NBER WORKING PAPER SERIES

ON THE SIZE DISTRIBUTION OF EMPLOYMENT AND ESTABLISHMENTS

Jonathan S. Leonard

Working Paper No. 1951

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
June 1986

I thank Zvi Griliches, Kevin Lang, George Akerlof, Bill Dickens, Katharine Abraham, Jack Johnston, Larry Katz, the referee and participants at seminars at the National Bureau of Economic Research, the BLS, U.C. Irvine, Wisconsin and the 5th World Econometric Society Conference for their comments. Points of view or opinions stated here do not represent the official position of policy of any agency of the U.S Government. The research reported here is part of the NBER's research program in Labor Studies. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

Working Paper #1951
June 1986

On the Size Distribution of Employment and Establishments

ABSTRACT

Recent arguments that employment growth occurs disproportionately at small establishments are fundamentally misleading because they confuse regression to the mean with structural shifts in the size distribution of establishments and with an aging effect within cohorts. The net growth usually observed in aggregate studies hides the gross flows; 13 percent of the jobs in existence in 1974 had disappeared by 1980, while 18 percent of the 1980 jobs had not existed six years previously. The variation observed here in labor demand over time within individual establishments may help to explain unemployment.

Jonathan S. Leonard
School of Business
University of California
Berkeley, CA 94720
and
NBER
1050 Massachusetts Avenue
Cambridge, MA 02138

What are the sources of employment and unemployment? In a sparsely travelled approach to this most fundamental question in economics, a few recent studies have analyzed employment growth across establishments of various sizes. These studies generally conclude that employment growth has been disproportionately concentrated in small establishments. This in turn has given rise to the folk wisdom that small establishments are the only vibrant part of the economy. To some concerned with a public policy in favor of job creation, such studies have suggested that employment policies be targeted toward the smaller establishments that appear to be the wellsprings of growth. Such an investment in jobs at small establishments may be unnecessary or short-lived because in many cases the Horatio Alger-like rise of the small firm may just be regression to the mean. This paper will present new evidence of a large transient component in the level of employment within individual establishments over time. This instability of jobs lends itself to a regression fallacy, but may also help to explain unemployment.

A stochastic model that resolves the paradox raised by previous studies that small establishments grow faster than large but the distribution of establishments by size remains unchanged is developed in section I. An analysis of the size distribution of establishments and employment is presented in section II. Section III uses a new longitudinal sample of establishments to analyze changes in the distribution of employment within cohorts. A set of regressions with controls for industry region, corporate structure, and other determinants of size is presented in section IV. Conclusions are presented in section V.

I. SMALL IS RANDOMLY BEAUTIFUL: THE DYNAMICS OF ESTABLISHMENT SIZE

Optimum establishment size is largely determined by economies of scale, or economies of scope. Economies of scale will depend on technology and the size of the market, which will vary by industry and region. In modeling the process of employment (size) change in a longitudinal sample of establishments, I seek to embody the following characteristics: (1) a time invariant distribution, (2) a transient random error, and (3) a partial adjustment toward the mean. It is useful to start with a time invariant distribution of establishment size to show that random fluctuations and regression to the mean will easily yield a situation in which small establishments account for a disproportionate share of employment growth even though the size distribution of employment is unchanged over time.

The simplest process embodying the first two characteristics is:

(1) $$S_{i,t} = X_i B + e_{it}$$

where:

$S_{i,t}$ is the logarithm of the size of establishment i in period t

X_i is the vector of establishment characteristics giving optimal scale

e_{it} is a random error that may include measurement error,

$e_{it} \overset{i.i.d}{\sim} N(0,\sigma_e^2)$.

This transparently embodies the essential characteristics of regression to the mean (Galton, 1886) in a time invariant distribution:

(2) $$E(S_{it} - S_{i,t-1} | S_{i,t-1}) = - e_{i,t-1}$$

For excellent earlier discussions of this triumph of mediocrity and the attendent regression fallacy, see Prais (1958) and the articles cited therein. Compared to their expected sizes, large firms are expected to shrink and small firms are expected to grow. However, this process assumes complete requilibrium within one period, an assumption that is relaxed in the following stochastic process.

(3) $$S_{i,t} = X_iB + \lambda(S_{i,t-1} - X_iB) + e_{it}$$

Equation (3) says that the logarithm of establishment size is determined by exogenous characteristics X_i which are expected to vary by industry and region, by the deviation of last period's size from expected size, and by a random error term. This process includes as special cases both the random walk (β=0, λ=1) and the fixed effect model ($\beta \neq 0$, λ=0).

