

The Growth of UK Companies and Their Contribution to Job Generation, 1985–1987

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ABSTRACT. Theories of firm growth are reviewed and various models examined. The firm growth and job generation process in the UK over the period 1985–87, is examined empirically, by using the very large data files of the Dun and Bradstreet credit rating organisation. In the analysis, four computer processes were carried out; the sorting and matching of files, the cleaning of the data, the validation of the cleaned data, and the scaling up the results. The final adjusted data were grossed-up to provide an overview of the growth and job generation potential of UK firms. This is compared with past results for the periods 1971–81, and 1982–84. Small firms performed well, providing 48% of all new jobs, although consisting of only 21% of all employment in 1985. The 1000+ employee range provided only 13% of all new jobs over the period, although consisting of 37% of all employment in 1985. An overall trend of positive performance in smaller firms, and negative in larger firms was apparent. The 20–49 employee cohort performed unusually poorly in firm and job creation, against the expected pattern. The effect of takeovers, mergers and rationalisations on employment was examined. As expected, there was negligible restructuring of small firms, but over 5% of employees in the largest 1000+ cohort were involved in some form of reorganisation.

In this and the two previous studies for 1971–81 and 1982–84, we found a consistent pattern of small firms as net generators of jobs, and large firms as net losers. This overall net behaviour is essential for the overall stability of the population, and can not be seen in 'good' or 'bad' terms. Bolton in 1971 found that the UK had an unduly small and weak small-firm sector. That trend to concentration is being reversed.

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1. Theories of firm growth

a. Evolutionary theories

The development of theories of firm growth can be viewed against the back-cloth of historical social attitudes. The 'Newtonian' view of the economy as a mechanistic system gave way to a 'Darwinian' view based upon the competition of the young for resources. In spite of its limitations, this view had the merit that it led researchers to start to view the diversity of firms in the economy as a 'population', which could be studied in ways similar to other populations. The concept has since been expanded to that of a dynamic population which changes through time whose characteristics have now been statistically described in some detail by Ganguly (1985), Gallagher and Doyle (1987), and Birch (1987).

Many authors when discussing firm growth refer back often unknowingly, to the work of Alfred Marshall (1920), who first provided a biological analogy of the growth of firms:

A business firm grows and attains great strength, and afterwards perhaps stagnates and decays; and at the turning point there is a balancing or equilibrium of the forces of life and decay . . . Here we may read a lesson from the young trees of the forest as they struggle upwards through the benumbing shade of their older rivals. Many succumb on the way, and only a few survive; those few become stronger with every year, they get a larger share of light and air with every increase of their height and at last in their turn they tower above their neighbours, and seem as though they would grow on for ever, and for ever become stronger as they grow. But they do not. One tree will last longer in full vigour and attain a greater size than another, but sooner or later age tells on them all. Though the taller ones have a better access to light and air than their rivals, they gradually lose vitality and one after another they give place to others, which though of less material strength, have on their side the vigour of youth.

The use of biological analogies for the growth of firms has continued to be popular. The Bolton report (1971), for example, described how one of the most important functions of the small firm sector was to act as a 'seed-bed' from which the new large companies of tomorrow will develop. Economics was given a sound basis for a life cycle view of firm development and growth by Schumpeter (1943). Batstone *et al.* (1988) have recently reviewed biological/life-cycle analogies of firm growth, and cite a wide range of authors who support these analogies. The life cycle is discussed by Evans (1987a, and 1987b), Gallagher and Doyle (1987), and Fothergill and Gudgin (1982). The forest analogy is discussed by Boswell (1973), Storey (1982), and Bannock and Doran (1978). Beesley and Hamilton (1984) also comment on the seed-bed analogy. Batstone *et al.* (1988), concluded in their review, that the stress of these 'evolutionary' approaches to firm growth is on the uncertainty of the market, as the equivalent of the role of selection pressure in biological evolutionary theory.

b. *The limitations of biological analogies*

Ritchie (1986) has argued that a life cycle view of firms includes stagnation as an inevitable part of the process, which is not apparent in nature. Stanworth and Curran (1986) oppose the use of an idealised version of nature to explain firm growth. They argue that biological analogies are imprecise, and are inadequately tested and articulated. They argue that there is no single stereotypical entrepreneur, and therefore there can be no single pattern for company growth. They suggest that the entrepreneurial role should be linked with firm growth, to enable a 'social dynamics' analysis to be made.

Marshall (1920) described how the biologists had learnt from the economists to help build their theories of evolution, and then how the economists in their turn learnt from the biologists. Current biological analogies have not taken account of recent biological theory. In real woods, the potential for growth is determined partly by environmental conditions, and partly by inherited genetic information. A forest is made up of several layers, or galleries, and the types of trees existing in each gallery is determined genetically. In a

mono-specific wood all of the trees would be of a very similar size (for example, a beech wood). Such a 'real' biological analogy to explain firm growth is obviously inappropriate. There also is confusion between the growth of individuals and the growth of populations or of cohorts within the population. Doyle and Gallagher (1986) attempted to use this analogy when trying to expand the trees-in-the-wood analogy.

c. *The neoclassical model*

In the neoclassical model, growth is perceived as a loosely defined adjustment mechanism related to the concept of optimum size, where optimum size is related to the long run maximisation of profits. There is no predetermined concept of optimum size, since it changes as economic conditions dictate. This model is abiological in concepts, and is similar in approach to Stanworth and Curran's (1986) social dynamics model, in that it allows a role for the entrepreneur.

