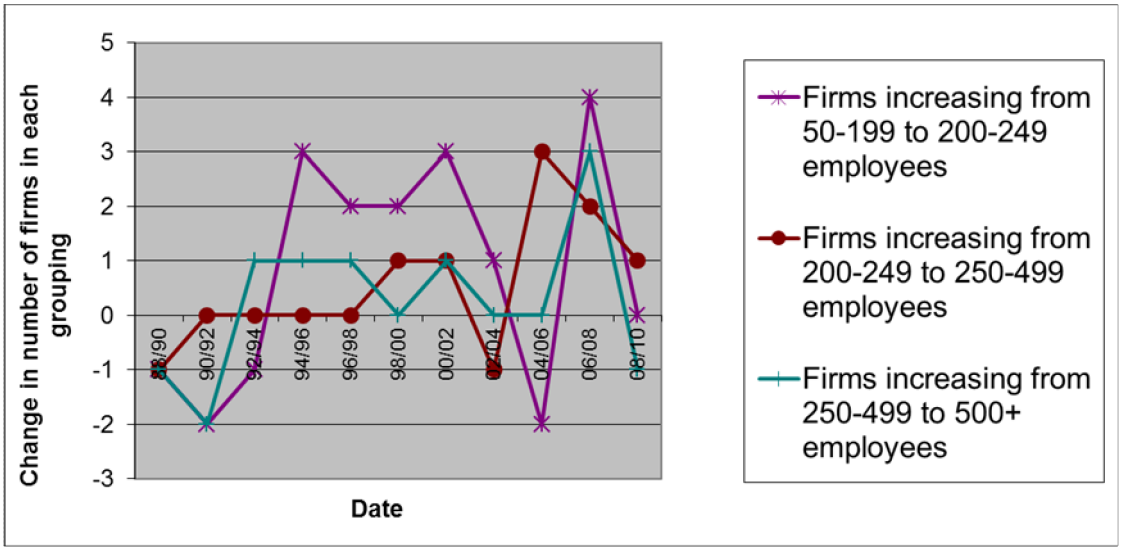
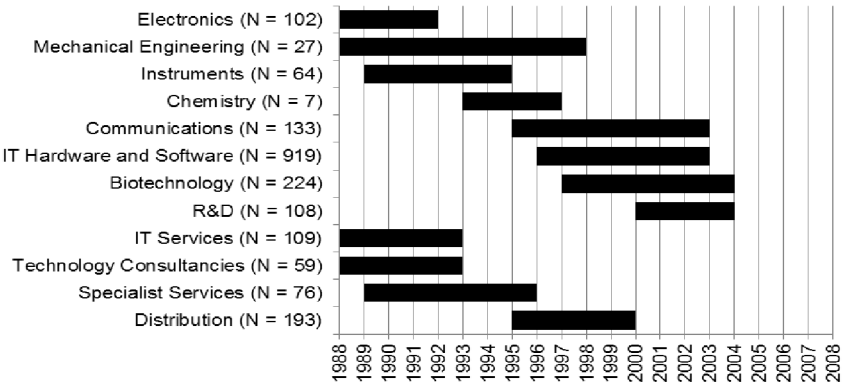


Figure 13 – Number of Firms Moving Between Large Firm Size Categories 1988-2010

3.5. Emerging Industries

"there is no automatic economic or political mechanisms that assures cities or regions [the capacity] to successfully renew themselves" as Boschma and Frenken noted in 2006 (p. 23). But over several decades the Cambridge cluster has experienced continuous waves of renewal as new firms have entered, supporting the development of the cluster. Figure 14 illustrates the entry windows of 50% of firms in selected different manufacturing and service firms in the high-technology cluster during the 1988-2008 period (Mohr and Garnsey, 2010). Initial entry waves in electronics and instrumentation during the late 1980s and early 1990s, were followed by emergence of communications, IT and biotechnology firms during the late 1990s and early 2000s.