For earlier developments of related stochastic models see Gibrat (1930), Steindl (1965), and Ijiri and Simon (1977, p. 156). These analysis typically derive a log-normal distribution of firm size from a random walk in logarithms (Gibrat's Law). Undesirably, such random walk models also imply an exploding variance of size. Empirical evidence that size follows a random walk in logarithms (growth is independent of size) can be found in Hart and Prais (1956), Simon and Bonin (1958), and Hymer and Pashigian (1962).

Following the process in equation (3) then, the logarithm of establishment size is normally distributed with mean X_iB and variance $(1/(1-\lambda^2)\ \sigma_e^2)$, or

(4) $$S_i \sim N(X_iB,\ (1/1-\lambda^2)\sigma_e^2)$$

The assumption that this distribution is time invariant implies that relative factor prices are fixed over time so employment is in fixed proportion to scale, however measured. σ_e^2 is a measure of our ignorance of the determinants of establishment size. In part, it may be due to random shocks in product demand or to tipping in product market share in response to unobserved technological innovations. If some factors of production are specialized to individual establishments, or if economies of diseconomies of scale are negligible, then optimal scale is not fully determined by the observable X's. This would result in persistent deviations from expected size. Although not developed here, it could be modelled by including an individual specific time-invariant unobserved error component.

Conditional on last period's size and delaying the discussion of measurement error, the expectation of this period's size is:

$$(5) \qquad E(S_{i,t} | S_{i,t-1}) = (1-\lambda)X_iB + \lambda S_{i,t-1}$$

and the expected change in establishment size is:

$$(6) \qquad E(S_{i,t} - S_{i,t-1} | S_{i,t-1}) = (1-\lambda)(X_iB - S_{i,t-1})$$

It is now clear that in a regression of logarithmic growth rates on the logarithm of lagged size, controlling for other characteristics, the coefficient on lagged size lies between zero and -1. At casual inspection it will appear as though size has a direct detrimental effect on growth, although nothing more need be at work than regression to the mean. In theory then, all of the job growth among the small could be accounted for by regression to the mean.

The probability that size will increase is given by:

$$(7) \qquad \text{Prob}(S_{i,t} > S_{i,t-1}) = 1 - F\{(1-\lambda)(S_{i,t-1} - X_iB)\}$$

where F is the cumulative normal distribution function. On average, small establishments are expected to grow.

In general, the greater the deviation of establishment size from its mean, the greater the expected subsequent movement toward the mean. In particular, the smaller the establishment, the larger its expected increase in size. Similarly, establishments found in the tails of the distribution are expected to have recently experienced the greatest random perturbation, and relatively few establishments are expected to experience great size changes. All of these patterns have been observed without explanation in the earlier literature, and follow directly from the model just presented.

Consider how a direct effect of size on growth can be distinguished from regression to the mean. Choose a period long enough that adjustment may be assumed to be almost complete ($\lambda \to 0$). The coefficient on lagged size is expected to be -1 even if there were no direct negative effect of size on growth, and will likely be negative even with a positive direct effect of size on growth. A test of the hypothesis that size slows growth is then that the coefficient on lagged size be less than -1. A coefficient greater than -1 could arise because of (1) a positive direct effect of size on growth, (2) incomplete adjustment ($\lambda > 0$) or (3) positive autocorrelation of errors. The role played by each of these possible factors is not identified without extra information if the observed coefficient is greater than -1. Of course, if growth rates do increase with size, the distribution explodes -- which should be easily detectable. On the other hand, since the last two factors would both give a coefficient greater than -1, a result less than -1 would be strong evidence that size slows growth. Previous studies then have to some degree been an exercise in demonstrating regression to the mean.[3]

II. THE DISTRIBUTION OF EMPLOYMENT AND ESTABLISHMENTS BY ESTABLISHMENT SIZE

If one is interested in determining whether growth is favored in establishments of a certain size for structural as opposed to purely random reasons, it is fruitful to start by looking at changes in the distribution over time.[4] If small establishments grow faster than do large, it follows that; absent births and deaths, the proportion of all establishments that are small decreases and their average size increases.

