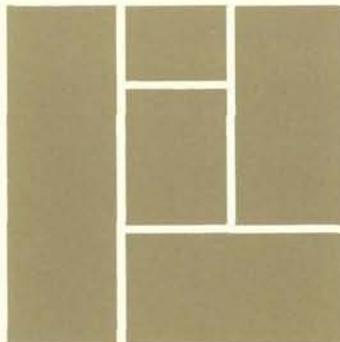
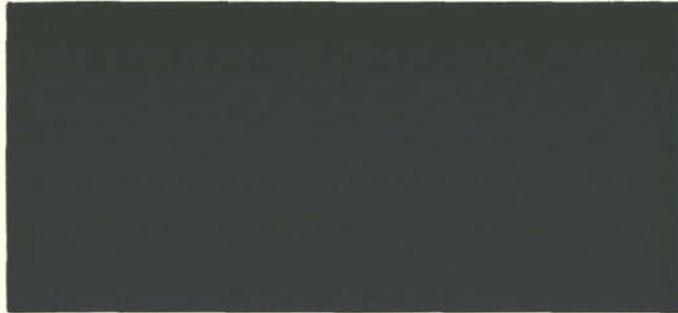


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**THE URBAN  
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**Project Report**

ECONOMIC ANALYSIS OF EFFECTS OF  
BUSINESS CYCLES ON THE ECONOMY OF CITIES

COMPONENTS OF REGIONAL EMPLOYMENT  
CHANGE OVER THE BUSINESS CYCLE

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## INTRODUCTION

The severity of the current recession in conjunction with long run spatial shifts in employment and population have increased academic interest in the responsiveness of regional and city economies to the business cycle. What are the factors that lead to spatial differences in the responses of subnational economies to national business cycles, and what is the relationship between the amplitude of an economy's cycle and its long run growth? The purpose of this report is to explore these questions as well as to address the broader issue of the affects of national cycles on regional and urban economies.

This report is the second part of a larger study of the effect of business cycles on city economies. An earlier study entitled "Cyclical Effects at the Local Level: A Microeconomic View" (Howland, 1983) explored such questions as, does the relative position of central city economies worsen during recessions, and do recessions dampen the decentralization of employment? The focus of the current report is to explore similar issues for regional economies. More specifically this report considers regional variations in cyclical employment and cross-regional variations in central city business cycles. The questions addressed in this study are whether there are regional variations in cyclical employment, why these variations occur and is there a relationship between the amplitude of an area's cycles and its long run growth.

This study focuses on the cyclical activity of establishments at the three-digit Standard Industrial Code level of detail. It is well known

that spatial variations in business cycles are due, in part, to spatial differences in industry composition. Local economies comprised of cyclically sensitive industries experience relatively volatile cycles, whereas economies comprised of cyclically stable industries are stable relative to the nation. This study takes the industry mix hypothesis as the starting point and addresses the question of whether firms in the same industry behave differently depending on location.

A second contribution of the approach of this study is the exploration of subnational cycles at a relatively small level of geographical detail. The cyclical sensitivity of central cities will be compared across regions.

Finally, the study explores spatial differences in employment change by type of change. Employment growth is disaggregated by growth due to expansions or contractions in existing establishments, to establishment closings or openings, and to migration of jobs in or out of an area. The extent to which these factors are important in explaining spatial variations in cyclical employment are considered.

This report will now turn to an outline of the questions to be addressed. A second section of the report will provide an explanation of the data set, and the manner in which it was created. The third section will present the results. Readers who have already read "Cyclical Effects at the Local Level A Microeconomic View" will find Section two and three of this paper repetitive of information presented earlier. These readers should skip these sections and procede to the "Results", beginning on page 32.

## STUDY PURPOSES

This study is divided into two broad areas of inquiry: regional comparisons of business cycles and cross-regional comparisons of central city cycles. Each of these two areas are subdivided into five topics. They are (1) regional comparisons of employment fluctuations, (2) an analysis of regional variations in the components of employment change including net expansions or contractions in continuing in-place establishments, (3) employment gains due to establishment births, (4) employment losses due to establishment closings, and (5) the effects of the cycle on interregional migration.