Kumar (1984) identified two types and two models of firm growth. These growth forms are seen as independent of the models, with either being found in both models. The two forms of growth are external and internal. External growth is defined as growth by acquisition and internal growth is defined as the total growth minus the external growth. For example, internal growth can be the result of the investment of profits back into the company.

d. *The stochastic model of firm growth*

The stochastic model is based upon the observation that the size distribution of the population of all firms is highly skewed, and that the upper tail of the curve resembles a Yule distribution (Kumar, *op. cit.*), which resembles the log-normal curve. From this observation it was deduced that the size of a firm should have no effect upon the expected growth of that firm. This is known as the Law of Proportionate Effect, or Gibrat's Law. It proposes that firm growth must be a random process, with any firm having an equal chance of growing to any particular size. One important argument against this model is that it does not allow for a decrease in firm size, i.e., the stochastic model explains the Yule distribution only in terms of positive com-

pany growth. Yet common observation shows that in the long run, as many companies decline as expand. Ijiri and Simon (1977) modified the model somewhat, deriving a stochastic process that could explain the Yule distribution, with firm growth being dependent on previous size increments.

e. *The Birch thunder cloud model*

Birch (1987) has reviewed his many previous statistical studies of the US economy, and has proposed the apt novel analogy of a thunder cloud to characterise the growth of businesses. The thunder cloud is a stable entity when viewed from a distance, but inside, its boundary is in considerable turbulence, with water droplets escaping, moisture being absorbed, and considerable internal movement and change of droplet size constantly taking place. This provides a graphic picture of the degree of turbulence which is constantly taking place within the system.

2. Job generation studies

Job generation studies have empirically examined the growth of companies, in terms of their contribution to the creation and destruction of jobs. During this century until the early 1970s, there had been a steadily increasing concentration of business (Prais, 1978). Concern about the extent of this concentration led to the 'Committee of Inquiry on Small Firms' (Bolton, 1971). The report pointed out that the concentration of production had had a harmful effect upon the small firm sector, and hence on the economy as a whole. The economic recession in the 1970s severely affected large companies, and in particular they created significant unemployment. Large firms were at that time clearly unable to create the new employment needed to offset these losses. In 1979 Birch published his seminal study of job generation in the USA which emphasised the major role which was being played by small firms in the creation of jobs in the USA. This study had a major impact upon policy makers and politicians in Europe.

The revitalisation of the small firm sector was seen to be of fundamental importance. This realisation led to a great increase in State policy

directed towards the small firm sector and to the stimulation of studies on the job generation potential of small businesses. The early studies of small firm job generation were largely empirical in nature. They also reinforced state policy, in that they demonstrated that the small firm sector had over the period being studied, when compared with large firms, a higher net rate of creation of new jobs. They also made clear that the picture is a complex one.

Detailed reviews of job generation studies have been carried out by Gallagher and Stewart (1986), Curran (1986), and Storey and Johnson (1987). What is clear from these reviews is that there is now a need for work which examines the issues of job generation by combining both an empirical and a theoretical viewpoint. This present paper seeks further refinement and elaboration of the empirical results. Without this base, theoretical discussions can only be speculative.

3. An analysis of job generation 1985–1987

In the study reported here, job generation in the UK over the period 1985–87, is examined empirically, with particular reference to small firms, and firm growth. The empirical work is based upon the very large data files of the Dun and Bradstreet (D and B) credit rating organisation. The D and B database is a very large commercial information database which is maintained to a high standard of accuracy for credit-rating information purposes. The basic 1985 and 1987 D and B databases held 320,000 and 360,000 records respectively. This study gives indications of the relative performance of firms over the period 1985–87, by size, in the UK job generation process. Previous work based on the D and B files has covered the periods 1971–1981 (Stewart and Gallagher, 1985) and 1982–1984 (Doyle and Gallagher, 1986).

The use of the D and B files for this type of research has been adversely reviewed by Storey and Johnson (1987). They questioned the use of ranged employment data in the 1971–1981 and 1982–1984 studies (the file since 1985 records exact employment data), and argued that D and B under-sample births and small firms in general. They suggested that the rapid growth observed in some firms may be due to clerical errors, and that

the data may be unduly biased towards dynamic small firms. They argued that small firm job generation is concentrated in a relatively few firms, so that the results are particularly sensitive to a small subset of the data. All of these points have been specifically addressed in this paper.

Although very large, the database must be treated as a sample of the UK population of firms, and data validation and scaling up procedures need to be followed. Four major computing processes were followed in this study: (a) sorting and matching the files; (b) cleaning the data; (c) validating the cleaned data; and (d) scaling up the results. All of the analyses and procedures were carried out using the statistical package SPSSx

a. *Sorting and matching the files*

The records on the files were sorted and matched by DUNS number, a unique numerical identifier. Full details of the file structures are available in Gallagher *et al.*, 1990. The records output from the matching were sorted into three categories. A record with the same DUNS number in 1987 as in 1985, was placed in the 'matches' file. A record with a DUNS number in 1985 and not in 1987 it was placed in the 'deaths' file. Conversely, if a DUNS number existed only in 1987 and not in 1985 then the record was written to the 'births/enhancements' file, and this file was then split according to the start-up date for the enterprise. Records with a start date after the end of 1985 were put in the births file, records with a start date prior to 1986 were put in the enhancements file.

b. *The cleaning of the data*

Three primary cleaning operations were performed on each of the data files. Firstly, all records with no employment information were removed from the files. Secondly, all records which were for branches of multi-branch enterprises were removed, as D and B record employment figures with the head office. Third, all of the records for subsidiary companies were removed from the files, to also avoid double counting.

c. *The identification of clustering of employment data*

An initial exploration of the employment data was

carried out by plotting the log-transformed employment data for 1985 and 1987 against one another. It became clear that some form of clustering of the 1985 data was present, revealed as visual horizontal striping in the plot. The same procedure was carried out on the 1984 and 1986 employment data, and the striping was even more distinct. Before 1984, the employment data had been coded as a ranged, not an exact figure. It appears from these results that as D and B changed from ranged to exact data, where a company had not been updated since the change over, then the mid-point value for the range band had automatically applied. This was further checked by dividing the data into size bands and performing a frequency analysis on the subsets.

The main problem caused by this process lay in the distribution of the 'real' data. The population size curve was highly skewed towards the smaller companies (see Section 3.2), thus any allocated values should have been less than the mid-point for the band. The consequence of this misallocation was that when the record was updated, there was a high probability that the company would exhibit an apparent net decrease in size. This would seriously influence any subsequent job generation analyses. It was ultimately decided that the best option was to remove all of those records from the deaths and matches files which contained a mid-point value for employment in 1985. A subsequent log plot of the cleaned data did not exhibit any striping. Full details of the handling of this striping is given in Gallagher *et al.* 1990.