There is some evidence that the size distribution of U.S. employment shifted toward small establishments between 1974 and 1980, but the patterns are not overwhelming and the shifts are less than those implied by previous studies. Table 1 shows the size distribution of establishments and employment in 1974 and 1980 from the U.S. Census Bureau's County Business Patterns reports. The sample is not fixed, but rather includes births and deaths. Of all 1974 employment, 52.5 percent was in establishments with fewer than 100 employees, so such establishments' 78 to 81 percent share of employment growth as measured by Birch (SBA, p. 85) or Armington and Odle (1982) is indeed greater than their share of employment.[5] However, by 1980 the share of total employment in such establishments has increased only slightly to 54.3. In the Census data, small establishments actually accounted for 64.4% of the net increase in jobs. This is less than might have been expected from previous studies. However, this in itself tells us nothing about the optimal scale of establishments, or about the relative economic performance of various establishments, or about which establishments should be the focus of a public policy to promote job creation.[6]

One cannot tell from the census statistics in Table 1 how much of the change in the size distribution of establishments is due to changes in the industrial or regional composition of employment or the births of small establishments and deaths of large ones. These problems of interpretation are eliminated in Table 2. This gives the distribution of establishments and employment by size class for a longitudinal sample of 68,690 establishments with more than 16 million employees. The sample is based on Equal Employment Opportunity (EEO) data,[7] and is discussed at length in other work (Leonard, 1984). The tradeoff in using a longitudinal data set, of course, is that in focusing on the health of the living, one no longer pays great attention to births and deaths. In particular, growth rates estimated here are overestimates in the sense that the worst cases, establishments that shut down completely, are absent from the sample.

In the moving cross sections of the longitudinal EEO sample the average number of employees in the small size (< 100) class did not increase as fast as in the large. Net employment fell in the small class size and grew in the large, so all net employment growth by size class is found in the large class, contrary to what might have been expected on the basis of previous studies.

III. COHORT ANALYSIS

A substantial advantage of the EEO sample is that it allows us to follow a cohort through time and see differential growth rates by size class. Column 5 of Table 2 stratifies 1980 employment by 1974 establishment size class. What has previously been the standard analysis in this area amounts to comparing column 5 with column 4, both of which stratify by initial state. It is immediately apparent that growth is concentrated in smaller establishments with less than 100 employees. These establishments accounted for 10.8 percent of all employees in 1974. By 1980, the same establishments accounted for 12.7 percent of all employees. In other words, employment grew by 23.5 percent among these establishments compared to 5.1 percent overall and 2.8 percent among the establishments with 100 or more employees. These small establishments, which comprise 48 percent of all establishments, then account for 50.3 percent of total net job growth. If one includes establishments with less than 250 employees among the small, the result is more striking: more than 100 percent of total net job growth occurs in such establishments.

The contribution made by small (<100) establishments which stayed small compared to those which grew (over 100) can be deduced by comparing the cohort in column 5 with the cross section in column 3. Establishments that are no longer small by 1980 can account for all of the net job creation in the small class.

Are small establishments then really the fountainheads of growth? Column 6 of Table 2 stratifies 1974 employment by end state: establishment size class in 1980. The obvious pattern, and one that has been largely ignored in previous studies, is that small establishments account for most net job loss just as surely as they account for most net job gain. Establishments with less than 100 employees in 1980 included 10.2 percent of all 1980 employees. The simplest way to see a central point of this paper is to compare column 6 with column 3, both of which stratify by terminal size. Six years earlier, these same establishments employed 12.2 percent of the work force. This simple finding is important: the small have shrunk. Comparing columns 6 and 4 shows that many of these establishments must have become small since 1974.

It is just as meaningful and valid to analyze the dynamics of size change classifying by end of period rather than beginning of period size. Think of a stochastic process that acted the same running backward or forward in time. In the process of equation 1, if S_{it} but not $S_{i,t-1}$ is known, the expectation of past change in size is:

$$(8) \qquad E(S_{i,t} - S_{i,t-1} | S_{i,t}) = e_{it}$$

Here, it is expected that a large firm will have recently experienced a positive random shock. The results in this case appear to be the opposite, but this is simply an illustration of regression to the mean. Just as establishments that are small tend to grow (eq. 2), establishments that are small tend to have shrunk (eq. 8). There is no greater implication for policy in the former phrase than in the latter, but either taken by itself is intrinsically misleading.