There are a number of reasons to expect geographical differences in business cycles. These reasons will be briefly described here. It is well known that a region or city's industry composition is an important determinant of the amplitude and timing of its local business cycles. Local economies comprised of cyclically sensitive industries experience recessions that are severe relative to the nation, whereas local economies made up of cyclically stable activities exhibit mild cycles relative to the nation.

The effects of industry mix on local cycles are clearly stated by Walter Isard (1957):

Differences in the intensity and timing of regional cycles are explained in terms of differences in the sensitivity and responsiveness of particular industries. Cycles of a regional economy are simple composites of the cyclical movement of the economy's industries appropriately weighted (Isard, 1957:31).

Borts (1960), Browne (1978), Engerman (1965), and Howland (1981) conducted empirical tests of the industry-mix hypotheses and found indus-

try mix to be an important explanatory factor in regional recessions. For example, Howland (1981) controlled for states' industrial composition at the two-digit (Standard Industrial Code) code level and found that industry composition explained an average of 36 percent of the variation in state business cycles for the five recessions between 1950 and 1975. Controlling for industry mix at the three-digit level for machinery manufacturing (SIC 35), Howland found that for the 1973-75 recession 38 percent of the variation in two-digit machinery manufacturing could be explained by industry composition at the three-digit level. For textile manufacturing (SIC 22), none of the cross-state variation in the 1973-75 recession could be explained by industry composition at the three-digit level. These findings as well as those of the above authors indicate that the strength of the relationship between an expected cycle based on industry mix and the actual cycle varies across regions as well as recessions and industries, and that there must be factors other than industry mix that explain the severity of local recessions.

The purpose of this study is to go beyond the industry mix hypotheses to explore economic and institutional factors particular to local economies that influence local cycles. Holding industry composition constant, such factors as the size and age distribution of an area's firms, the age of an area's capital stock, the labor or capital intensity of the aggregate production function, the extent to which the workforce is unionized, the skill level of its workers, the level of unemployment insurance benefits, and a shortage or surplus of workers are all expected to influence the amplitude of local short run fluctuations in employment. Each of these factors will be described briefly in turn.

AGE AND SIZE DISTRIBUTION OF FIRMS

The first hypothesis is that areas with a large proportion of new firms will be more cyclically sensitive than areas with older established firms.

Small establishments have been found to be more susceptible to failure during recessions than large establishments. Using the Dun and Bradstreet data, Birch (Appendix D, 1979) found that during recessions job loss in small establishments was greater than in large establishments and that the primary reason for job loss in small establishments was bankruptcy. Among establishments sized 1 to 20 employees, 9.7 percent of employment was lost due to firm failures. The percent of total jobs lost due to bankruptcy for establishments with 21 to 100 employees was 5.1. The comparable figures for establishments with 101 to 500 employees and 501+ employees were 4.6 percent and 2.1 percent respectively. In larger establishments, Birch found employment contraction to be a more important explanation of job loss during recessions.

The results are derived from data that do not correspond well with peaks and troughs of the national economy, however, they do suggest that spatial differences in the firms could lead to differences in intensity of the business cycle. Birch's results are derived from the 1972, 1974, and 1976 Dun and Bradstreet data. Birch's results also report on small establishments rather than small firms. The small establishment, which may be the small branch of a large corporation is not expected to experience the same vulnerability to the cycle as the small firm.

New firms are also expected to be more susceptible to bankruptcy than well established firms. New firms have less in the way of retained earnings and less well established lines of credit to see them through periods of economic stringency than mature firms.

AGE OF CAPITAL

A second hypothesis is that geographical differences in the age of capital also influence local cycles. New capital is, on the average, more appropriate for current relative prices of land, labor, and other inputs than old plant and equipment. For this reason establishments with a high average age of capital should have a higher average cost curve and lower profits than plants producing the same product with a new capital stock.

In multiplant firms, the oldest capital plants should absorb a disproportionate share of the firms' recessionary cutbacks in output. Losses in profits are minimized when cutbacks are concentrated in the least efficient, highest average cost plants. During the expansionary phase of the cycle output should again resume in the relatively old plants. For this reason employment is expected to be more variable in firms with old capital; in the aggregate employment cycles should be more variable in regions and locations where old capital is concentrated. (Jackson et al., 1981).