4. *Validating the cleaned data*

A preliminary analysis of the cleaned births, deaths and matches files revealed a high number of large companies that had been born or had died, as well as a number of companies with exceedingly high growth rates. A large sample of both these 'outliers' and of 'normal' companies were examined in detail. This was accomplished by using on-line computer access to the full commercial D and B DunsTel and DunsPrint services. For each of the sample companies individually checked, a hard-copy business report was obtained, which is very comprehensive and detailed. It was thus possible to identify the current state of each particular company, as well as its state in 1985–1987. Typical examples from

the births, deaths and matches files have been provided in the full detailed report available on this research (Gallagher *et al.*, 1990).

a. *The validation of the births*

The number of companies to be sampled in each band needed to be defined in a way which would give an acceptable level of probability of accuracy. Each size-band sample was defined in terms of the maximum percentage of the population that could have a particular attribute, and yet for there to be at least a 10% chance of the attribute not being present in the sample. To determine the appropriate sample size for each band, successive values of sample size were chosen that put the percentage missed below a value of 0.5%. The exception to this rule was companies employing over 1000, which were all examined.

One striking feature was that clerical errors accounted for 6% of the population in our sample, and for 87% of the employment, i.e., a few input errors had an enormous effect on the job generation equation. These massive effects all occurred in the 1000+ size band. Indeed virtually all of the employment error was in the 8000+ band. Thus the 100% sampling of these very large births was amply vindicated.

b. *The validation of the deaths file*

The procedure used to construct a sampling frame was identical to that used for births. The high percentage (54%) of companies that fell into the 'still in existence' category caused concern, this category maintaining its high percentage, in terms of both jobs and companies, across all size bands. D and B explained that this was due to the vigorous database cleaning which had occurred in 1986.

c. *The validation of the matches file*

A similar methodology as outlined above for births and deaths, was used to create a sample size for each band. The criterion used to evaluate the sample size was the percentage of total absolute population change likely to be missed. Each sample size was defined such that the change likely to be missed in each band was below 0.5%. As for the births sampling results, a small percentage of

clerical errors created very large changes in employment. In general, the matches sampled demonstrated a reasonable percentage accuracy over the central percentage growth bands, with accuracy rapidly declining as percentage growth/decline became extreme.

5. Adjustments to the raw data

Adjustments to the cleaned data, in the light of the data validation results, could be made in one of two ways, reflecting the differences between external and internal growth forms. They could be adjusted so as to take account of only 'real' births, deaths and matches, or could be presented so as to also look upon other changes such as takeovers, buy-outs, mergers, and reorganisations, as a part of the creation and loss process. The contrast here is for example, between the entrepreneur who establishes a new business, and creates new jobs 'ab initio', with a management buyout from an established corporation in which there is no creation of 'new' jobs, but only a book transfer of ownership. This second option would look upon a straight change of ownership as a death followed by a birth, and place more emphasis on structural change than is appropriate here. The first provides the 'bare bones' of the employment patterns for the period under study, and was used here.

a. *Adjustments to the matches.* The unadjusted data was corrected in proportion to the results from the matches sampling. This removed the extreme growth/decline values. A final correction was made to the creations to avoid double counting the jobs concerned with takeovers, mergers, and rationalisations.

b. *Overall adjustment to births and deaths.* The procedures were very similar to that for the matches, and the adjustments included only 'real births' and 'deaths'. The same procedure was carried out for job change.

c. *File enhancement, and the lag between births and deaths.* Our sample showed a 10% fall in the number of firms over the period (births, *cf.* deaths), while we knew from other sources of data such as the vat statistics, that they had actually increased over this period. The main explanations lay in the treatment of file enhancements, and a lag

TABLE I
Final cleaned ungrossed results for firms and jobs

Ungrossed data for firms										
Legend	1	2	3	4	5	6	7	8	9	10
Firm cohort size	Corrected births	Initial births	Deaths	Contracting firms	Expanding firms	No change	Net change	Total firms in 1985	% firms in 1985	Total firms in 1987
1-19	11,521	9,601	9,036	3,730	4,423	15,708	2,485	32,897	62	—
20-49	769	641	1,928	2,375	2,260	4,731	-1,159	11,294	21	—
50-99	223	186	329	1,248	1,707	1,502	-106	4,786	9	—
100-499	60	50	189	723	1,284	749	-129	2,945	6	—
500-999	5	4	28	107	142	49	-23	326	1	—
1000+	0	1	15	179	308	33	-14	535	1	—
Totals	12,579	10,483	11,525	8,362	10,124	22,772	1,054	52,783	100	53,837

Ungrossed data for employment													
Legend	11	12	13	14	15	16	17	18	19	20	21	22	23
Firm cohort size	Corrected births	Births	Deaths	Jobs in 85 in contracting firms	Jobs lost by contracting firms	Jobs in 85 in expanding firms	Expanding firms	No change	Net change	Takeovers, mergers, rationalisations	Total jobs in 1985	% jobs in 1985	Total jobs in 1987
1-19	59,701	49,751	68,732	35,566	11,219	22,118	39,907	111,810	19,657	0	238,226	3	—
20-49	22,704	18,920	56,454	70,647	18,163	66,520	36,841	133,433	-15,062	3,163	327,054	4	—
50-99	13,871	11,559	19,245	82,438	18,454	113,147	38,415	94,449	14,587	5,333	309,279	4	—
100-499	11,495	9,579	35,878	135,721	33,663	249,135	67,416	124,624	9,370	14,793	545,358	7	—
500-999	3,241	2,701	18,252	69,598	13,115	100,433	42,744	34,612	14,618	7,112	220,895	3	—
1000+	1,700	1,700	36,470	2,714,727	466,579	3,311,224	395,499	95,620	-105,850	325,218	6,158,041	79	—
Totals	112,712	94,210	235,031	3,108,697	561,183	3,862,577	620,822	592,548	-62,680	355,619	7,798,853	100	7,736,173

which occurs in the D and B data gathering system for births. Some births in the early part of the period are rejected as file enhancements, while deaths over the same period are counted. We calculated using this method of analysis, that it would be appropriate to scale up the births by a factor of 1.33.