IV. REGRESSION ANALYSIS

Table 3 presents estimates of regressions of the logarithm of employment growth between 1974 and 1980 controlling for industry, region, size, corporate structure, occupational structure and federal contractor status, using the longitudinal EEO sample of 68,690 establishments. Do establishments of different sizes have different growth rates once industry, region, etc., are controlled for?

The evidence in regression 1 of Table 3, which controls for initial size, only seems to give a clear answer. The elasticity of growth rate with respect to size in 1974 is -.124. As initial size increases by 10 percent, growth rate declines by 1.2 percent. Growth rates appear to fall significantly with initial size.

The sample is longitudinal, so none of these differences can be due to differential birth or death rates, or to differences in the composition of the sample over time. Moreover, industry and region are controlled for, so these differences cannot be attributed to different efficient scales in various industries or regions. These estimates, with a more extensive set of controls, may appear on casual inspection to confirm recent findings (Armington and Odle, 1982; Birch, 1979; Teitz et al., 1981) that employment growth is concentrated in small establishments.

The stochastic model of change in establishment size presented in section I shows why such an interpretation of the distribution of growth by establishment size can be misleading. With regression to the mean a negative coefficient on lagged size is likely even if the direct effect of size on growth is positive. Strong evidence that size hinders growth would be a coefficient less than -1. Since the estimated coefficient is significantly greater than -1 we cannot accept the hypothesis that size hinders growth. It is possible then that all of the apparent size differential in growth rates could be accounted for by regression to the mean.

Regression 2 of Table 3 is identical in specification to regression 1 with the exception that it controls for 1980 size rather than 1974 size, and is so a logical extension of Table 2. Now it appears that growth rates are significantly higher in establishments that end up large. Again, in light of the stochastic model of section I, there is no contradiction between observing that small establishments are more likely than small to have grown while the small are more likely to have shrunk. The near identity of standard errors across regressions merely reflects the high correlation of size across years.

There are several possible interpretations of regression 2. Multiplying both sides by -1, it is a bivariate regression of shrinkage rates on terminal size. It then says that the small in 1980 shrunk more since 1974 than the small in 1974 grew by 1980, although the difference (between -.126 and -.124) is insubstantial. In a measurement error context, regression 2 can also be read as a reverse regression. From equation 3 it follows that:

$$(9) \qquad S_{it} - S_{it-1} = \frac{1-\lambda}{\lambda}X_iB + [1-\frac{1}{\lambda}]S_{it} + \frac{1}{\lambda}e_{it}$$

The coefficients on the X variables are so expected to be $\frac{1}{\lambda}$ times greater in the reverse regression. As is well known in the case of measurement error affecting the dependent variable and one independent variable, the forward and reverse regressions can be used to bound the true parameter. As a reverse regression, regression 2 implies $\lambda = 1.144$, which would be upward biased by measurement error. If we add the stability constraint, λ is bounded by .876 (=1-.124) and 1. This seems a slow adjustment to optimal size, in which case positive serial correlation of the errors may be suspected. In either case, there is no compelling evidence here that size has a negative effect on growth beyond what would be expected from regression to the mean.

To see how easily the estimates of size effects in Table 3 could arise, consider the following simplified case. Let y be the 1980 logarithm of size, x the 1974 logarithm of size, S_{yy} and S_{xx} the respective variances, and r^2_{xy} their correlation. Now in simple regressions, $b_{yx} = r^2_{yx} \cdot S_{yy}/S_{xx}$ and $b_{xy} = r^2_{yx} \cdot S_{xx}/S_{yy}$. Since the model in this paper assumes constant variances over time, $S_{yy} = S_{xx}$, and so $b_{xy} = b_{yx} = r^2_{yx}$. For illustration, suppose $r^2_{yx} =$ .885. Now the expected coefficient from a simple regression of y-x on x is

$b_{yx}-1$, or -.125. The expected coefficient from a simple regression of y-x on y is $1-b_{xy}$ or .125. This illustrates that the size effects estimated in Table 3 can arise quite easily without any true direct effect of size on growth.

Regression 2 of Table 3 read in conjunction with regression 1 also shows other interesting shifts in the distribution of establishment size. In most economic models, corporate structure is a veil. With competitive capital and product markets, there is little reason to expect establishments to differ depending on whether or not they are owned by a larger enterprise. But this is an empirically testable proposition. Single establishments -- those that are not part of multiplant companies -- appear to have significantly greater growth rates, ceteris paribus (regression 1). In general, single establishments are subject to greater variations in employment, so we also see (regression 2) that they appear to have shrunk more, as well. The net effect, however, is greater growth.[8] Similar evidence is found on the relationship between growth and being a 1974 federal contractor. In both cases, employment is relatively more volatile in such establishments.