A second reason for more severe cycles in old-capital areas is that single and multiplant firms are more likely to shut down, during the recession, when their capital is old. Economic theory suggests that a firm will continue to produce as long as price is greater than average variable costs (AVC). When price falls below AVC the firm or plant will be closed. This shut-down will take place earlier in the old capital, high-average-cost plants than in new, efficient operations. Thus we would expect plant closings to be greater in areas where old capital is concentrated. Whether this would also lead to more severe cycles in areas with a high average age of capital would depend upon the rate of new investment during the recovery.

Varaiya and Wiseman (1977) have suggested that old capital stock may lead to more severe regional recessions because the retirement of obsolete capital is concentrated in regions where the average age of capital is high. During the expansionary phase of the cycle, scheduled retirements may be postponed because either the revenues from running the old capital are temporarily higher than the salvage value of the land, labor and capital, or orders from regular or new customers must be met. With the end of the expansion, the delayed retirements combined with the regularly scheduled retirements are bunched together, creating the appearance of a more volatile cycle. This phenomenon is expected to explain a concentration of plant closings during economic downturns.

Old capital in this argument is a sign of long run disinvestment. Due to high relative wages, declining markets, etc., firms may disinvest in a region with a view to eventually closing the plant. It is these permanent plant closings that are described by Varaiya and Wiseman. Since branch plants with old capital are spatially concentrated in the Northeast and Midwest and in cities rather than suburbs, it is expected that, all other factors constant, the Northeast and Midwest will experience more severe recessions than the South and West. It is also expected that employment in cities will be more variable than in suburbs.

#### LABOR INTENSITY OF THE PRODUCTION PROCESS

A third hypothesis is that labor-intensive branches of multi-establishment firms absorb a disproportionate share of the firm's output adjustments during the business cycle. Because labor-intensive operations are concentrated in low wage regions and/or regions with relatively old

capital, local business cycles in these areas may be more severe than the national average, holding all other factors constant.

During periods of cyclical downturn, managers of profit-maximizing multi-plant firms should allocate, ceteris paribus, production cutbacks disproportionately with high-variable-cost plants bearing a larger burden of economic slowdown than the high-fixed-cost plants. The reason is that the cost of idle fixed inputs is borne entirely by the firm, whereas the cost of idle variable inputs is not or is only partially assumed by the firm. Labor is a major variable cost, whereas capital is a major fixed cost. Thus, losses to the firm are minimized when labor-intensive plants are idled, workers laid off, and production shifted to capital-intensive plants. As a consequence it is predicted that, during economic downturns, firms and, in the aggregate, regions and cities with low capital-labor ratios will experience more severe reductions in aggregate output and therefore greater cyclical unemployment than their high capital-labor ratio counterparts.

This hypothesis depends upon the evidence of Feldstein (1976), McLure (1977), and Vickery (1979). All three researchers found that with the current unemployment insurance system, firms do not bear the full cost of layoffs. To illustrate the cross-regional variations in production functions, within two-digit SIC level industries the capital-labor ratios for the South, North Central, and Northeast were 12.0, 8.8, and 9.0, respectively, for textile manufacturing in 1972. The values for machinery manufacturing were 7.9, 7.6, 10.4, and 12.0 for the West, South, North Central, and Northeast regions, respectively, in 1972.

Because capital and skilled labor are complements in the production process, the owner of capital-intensive plants may be reluctant to reduce

output through layoffs in that plant due to the high cost of replacing skilled workers during the recovery. This effect would reinforce a positive relationship between layoffs and labor intensity of branch plants. It is worth mentioning that capital-intensive operations are energy using. Thus in the post-1973 period, capital-intensive plants may have had relatively high average costs. This effect would counteract the negative relationship between layoffs and capital intensity hypothesized here.

#### UNIONIZATION

The fourth hypothesis of spatial differences in business cycles is that cross-area differences in layoff practices occur due to cross-area differences in union strength. Feldstein (1978) and Medoff (1979) found evidence to support the hypothesis that workers in unionized firms have significantly higher probabilities of being laid off than workers in similar nonunionized firms. When demand for labor falls, management has several options for reducing their workforce: to leave positions vacated by quits unfilled, to reduce or slow the growth in real wages, to reduce hours, or to increase layoffs.

Adjustments through unreplaced quits are less of an option for the unionized firm than the nonunionized firm. The reason is that the quit rate in union firms is relatively low (see Freeman [1978] and Johnson [1976]).