For a second approach, the D and B sample can be compared with three possible populations of firms in the UK. These are, (a) the population of registered companies at Companies House (about 870,000 in 1985); (b) the population of firms on the vat register (1.4 million in 1985); and (c) the estimated total number of active firms in the UK (2.5 million in 1986). Of these, it compares best with the Companies House database, where the number of active companies on the register increased over the two year period by 7%, which on our D and B 1985 sample would require a 28% increase on the total of births.

Our final judgment was to correct the births results proportionately by a more modest factor of 1.2, except for the 1000+ category, on which we

had carried out 100% verification. The same scaling was also applied to the jobs results for births.

d. *The calculation of the results.* The results were then combined together to provide a summary of the numbers of firms growing, contracting or remaining static as well as the changes in the numbers of jobs (Tables I & II). The results were calculated as follows:

Total firms in 1985. This is made up of the sum of:

- The number of firms which did not change in size.
- The number of firms which lost jobs.
- The number of firms which gained jobs.
- The number of firms which died.

Total firms in 1987. This is made up of the sum of:

- The total number of 1985 firms.
- The number of new firms born.
- Less, the number of firms which died.

TABLE II
Final cleaned results for firms and jobs

Legend	Explanation	Calculation
1 Corrected Births	firm corrected births	
2 Initial births	firm births	
3 Deaths	firm deaths	
4 Contracting firms	firms which contracted	
5 Expanding firms	firms which expanded	
6 No change	firms which did not change	
7 Net change	net change in the number of firms	1-3
8 Total firms in 1985	the total number of firms in 1985	3 + 4 + 5 + 6
9 % firms in 1985	% firms in 1985	
10 Total firms in 1987	the total number of firms in 1987	7 + 8
11 Corrected births	jobs (corrected) from births	
12 Initial births	jobs from births	
13 Deaths	jobs lost due to deaths	
14 Jobs in 85 in contracting firms	jobs in 85 contr. firms	
15 Jobs lost by contracting firms	jobs lost due to contraction	
16 Jobs in 85 in expanding firms	jobs in 85 in exp. firms	
17 Expanding firms	jobs created due to expansion	
18 No change	jobs in firms which did not change	
19 Net change	net change in the number of jobs	(12-13) + (17-15)
20 Takeovers, mergers, and rationalisations	jobs in takeovers, mergers, and rationalisations	
21 Total jobs in 1985	the total number of jobs in 1985	13 + 14 + 16 + 18
22 % jobs in 1985	% jobs in 1985	
23 Total jobs in 1987	the total number of jobs in 1987	21 + 19

Total employment in 1985. This is made up of the sum of:

- The total of employment in firms which did not change in size.
- The initial employment in firms which expanded.
- The initial employment in firms which contracted.
- The initial employment in firms which died.

Total employment in 1987. This is made up of the sum of:

- The total of employment in 1985;
- plus, the total of employment in firms which gained jobs;
- plus, the total of employment in firms which were born;
- less, the total of employment in firms which lost jobs;
- less, the initial employment in firms which died.

6. Grossing-up

a. *The grossing-up procedure*

To gross-up these results, we needed to take into account a number of factors: (a) The distribution of firms and jobs in the population at large. (b) Known changes in the numbers of firms over the period being studied. (c) Known changes in the number of employees in the private sector in the UK over the period being studied. No comprehensive published data is available which covers all sectors of the economy, and also all sizes of firms. The Annual Census of Production, for example, covers only manufacture. However, the data on this subject has recently been reviewed in detail in Bannock (1989), and in Bannock and Daly (1990), and estimates of the distribution of firms and jobs by size of company in the UK are now available (see Table III).

Given the preponderance of incorporated companies on the D and B file, it is likely that most in the 1–2 and 1–5 categories will not be covered. For the purposes of grossing-up therefore, our results were compared with the Bannock estimates, (a) with the 1–2 category excluded; and

TABLE III
Daly/Bannock UK firm and job distribution estimates

Cohort size	Firms	%	Jobs	%
<i>All firms</i>				
1–19	2,254,178	96.1	6,837,000	34.9
20–49	45,502	1.9	1,365,000	7.0
50–99	29,766	1.3	2,048,000	10.4
100–499	14,194	0.6	2,374,000	12.1
500–999	1,487	0.1	1,030,000	5.3
1000+	892	0.0	5,948,000	30.3
Total	2,346,614	100.0	19,602,000	100.0
<i>Excluding those with 1–2 employees</i>				
3–19	790,843	89.5	5,081,000	28.5
20–49	45,502	5.2	1,365,000	7.6
50–99	29,766	3.4	2,048,000	11.5
100–499	14,194	1.6	2,374,000	13.3
500–999	1,487	0.2	1,030,000	5.8
1000+	892	0.1	5,948,000	33.3
Total	883,279	100.0	17,846,000	100.0
<i>Excluding those with 1–5 employees</i>				
6–19	326,361	77.9	3,362,000	20.8
20–49	45,502	10.9	1,365,000	8.5
50–99	29,766	7.1	2,048,000	12.7
100–499	14,194	3.4	2,374,000	14.7
500–999	1,487	0.4	1,030,000	6.4
1000+	892	0.2	5,948,000	36.9
Total	418,797	100.0	16,127,000	100.0

(b) with the 1–5 category excluded (see Table IV).

The significant points are: (a) Given the highly aggregated nature of the data, there is reasonable consistency between the ratios of the distributions for both firms and jobs. (b) The high ratios for the 3–19 and 6–19 categories are to be expected. This is notoriously the most difficult cohort upon which to find information. (c) The differences in the 1000+ cohort for numbers of firms is almost certainly due to differences of definition for holding companies (note the similarity in the employment figures). The reason for this difference needs to be examined, but it does not affect the overall broad results, in particular for jobs.