Occupational structure does have a significant and consistent effect. Establishments that are nonclerical, white-collar intensive exhibit significantly greater growth rates, and significantly lower shrinkage rates within industry and region. This may reflect pervasive technological change favoring white-collar intensive establishments. In other words, optimal scale appears to have increased for such establishments.

Optimal establishment size is a function of both the technology of production and the size of the market, so we allow growth patterns to differ across industries and regions. Concerning industry specific effects, the signs of the largest effects are not always the same across equations, so the bounded estimates include zero. Mining, Chemicals, Machinery, Instruments, and Services have been the most consistent growth sectors. Across regions, establishments have grown significantly less in the Mid-Atlantic and East North-Central regions, and significantly more in the West.

VI. CONCLUSIONS

The large transient component of establishment size that gives rise to the regression to the mean phenomena analyzed above can also be of potential use in explaining unemployment. At least 13.2 percent of the EEO sample jobs in existence in 1974 no longer existed by 1980.[9] Of the sample establishments, 43.4 percent experienced an employment decline between 1974 and 1980, losing an average of 72 jobs. Over the same period, at least 18.2 percent new jobs were created. 54.7 percent of the establishments grew, by an average of 79 jobs. In other words the 5.1 percent net job growth observed in this sample is the result of two much larger partially offsetting but typically unobserved flows. Labor demand is more volatile than is apparent from the usual aggregate net statistics. This volatility suggests that some unemployment could be explained by unstable jobs rather than unstable workers.[10] It also raises two questions for future research: 1) to what extent are low tenure workers sorted into low tenure jobs? and 2) to what extent can the life expectancy of jobs be anticipated by workers and so enter into job security, contracting and compensation decisions?

Longitudinal of data with large transient components are subject to the misinterpretation of what could simply be regression to the mean. In the case of the size distribution of employment, previous studies have pointed to the disproportionate share of employment growth accounted for by small establishments and argued that these small establishments are the wellsprings of growth. I have argued here that part of the phenomenon these analysts have described may be regression to the mean. None of the previously observed patterns need tell us anything more than that establishment size is subject to transient shocks, from which it then requilibrates. Size is better thought of as an endogenous than as an exogenous variable. The size distribution of establishments is a less dangerous guide to how economic conditions favor establishments of any given size.

This study has begun to point out the large variations in employment levels within individual establishments during a brief six-year period.[11] This suggests that part of the problem of unemployment is to be found not just in people, or in the match of people and jobs, but also fundamentally in the volatility of jobs themselves.

Footnotes

1. The response received by the most publicized study of the small business share of job creation has been described by Bluestone and Harrison (1982, p. 221):

> Thus it would be hard to exaggerate the excitement that has been generated ... by the most recently published research of David L. Birch ... Birch has written that: 'of the all net new jobs created in our sample of 5.6 million [establishments] between 1969 and 1976, two-thirds were created by firms with twenty or fewer employees, and about 80 percent were created by firms with 100 or fewer employees'. This has been picked up by the media in the United States, Canada, and Great Britain and repeated endlessly by advocates of a policy of switching the focus of publicly-subsidized development programs from large corporations to the 'small business community'.

2. One of the earliest demonstrations of the importance of transient components is found in Friedman (1957).

3. Birch does note the volatility of jobs and seems to have given this more attention in recent work. He observes that small establishments have higher death rates, and that "establishments with the greatest odds of experiencing a big loss are the ones that have have just grown the most" (Birch, 1979, p. 39). In later work he struggles with the paradox of reconciling disproportionate job growth among small establishments with a stable distribution over time, and in his "pulsation" analogy (Birch, 1981, p. 20) comes close to the idea of regression to the mean. Armington and Odle find that much of the growth observed by Birch using Dun and Bradstreet data takes place among small establishments that are part of large companies. Teitz et al. add the qualification that growth is concentrated in just 12 to 15 percent of small establishments, and that the half-life of most new jobs is probably well under four years (p. 61). Fothergill and Gudgin present a comparative analysis of British manufacturing job growth and evidence of a much smaller decline in growth with size among both young and old establishments. Previous work suffers mostly from the lack of a statistical model to guide the interpretation of the observed patterns.