Source: Mohr and Garnsey, 2010

Figure 14 – Entry Patterns in the Cambridge Technology Cluster

Figure 15 and 16 trace the employment levels and firm numbers in three sectors that have increasingly been cited as drivers of future economic growth in advanced economies – opto-electronics, environmental technologies and regenerative medicine (BERR, 2009)[2]. Drawing on the cluster's traditional strengths in the physical, engineering and life sciences, all three sectors have begun to emerge in the Cambridge cluster. Akin to Figure 14, a wave pattern is discernible at this micro-level. While opto-electronics firms experienced a wave of entry during the early 2000s, the number of environmental technology firms began to expand rapidly from the mid-2000s onwards, following the growing prominence of environmental issues in the international conversation. Similarly, the late 2000s saw the initial emergence of regenerative medicine firms in Cambridge. Encouragingly, Figure 13 indicates that these sectors provided important sources of job growth during the 2008-2010 period.

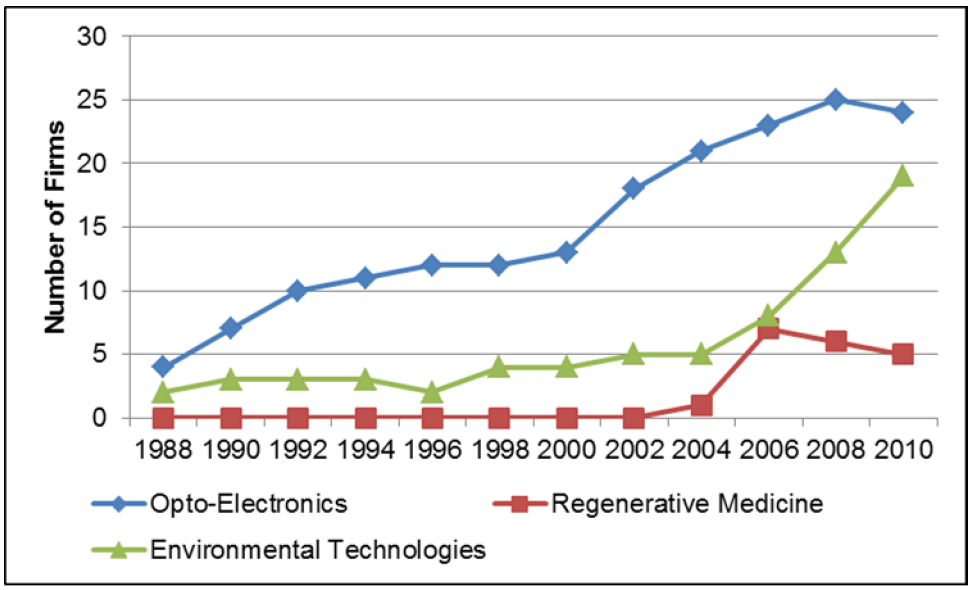


Figure 12 – Number of Firms in Selected Emerging Industries 1988-2010

[2] Figure 15 and 16 exclude the employment created in large multinational firms located in the Cambridge cluster, such as Pfizer, which have recently intensified their involvement in the sectors analysed.