A summary of the ratios for firms and jobs is given in Table V. Our conclusion was to use the following rounded ratios for grossing-up, for both firms and jobs:

Size	Grossing ratios
6(3)—19	15
20—49	5
50—99	5
100—499	5
500—999	5
1000+	1

The possible use of different grossing factors for firms and jobs was considered in some depth. The summary results which followed from grossing-up using the same ratios for firms and jobs did eventually indicate a good similarity between our D and B sample, and the actual firm and job population distributions. The use of different grossing factors would have also added unnecessary complexity to the analysis.

of expansions outweighed that of contractions. This is not too suprising, since in this analysis there is no absolute limit to the number of jobs which can be gained in an expanding firm (in the smallest cohort), whereas the number which can be lost by a contracting firm cannot exceed 18. The overall job growth of 307,000 is the net result of four much larger figures, underlining the degree of turbulence in jobs.

iii. *The reliance of job generation performance on a small number of firms.* This covers two distinct points. First is the assertion that because only a small proportion of firms contribute significantly to employment growth, government assistance should be directed towards these firms. While this argument is beyond the detailed scope of this paper, the ability to identify such firms systematically in advance of their performance has up to now not been possible. Second, are our overall results sensitive to errors in the records of the small proportion of high growth firms? Third, is there a bias in the data acquisition procedures which leads to a relative over-sampling of fast-growing firms?

Inspection of the data showed that after the rigorous data cleaning and validation processes and the grossing up procedure there were no ultra-large extreme changes left. However, we did find that a high proportion of net job creation was due to a small proportion of total firms. Only 16% of firms expanded, and these were by definition responsible for 100% of the gross, and more than 100% of the net job creation. Focusing on the firms of most interest, those expanding out of the 5—19 size band, these were 3.5% of all firms

job creation identified is attributed to the smallest size band, even though this accounted for little more than one fifth of total employment in 1985. This is the result of a number of factors. The effects of births and deaths were more nearly balanced in this band than in the larger size bands. In terms of numbers of firms, it was indeed the only size band for which there were more births than deaths. Another factor was the degree to which the net effect of expansions outweighed that of contractions. This is not too suprising, since in this analysis there is no absolute limit to the number of jobs which can be gained in an expanding firm (in the smallest cohort), whereas the number which can be lost by a contracting firm cannot exceed 18. The overall job growth of 307,000 is the net result of four much larger figures, underlining the degree of turbulence in jobs.

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b. *The results of the grossing-up*

i. *An overview.* The results in Table V show estimates of nearly 600,000 firms in 1985 employing a 16.7 million. This is as close as could be expected to the actual figures; estimates of total sector employment in mid-1985 was 17.5 million including 2.6 million self-employed. Given the lack of coverage of the smallest firms, the fact that just over 1 million is not unreasonable. The estimate of 600,000 firms is consistent with actual incorporated businesses, although exact comparisons are difficult, because the way in which firms are associated is aggregated varies between sources.

New employment growth over the period 1985 to 1987 was substantially less than the official estimate of 610,000 (Fleming, 1989). This suggests that the very smallest firms, which do not get recorded by D and B, account for further substantial job generation. It may also reflect the effect of the analysis to err on the side of understating the small firms contribution. But above all it reflects imperfections in the original data and in the process of scaling up.

TABLE IV
UK firm and job distribution — a comparison of Daly/Bannock and D and B ungrossed results

Daly/Bannock (Excluding all firms with 1–5 jobs)			D and B 1985		Ratio
Size	Firms (A)	%	Firms (B)	%	A/B
6–19	326,361	77.9	32,897	62.3	9.9
20–49	45,502	10.9	11,294	21.4	4.0
50–99	29,766	7.1	4,786	9.1	6.2
100–499	14,194	3.4	2,945	5.6	4.8
500–999	1,487	0.4	326	0.6	4.6
1000+	892	0.2	535	1.0	1.7
Total	418,797	100.0	52,783	100.0	7.9

Size	Jobs	%	Jobs	%	
6–19	3,362,000	20.8	238,226	3.1	14.1
20–49	1,365,000	8.5	327,054	4.2	4.2
50–99	2,048,000	12.7	309,279	4.0	6.6
100–499	2,374,000	14.7	545,358	7.0	4.4
500–999	1,030,000	6.4	220,895	2.8	4.7
1000+	5,948,000	36.9	6,158,041	79.0	1.0
Total	16,127,000	100.0	7,798,853	100.0	2.1

Daly/Bannock (Excluding all firms with 1–2 jobs)			D and B 1985		Ratio
Size	Firms (A)	%	Firms (B)	%	A/B
3–19	790,843	89.6	32,897	62.3	24.0
20–49	45,502	5.2	11,294	21.4	4.0
50–99	29,766	3.4	4,786	9.1	6.2
100–499	14,194	1.6	2,945	5.6	4.8
500–999	1,487	0.2	326	0.6	4.6
1000+	892	0.1	535	1.0	1.7
Total	882,684	100.0	52,783	100.0	16.7

Size	Jobs	%	Jobs	%	
3–19	5,081,000	28.5	238,226	3.1	21.3
20–49	1,365,000	7.6	327,054	4.2	4.2
50–99	2,048,000	11.5	309,279	4.0	6.6
100–499	2,374,000	13.3	545,358	7.0	4.4
500–999	1,030,000	5.8	220,895	2.8	4.7
1000+	5,948,000	33.3	6,158,041	79.0	1.0
Total	17,846,000	100.0	7,798,853	100.0	2.3

generation was accounted for by those remaining below 50 employees, and virtually all by those remaining below 100. Although a small percent-

age of records accounted for the bulk of net job generation, it was not the case that the results are sensitive to a tiny handful of outliers.

TABLE V
UK firm and job distribution — a comparison of ratios Daly/Bannock and D and B ungrossed results

Excluding firms with 1–5 jobs			Excluding firms with 1–2 jobs			Overall average
Size cohort	Firms	Jobs	Size cohort	Firms	Jobs	
6–19	9.9	14.1	3–19	24.0	21.3	17.4
20–49	4.0	4.2	20–49	4.0	4.2	4.1
50–99	6.2	6.6	50–99	6.2	6.6	6.4
100–499	4.8	4.4	100–499	4.8	4.4	4.6
500–999	4.6	4.7	500–999	4.6	4.7	4.6
1000+	1.7	1.0	1000+	1.7	1.0	1.0

iv. *Does the file contain a too-high proportion of fast growers?* For this criticism to be valid and our final results to be affected, it would be necessary for an unduly large proportion of fast growers to be taken on to the database some years before they grew. There is no direct way of answering this point, but for it to be true, it would mean that future potentially fast growth companies would be more likely to be seeking credit, which does have some plausibility. On the other hand, our results certainly show that D and B do add to the database very many non-growers. Another indirect indicator that the data are not unduly biased comes from the results of the grossing up. If there were an over sampling of fast growers, one might expect the aggregate employment change to be significantly overstated; but this is not the case.