4. For related arguments comparing static analysis and survivor technique, see Caves, et al. (1975) and Stigler (1958).

5. The direct job creation by small firms may be distinguished from their indirect effect. See Meller and Marfan (1981) for evidence that employment multipliers are larger for large than small industries, based on input-output data for Chilean manufacturing.

6. There are some basic patterns in Table 1 that deserve mention before passing on. More than half of all establishments have less than five employees, but more than half of all employees are in establishments with 50 or more employees, and 14.3 percent of all workers are employed in the one-tenth of 1 percent of all establishments with 1,000 employees or more, down from 16 percent in 1974. Average establishment size did increase from 15.5 to 16.5, or by 6 percent, which is less than the 12 percent growth in

total employment. At the same time, the average size of a small (<100) establishment did increase.

7. The EEO sample is not directly comparable to the Census sample. Small establishments that are part of small companies are not required to report. Title VII of the Civil Rights Act of 1964 requires annual reports on work force demographics from all private employers with 100 or more employees, or 50 or more employees and a federal contract or first-tier subcontract or purchase order worth $50,000 or more, with special provisions for financial institutions. In the case of multi-establishment enterprises, all establishments with more than 24 employees that belong to enterprises that fulfill the above conditions must report individually. So while the longitudinal EEO sample contains 25.7 percent of Census-reported employment in 1974, it contains only 1.7 percent of Census-reported establishments. Nevertheless, the EEO sample has enough size variation to support the regression analysis that follows. Note that temporary or casual employees are not counted, according to regulations, among employees in the EEO sample. The results reported here do not depend on a sample that overrepresents large establishments. See Leonard (1986) for a related study of a population, including the smallest establishments.

8. The differences in growth rates and employment variability between single establishments and those that are part of larger companies are complex. When terms interacting single and size are added to the right hand side, these interaction terms are positive in both regressions. Growth rates appear lower for small single establishments than for non-single, but this relationship reverses at larger size.

9. It is doubtful that much of what I interpret here as permanent job losses are really temporary layoffs or temporarilly unfilled vacancies. Lillien (1984) finds an average temporary layoff duration of 6 to 8 weeks. Abraham (1983) reports vacancy rates during the 1970's of 1.7 to 3.7 percent. The first is much shorter and the second much smaller than the 13.2 percent job loss over 6 years calculated here.

10. Of course, there is a great deal of evidence that unemployment is not randomly distributed across people; blacks and teenagers in particular are more likely to be unemployed. Short employment spells also appear to be more common early in working life (Hall) and to be disproportionately borne by relatively few people. For example, Akerlof and Main (1981, p. 1007) estimate that while the mean unemployment year of a white male is spent in an 18-year job, the mean length of all jobs held by white males is only 4 years. Most workers appear to eventually find their way into stable jobs.

11. A number of important questions cannot be answered with the limited panel of data examined here, but will be explored in further work. How fast is job turnover taking place, and is the rate stable over time? The six-year changes can only be a lower bound of total changes in the distribution of jobs during the intervening years. If jobs flicker on and off faster, and are not all associated with known temporary layoffs, then the potential for unemployment is greater, as is the difficulty of distinguishing bad jobs from bad people. If the duration of jobs -- not of an individual's employment, but the lifetime of the position itself -- has decreased over time, the "natural" rate of

unemployment will rise. It would be interesting to observe how the variability of firm size changed over the business cycle and with changes in government policy. In addition, we lack studies of the birth and death of establishments and firms, and of how optimum size and the equilibrium distribution of size vary with factor prices, regulations, and market conditions.

REFERENCES

Abraham, Katherine. "Structural/Frictional vs. Deficient Demand Unemployment." American Economic Review 73, no. 4 (September 1983): 708-724.

Akerlof, George A., and Main, Brian. "An Experience-Weighted Measure of Employment and Unemployment Durations." American Economic Review 71, no. 5 (December 1981): 1003-1011.

Armington, Catherine, and Odle, Marjori. "Further Examination of Sources of Recent Employment Growth: Analysis of USEEM Data for 1976 to 1980." Unpublished paper, The Brookings Institution, March 1983.

______________________________________. "Small Business -- How Many Jobs?" Brookings Review (Winter 1982).

Birch, David L. "The Job Generation Process." Cambridge, MA" MIT Program on Neighborhood and Regional Change, 1979.