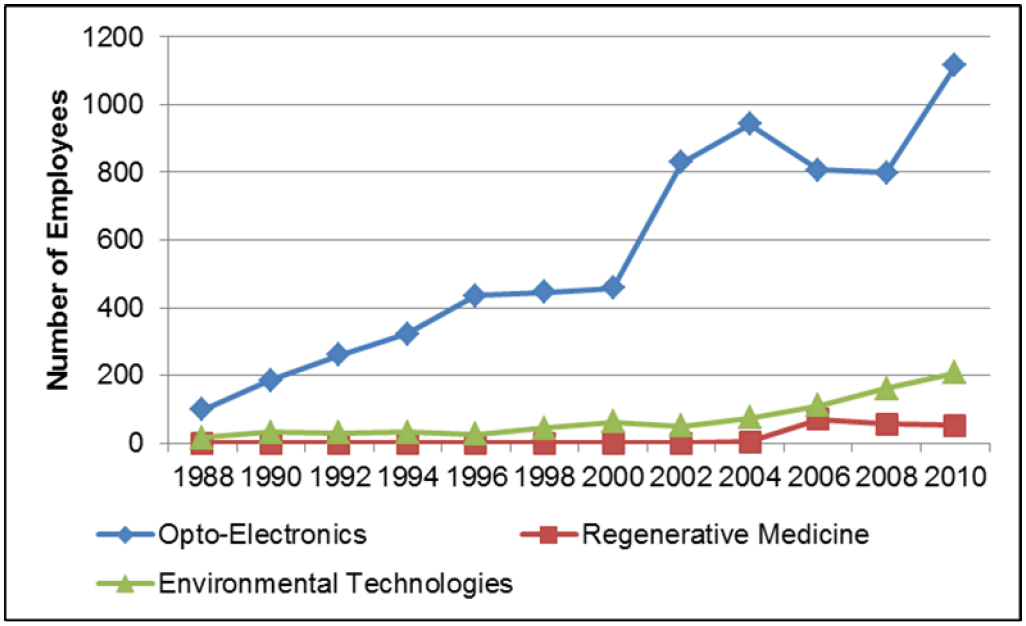


Figure 13 – Employment in Selected Emerging Industries 1988-2010

The importance of larger independent firms for the area is shown by the performance of four among , ARM (chip design), Autonomy (search engines), CSR (semiconductors) and Domino (ink jet printing). These have grown to become leading firms in their respective industries despite initial periods of setback (Garnsey et al., 2006). Figure 14 analyses the cumulative employment in these firms from 1988 to 2010. Employment in these firms decreased only by 2.5% and thus substantially less than the cluster overall, illustrating the reduced vulnerability of these firms as a result of their size and industry leadership.

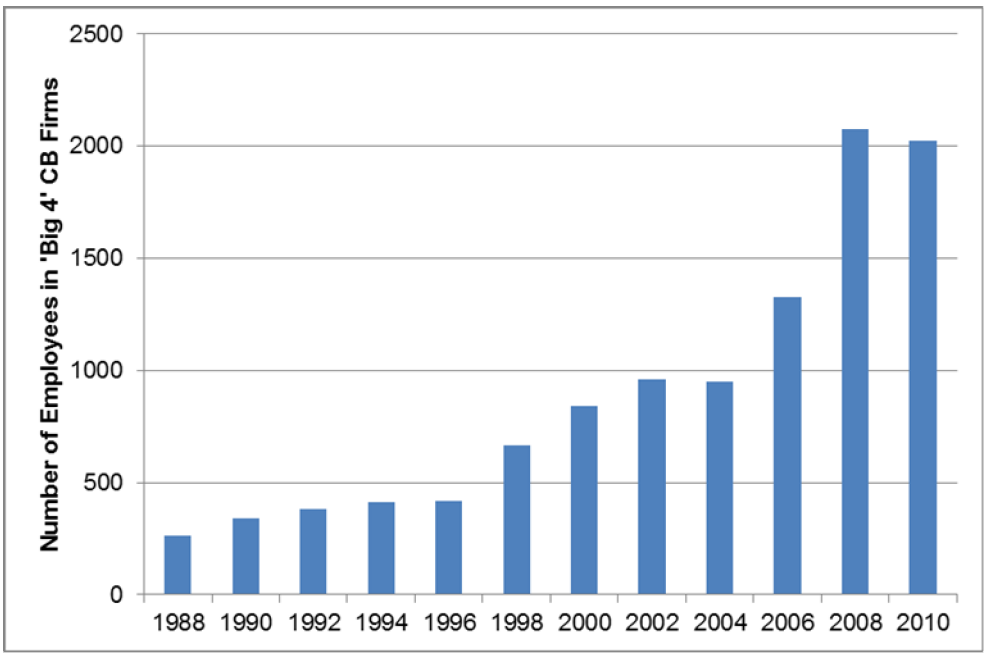


Figure 14 –Impact of ARM, Autonomy, CSR and Domino on Jobs

4. Conclusion

The number of firms in the Cambridge high tech cluster is down to levels in 2000, largely asa result of reductions in the numbers of micro-sized firms. Jobs kept up better than firm numbers through to 2010, and there was actually expansion in employment in selected emerging industries including opto-electronics and environmental technology. Firms founded recently showed higher survival rates than those founded earlier on, suggesting that, as in the early 1990s, only firms with good prospects are started during a period of economic stringency. These firms showed greater resilience than might have been expected. But if they are to fulfil the hopes pinned on them, their growth requirements need to be understood and met to a greater extent than has occurred so far.

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