7. Discussion

a. Introduction

The size categories used of 1–19, 20–49 etc., are a historical accident and can be misleading statistically, as they are not systematic groups of jobs or of firms. In addition, each sizeband is heterogeneous, so that when we say that the 1–19 band performed well and the 20–49 band poorly, this does not imply a cut-off at 20. There will be a gradual change in performance with size.

Care needs to be used in interpreting the effects of changes at the cohort level, in relation to total population. As can be seen in the Bannock estimates, in terms of jobs, it is the 1000+, 1–19, and 100–499 categories in that order which are

particularly important. In terms of firms, the 1–19 category is overwhelming.

The period upon which this study is based, 1985–87, needs to be born in mind, as the job creating performance of firms has been found to be strongly influenced by the economic environment (Birch, 1987). Large firms were seriously affected by the recessions of the mid and late 70s. The strong performance of small firms in 1971–81 correlates with their growing contribution to the economy in the 1970s, when their share of employment increased. The trend away from manufacturing, and into the service sector will also have helped small firm performance. The effects of this shift on the job creation performance of small firms in the USA and West Germany has been examined in some detail by Acs and Audretsch (1988)

b. The job creation index

One way the employment creation performance of size-groups of firms can be assessed is by their contribution to the creation side of the equation, in terms of their total share of share of employment. A 'creation index' was computed as the ratio of two percentages, one for job creation, and one for employment, for each size cohort. In other words, (a) cohort (births + creations), as a percentage of all job creation; and (b) cohort (population), as a percentage of all 1985 population. The index is the ratio a/b. For comparative purposes, the results of the current 1985–87 study are given together with past results from studies carried out for the periods 1971–81, and 1982–84. The

three sets of results are given in Table VII and illustrated in figure 1.

When considering differences between the studies, it must be remembered that changes in data and methods will have had some effect. Most obviously, the use of exact data rather than ranged means that for 1985–87, unlike 1971–81, and 1982–84, it has been possible to record contractions in the 1–19 band, and expansions in the 1000+ band.

TABLE VII
A comparison of job creation indices

Firm size cohort	Time periods studied			Mean index
	71–81	82–84	85–87	
3–19	3.1	2.0	2.3	2.47
20–49	1.4	1.2	1.0	1.21
50–99	1.6	1.3	0.9	1.26
100–499	1.1	0.6	0.8	0.81
500–999	1.0	0.5	1.1	0.86
1000+	0.3	0.5	0.4	0.40

The small firms in the 85–87 sample performed well, providing 48% of all new jobs, over the period although consisting of only 21% of all employment in 1985. No firms in other size-groups performed as well. They suggest that the smallest firms still have a great potential to create jobs.

Firms in the 20–49, 50–99, 100–499, and 500–999 employee ranges all produced about the same proportion of jobs as their 1985 employment. The 1000+ group provided only 13% of all new jobs over the period, although consisting of 37% of all employment in 1985.

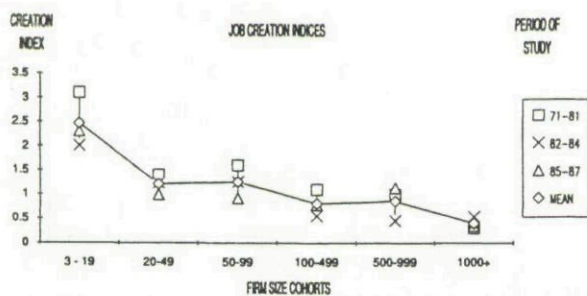


Fig. 1.

There is some consistency in the performance of the size ranges through time. The 5–19 cohort has a mean index of 2.47 for the three studies, and this then generally falls through the size ranges to a mean of 0.40 for the 1000+ firms (see Table VIII). The overall shape of the data in this chart is consistent with the concept of a dynamic population in some form of balance through time.

Another possible trend is that the creation indices of the 5–19, 20–49, and 50–99 cohorts have in general tended to decrease through time, while the indices for the medium sized and larger firms of 500–999, and 1000+ have shown a more stable overall behaviour.

TABLE VIII
A comparison of job loss indices

Firm size cohort	Time periods studies			Mean index
	71–81	82–84	85–87	
3–19	1.13	0.64	2.03	1.27
20–49	1.12	0.73	1.38	1.08
50–99	1.11	1.16	0.74	1.00
100–499	1.07	1.14	0.77	0.99
500–999	1.07	1.32	0.86	1.08
1000+	0.87	1.14	0.49	0.84

c. The job loss index

An index of job loss performance was computed in the same way, as the ratio of two percentages, (a) deaths plus losses, as a percentage of all job losses; and (b) size cohort of population as a percentage of total population. This was again carried out for all three studies, and the results are shown in Table VIII, and illustrated in Figure 2.

The data shows considerably less consistency than did the creation index. There is greater fluctuation among smaller firms in terms of loss than there is for larger firms. The indication is that small firms, (and in particular the 5–19 and 20–49 cohorts), suffer much greater fluctuations in their propensity to close or lose jobs through time than do large firms. This agrees with the well known vulnerability of small firms to changes in the economic climate. However, the mean index over the size ranges does not vary substantially.

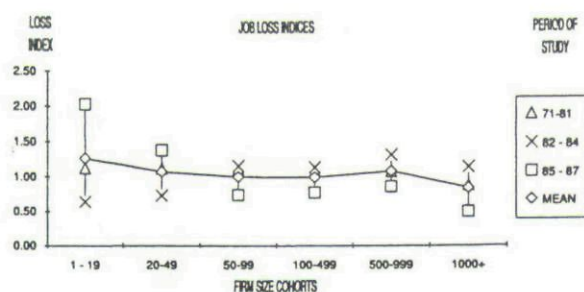


Fig. 2.

d. Job net fertility indices

A net fertility index was computed in the same way as for job creation and job loss, for each size cohort on the basis of: (jobs in new births in 87 size-band, plus jobs gained in expanding firms in 85 size-band, minus jobs lost by deaths from 85 size-band, minus jobs lost by contraction from 85 size-band) as a percentage of the same overall total. This is expressed as a ratio of the percentage total jobs in the size band in 1985.