______________. "Corporate Evolution, A Micro Based Analysis." Washington, D.C.: Small Business Administration, January 1981.

______________, and McCracken, Susan. "The Small Business Share of Job Creation -- Lessons Learned from the Use of a Longitudinal File." Washington, D.C. Small Business Administration, 1982.

Bluestone, Barry, and Harrison, Bennett. Capital and the Communities. Washington, D.C.: The Progressive Alliance, 1980.

Caves, Richard E.; Khalilzadeh-Shirazi, Jagdish; and Porter, Michael E. "Scale Economies in Statistical Analyses of Market Power." Review of Economics and Statistics 67 (May 1975): 134-141.

Fothergill, Steve, and Gudgin, Graham. The Job Generation Process in Britain, Research Series 32. London: Center for Environmental Studies, 1979.

Friedman, Milton. A Theory of the Consumption Function. Princeton, N.J.: National Bureau of Economic Research, 1957.

Galton, Francis. "Regression Toward Mediocrity in Hereditary Stature," Journal of the Anthropological Institute 40 (1886): 246-263.

Gibrat, R. Les Inegalites Economiques. Paris, 1930.

Hall, Robert E. "The Importance of Lifetime Jobs in the U.S. Economy." American Economic Review 72, no. 4 (September 1982): 716-724.

Hart, P.E. and Prais, S.J. "The Analysis of Business Concentration: A Statistical Approach," Journal of the Royal Statistical Society, Series A, Vol. 119: 150-181.

Hymer, Stephen and Pashigian, Peter. "Firm Size and Rate of Growth," Journal of Political Economy 70, No. 6 (December, 1962): 556-569.

Ijiri, Yuri, and Simon, Herbert A. Skew Distributions and the Sizes of Business Firms. New York: North-Holland, 1977.

Leonard, Jonathan S. "The Impact of Affirmative Action on Employment." Journal of Labor Economics 2, no. 4 (October 1984): 439-463.

Leonard, Jonathan S. "Unemployment and the Volatility of Labor Demand," unpublished paper, 1986.

Lillien, David M. "The Cyclical Pattern of Temporary Layoffs in United States Manufacturing." Review of Economics and Statistics (February 1980): 24-31.

Meller, Patricio and Marfan, Manuel. "Small and Large Industry: Employment Generation, Linkages, and Key Sectors," Economic Development and Cultural Change 29, No. 1 (January 1981): 263-274.

Prais, S.J. "The Statistical Conditions for a Change in Business Concentration," Review of Economics and Statistics (August, 1958): 268-272.

Steindl, Josef. Random Processes and the Growth of Firms: A Study of the Pareto Law. New York: Hafner Publishing Company, 1965.

Stigler, G.J. "The Economies of Scale." Journal of Law and Economics 1 (October 1958): 54-71.

Teitz, Michael B.; Glasmeier, Amy; and Svensson, Douglas. "Small Business and Employment Growth in California," Working Paper No. 348. Institute of Urban and Regional Development, University of California, Berkeley, March 1981.

U.S. Department of Commerce. Bureau of the Census. County Business Patterns, United States. Washington, D.C.: U.S. Government Printing Office, 1974 and 1980.

U.S. President. The State of Small Business: A Report of the President. Washington, D.C.: U.S. Government Printing Office, 1983.

Table 1

The Size Distribution of Establishments and Employment 1974-1980,
County Business Patterns Sample

Class	Proportion of all Establishments 1980	1974	Proportion of all Employment 1980	1974
1-4	.543	.586	.067	.072
5-9	.198	.180	.085	.082
10-19	.124	.113	.108	.104
20-49	.083	.075	.159	.153
50-99	.029	.025	.124	.114
100-249	.016	.014	.144	.136
250-499	.0044	.0043	.094	.096
500-999	.0018	.0019	.076	.083
1000+	.0010	.0011	.143	.160
TOTAL	4,543,167	4,110,112	74,835,525	63,487,630

Source: U.S. Bureau of the Census, County Business Patterns, United States, 1974 and 1980, Table 1B, p. 3.

Table 2

The Size Distribution of Establishments and Employment 1974-1980, EEO Sample

	Proportion of all Establishments		Proportion of all Employment			
Column	(1)	(2)	(3)	(4)	(5)	(6)
Year	1980	1974	1980	1974	1980	1974
Size Class	.225	.244	.033	.038	.050	.044
1-49	.243	.236	.069	.070	.077	.078
50-99	.296	.300	.190	.200	.217	.201
100-249	.296	.300	.190	.200	.217	.201
250-499	.134	.124	.187	.181	.180	.184
500-999	.064	.061	.177	.177	.170	.166
1000+	.038	.035	.345	.335	.306	.327
TOTAL	68,690	68,690	17,111,035	16,287,127	17,111,035	16,287,127

Note: All data are from the longitudinal EEO sample.

Columns 3 and 4 are moving cross-sections.
Column 3 presents the distribution of 1980 employment by 1980 size class.
Column 4 presents the distribution of 1974 employment by 1974 size class.
Column 5 and 6 follow cohorts.
Column 5 presents the distribution of 1980 employment by 1974 size class.
Column 6 presents the distribution of 1974 employment by 1980 size class.

Table 3

Regression of the Logarithm of Establishment Growth on Size, Corporate Structure, Industry and Region, 1974-1980
(N=68,690)

Variable	Regression 1 Coefficient	Regression 1 Standard Error	Regression 2 Coefficient	Regression 2 Standard Error
Size 74	-.124	(.002)	-	-
Size 80	-	-	.126	(.002)
Single	.151	(.005)	-.041	(.005)
Proportion White Collar	.069	(.007)	.119	(.007)
Contract	.008	(.004)	-.051	(.004)
Industry				
Agriculture	.095	(.027)	-.008	(.027)
Mining	.265	(.014)	.190	(.014)
Construction	.002	(.014)	-.044	(.014)
Food	.137	(.009)	.032	(.009)
Tobacco	.051	(.047)	-.201	(.047)
Textiles	.121	(.013)	-.133	(.013)
Apparel	.101	(.013)	-.068	(.013)
Lumber	.076	(.016)	-.009	(.016)
Furniture	.101	(.018)	-.063	(.018)
Paper	.119	(.013)	-.034	(.013)
Printing	.143	(.014)	.024	(.014)
Chemicals	.171	(.012)	.037	(.012)
Petroleum & Coal	.168	(.027)	-.025	(.027)
Rubber & Plastics	.126	(.016)	-.024	(.016)
Leather	.065	(.024)	-.112	(.024)
Stone, Clay & Glass	.074	(.014)	-.058	(.014)
Primary Metal	.141	(.014)	-.083	(.014)
Fabricated Metal	.087	(.011)	-.044	(.011)
Machinery, non-electrical	.200	(.011)	.003	(.011)
Electric Machinery	.238	(.012)	-.019	(.012)
Transportation Equipment	.234	(.014)	-.115	(.014)
Instruments	.244	(.018)	.060	(.018)
Misc. Manuf.	.112	(.022)	-.035	(.022)
Transportation	.087	(.008)	.029	(.008)
Utilities	.102	(.009)	-.002	(.009)
Wholesale Trade	.035	(.007)	.058	(.007)
Finance, Insurance	.040	(.007)	.077	(.007)
Services	.212	(.006)	.093	(.006)

Table 3 Continued

Regression of the Logarithm of Establishment Growth on Size, Corporate Structure, Industry and Region, 1974-1980
(N=68,690)

Variable	Regression 1 Coefficient	Regression 1 Standard Error	Regression 2 Coefficient	Regression 2 Standard Error
Census Region				
Mid-Atlantic & E. North Central	-.033	.007	-.044	.007
W. North Central	.007	.009	.016	.009
South	.011	.007	.022	.007
West	.043	.008	.054	.008
Intercept	.490	.012	-.581	.012
R^2	.09		.09	
S.E.E.	.431		.431	
Mean of the Dependent	.050	.050		

Note:

The dependent variable is the logarithm of the ratio of establishment size in 1980 to establishment size in 1974, or Size 80-Size 74.

Size 74 is the logarithm of the number of employees in 1974.

Size 80 is the logarithm of the number of employees in 1980.

Single is a dichotomous variable set to 1 if the establishment was not part of the multiplant enterprise in 1974.

Proportion White Collar is the ratio of non-clerical white collar employment to total employment in 1974.

Contract is a dichotomous variable set to 1 if the establishment was part of a federal contractor enterprise in 1974.

The omitted groups in the sets of dichotomous variables are retail trade and New England.