The results are shown in Table IX and illustrated in Figure 3. They show a very much better performance by the larger firms since the 1982–84 study. The poor performance of the 20–49 cohort is to be noted.

There is clearly considerably more variation in net performance by size cohort. However the overall trend of positive performance in the smaller cohorts, and negative performance in the larger cohorts is still apparent. For example, over all three study periods, the 5–19 cohorts have

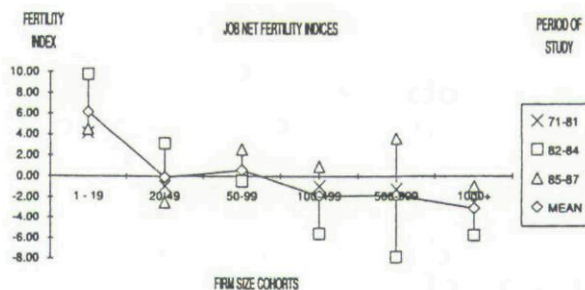


Fig. 3.

always been positive, while over the same periods, the 1000+ cohorts have always been negative. There has been some fluctuation (sometimes considerable) by the intermediate size ranges.

The mean and spread of the results in Figure 3 reinforces our overall understanding of the behaviour of our population of firms, that while it has broad longer term stable characteristics, it also has considerable variation in its makeup over the short term.

Once again, it becomes apparent how the net negative behaviour of larger firms, and net positive behaviour of smaller firms is essential for the overall stability of the population, and at one level, can not be seen in 'good' or 'bad' terms.

e. The poor performance of the 20–49 cohort

It is noticeable from Table VI that the 20–49 cohort has performed unusually poorly, both in terms of net new firm creation and in net new job creation. This is a trend which is against the pattern of recent years for this size cohort. The poor performance is even more noticeable in Table X, where the absolute figures for firms and jobs have been expressed as percentages of the 1985 employment in that size cohort. It can be seen in Table X that the 20–49 cohort performed the worst of all size cohorts, in terms of net firm and net job creation. This poor performance has been looked at in more detail. To examine the problem more closely, in Figures 4 and 5, the percentage results for the 20–49 cohort have been plotted alongside those for the 5–19 cohort. This is the next group which is most similar in characteristics and performance, in that they are all very small firms.

TABLE IX
A comparison of job net fertility indices

Firm size cohort	Time periods studies			Mean index
	71–81	82–84	85–87	
3–19	4.17	9.77	4.51	6.15
20–49	–0.93	3.14	–2.52	–0.10
50–99	–0.32	–0.46	2.58	0.60
100–499	–0.93	–5.59	0.94	–1.86
500–999	–1.21	–7.88	3.61	–1.82
1000+	–2.50	–5.77	–0.94	–3.07

TABLE X
Percentage effects within each size cohort

Percentages of firms in 1985									
Legend	1	3	4	5	6	7	8	9	
Firm cohort size	Corrected births	Deaths	Contracting firms	Expanding firms	No change	Net change	Total firms in 1985	% firms in 1985	
3-19	35	27.5	11.3	13.4	47.7	7.6	493.5	84	
20-49	6.8	17.1	21	20	41.9	-10.3	56.5	10	
50-99	4.7	6.9	26.1	35.7	31.4	-2.2	23.9	4	
100-499	2	6.4	24.6	43.6	25.4	-4.4	14.7	2	
500-999	1.5	8.6	32.8	43.6	15	-7.1	1.6	0	
1000+	0.2	2.8	33.5	57.6	6.2	-2.6	0.5	0	
Total	30.1	25	13.3	15.8	45.8	5.1	590.7	100	

Percentages of employment in 1985									
Legend	11	13	14	15	16	17	18	19	21
Firm cohort size	Corrected births	Deaths	Jobs in 85 in contracting firms	Jobs lost by contracting firms	Jobs in 85 in expanding firms	Expanding firms	No change	Net change	Total jobs in 1985
3-19	25.1	28.9	14.9	4.7	9.3	16.8	46.9	8.3	3.6
20-49	6.9	17.3	21.6	5.6	20.3	11.3	40.8	-4.6	1.6
50-99	4.5	6.2	26.7	6	36.6	12.4	30.5	4.7	1.5
100-499	2.1	6.6	24.9	6.2	45.7	12.4	22.9	1.7	2.7
500-999	1.5	8.3	31.5	5.9	45.5	19.4	14.8	6.6	1.1
1000+	0	0.6	44.1	7.6	53.8	6.4	1.6	-1.7	6.2
Total	6.9	10.3	30.1	6.3	37.6	11.5	22.1	1.8	16.7
									100

Legend as used in Table I.

We should bear in mind that while the two cohorts are similar in some ways, they are also very different in size, with 490,000 firms in the 5–19 cohort but only 56,000 firms in the 20–49 cohort (an order of magnitude difference). Nevertheless there are some similarities of performance between the two. The percentage of firms in both cohorts which did not change their size is very similar, at over 40% in each case. The broad distribution of firms and jobs between the different categories is also very similar, with one or two notable exceptions.

It is apparent that the poor performance of the 20–49 cohort is, relatively, the net small result of very large swings and changes in the total population.

For the number of firms (Figure 4), the poor performance of the 20–49 group can be seen to be a result of two factors. A very low rate of new birth formation, and in contrast, a relatively high level of firm deaths.

The poor job creation performance (Figure 5) is the result of (a) a relatively low level of new jobs created by births; (b) in line with the high firm death rate, a high percentage of jobs lost due to

firm deaths (17%); and (c) an unusually low level of jobs created by firm expansions (11%). This is the lowest percentage of any cohort excepting the 1,000+.

The picture appears to be that firms in the 20–49 cohort over this time period did not benefit from new births, while suffering an unusually high death rate. This is in contrast to the 5–19 cohort where we would expect high death rates which are compensated for by very high birth rates at the same time. In parallel with this, while the number of jobs lost due to contraction was not untoward, the number of jobs being created by expansion within the cohort was distinctly low.

The question which this scene poses is: What conditions in the business environment over the mid 80s have been so disadvantageous to the performance of this particular size group? Typically they will have been firms which have been established for a number of years. We know that such small firms are particularly vulnerable to small fluctuations in the economic environment, and in contrast to large firms they have a greater propensity to die rather than contract.

One possible explanation is that there is now in place a substantial national governmental structure to support new firm formation in terms of grants and advice. There is also significant support for small firms on an ongoing basis, but it may be that it is not sufficiently robust or wide ranging. One conclusion is that the extent of support being given to this size cohort of firms should be reviewed.

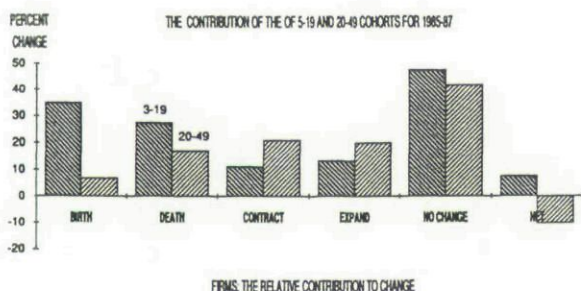


Fig. 4.

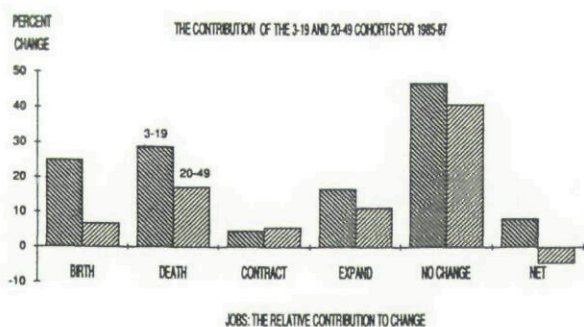


Fig. 5.

f. Takeovers, mergers and rationalisations

The number of jobs which were involved in change due to takeovers, mergers, rationalisations and reorganisations is shown in Table XI, and graphically in Figure 6. As would be expected, the percentage of jobs in each cohort increases steadily with size. As a percentage there was virtually no restructuring of firms in the smallest cohort, while in contrast, over 5% of employees in the largest cohort were involved in some form of reorganisation.

It should not surprise us that 5% of the workforce in firms employing more than 1,000 have been involved in some form of reorganisation. Some of these will have been very trivial, such as

TABLE XI
Jobs involved in takeovers, mergers, and rationalisations

Firm size cohort	Estimated jobs	Total 1985 jobs	Percentage of cohort
3-19	0.00	3.57	0.0.
20-49	0.02	1.64	1.0.
50-99	0.03	1.55	1.7.
100-499	0.07	2.73	2.7.
500-999	0.04	1.10	3.2.
1000+	0.33	6.16	5.3.
Total	0.48	16.74	2.9.

Jobs in millions.

the acquisition of an additional small firm, or an internal company restructuring. These will have had little or no effect upon employees. On the other hand others will have been very substantial, such as a major takeover and rationalisation, or an internal rationalisation which involves job movement or job loss.

In one way, this form of constant "turbulence" or rationalisation can be seen as the large firm's equivalent of what we see in very small firms in terms of high birth and death rates. It again illustrates how the population of firms in a developed economy is very alive and dynamic. We have a desire to imagine it in static terms, because that is the easiest form which we can perceive. A good analogy was that given by Birch, of a 'cloud', inside of which there is constant activity, and the activity taking different forms at different levels within the cloud.

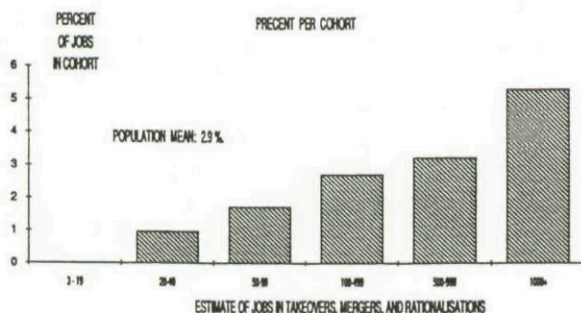


Fig. 6.

g. *The implications for theory*

The neoclassical model, proposes that growth is an adjustment mechanism related only to the concept of optimum size (and therefore related to the maximisation of profits). The 'law of proportionate effect', or Gibrat's law, proposes that firm growth must be a random process, with any firm having an equal chance of growing to any particular size, and that the size of a firm should have no effect upon the expected growth of that firm. Neither of these propositions were supported by the findings of this study. The statistical propensity for firms to grow or contract were found to vary significantly with their size.

8. Conclusions

In this 1985-87 study, and in the two previous studies, there has been a consistent pattern in which small firms are net generators of jobs, and in which large firms are net losers. The differences lie in the steepness of the trend from small firm job-generation to large firm job-loss, and in how far towards the small or large end of the continuum net job generation becomes net job loss. But the basic trend does not differ, that the larger the firm, the fewer net jobs it will create.

This pattern is not remarkable, in that small firms in aggregate must grow, and large firms in aggregate must contract or die over time, if a dynamic population is to stay in some sort of long-term balance. In any developed economy, small firms must have a greater expectation of growing, in order to replace those large firms which contract or die. In a similar way, if the net growth of large firms were to be consistently greater than the net growth of small firms, then the total working population would grow at an ever increasing absolute rate, and would become unsustainable.

Although over each time period, large firms have been net losers of jobs, it does not follow that there are fewer large firms, or people working in them. At the end of each period, some small and medium sized firms will have grown to replace them.

The increase in jobs in small firms, and the number of small firms, suggests that the steady process of concentration in British industry which has taken place over most of this century (Prais,

1976) has been gradually reversed over the past two decades. The Bolton Report (1971) pointed out that compared to most other developed countries the UK had an unduly under-sized small firm sector. We need to review now, the extent to which change has taken place, and whether it has yet gone far enough.

Note

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