A second option for labor adjustments is a reduction in wages. Empirical evidence by Hamermesh (1970) and Lewis (1978) suggests that real wages in the union sector are less sensitive to changes in the unemployment rate than are wages in the nonunion sector, a finding that suggests

that unionized establishments are unlikely to respond to falling labor demand by reducing wages. With lower quit rates and less ability to reduce wages, union firms must make use of either layoffs or work sharing.

Work sharing is likely to be the preferred strategy of the younger, more recently hired workers. With work sharing the marginal worker bears only part of the cost of the cutback whereas with layoffs, the recently hired or marginal worker bears the total cost. The older workers, on the other hand, prefer cutbacks to take the form of layoffs. Under a policy favoring layoffs, senior workers are likely to retain their jobs, and therefore incur no or little cost.

Because in nonunionized firms the marginal workers' preferences are transmitted to management, it is likely that cutbacks in such firms will take the form of work sharing and cuts in wages. In unionized firms where the demands of the average and more senior workers predominate, layoffs will be more likely to prevail (see Medoff [1979]).

An additional hypothesized reason for the positive relationship between unionization and layoffs is that managers of unionized firms may find a policy favoring layoffs acceptable because they expect low rehiring costs during the recovery. Laid off union workers are not likely to abandon a union job. Rather, they will collect unemployment benefits and wait to be recalled. This ensures the firm a ready pool of workers to draw from during the upswing, making firms less reluctant to lay off workers during the downturn. Additional evidence by Freeman (1978) has shown that years of tenure with an employer are positively correlated with unionization, a result consistent with the argument that workers are reluctant to relinquish a union job.

Union workers tend to be skilled. Since employers are reluctant to lay off skilled employees, the impact of unionization on the severity of regional recession will be muted.

#### LABOR SURPLUS

Another hypothesis of cross-area differences in layoffs, the fifth, is that employers in labor-surplus markets may expect low labor search costs during the recovery and therefore readily lay off workers during the downturn. Comparable plants in labor-short areas may expect difficulties in rehiring and, therefore, find it cheaper in the long run to hoard workers. Using the annual peak-level unemployment rate as a proxy and data from Great Britain, Thirwell (1966) found that regions experiencing the greatest cyclical sensitivity were those with unemployment rates persistently above the national average.

#### UNEMPLOYMENT INSURANCE

A sixth hypothesis is that plants located in states with greater unemployment insurance (UI) benefits relative to wages are expected to experience more severe layoffs. The greater the state's UI in relation to wages, the more likely workers are to wait out the recession without looking for and taking another job. Employers, therefore, may be inclined to lay off workers expecting them to be available for rehiring at a later date. Also, employees with some bargaining power are more likely to accept layoffs in high UI states than in low UI states. In low UI states workers may prefer wage or hour reductions to layoffs. The level of unemployment insurance benefits should only affect regional cycles, not

metropolitan/non-metropolitan or central city/suburban differences in employment cycle.

#### HEADQUARTERS VS. BRANCH PLANTS

A final hypothesis holds that headquarters locations of firms will be less vulnerable to economic cycles than branch plant locations. In one interpretation, cities can be divided into "command and control" centers and "production" centers (Noyelle and Stanback, 1983). The former have a high concentration of service and management activities, which insulates them from cyclical fluctuations. There is also held to be a managerial or social inclination to mitigate cyclical fluctuations in the headquarters location, while concentrating recessionary cutbacks in production principally in branch plants at other locations. (See also Bluestone and Harrison, 1982.)

To determine whether the share of manufacturing employment in administrative position varies by area, the following percentages were calculated. In the New York SMSA, .15 of all manufacturing employment is in administrative positions. The equivalent values for Boston, Baltimore, and Houston are .10, .03, and .07, respectively. The proportion of manufacturing employment in administrative positions also varies by state. For example, the value for Florida is .02 and for Michigan is .09 (Census of Manufacturers, 1972). Area differences in employment in central administrative employment may explain, in part, why regional business cycles within the same industry vary.

SUMMARY

To summarize, it has been hypothesized that the severity of actual recessions deviates from the pattern based on industry mix alone for seven reasons: the age and size of firms, age of capital, capital-labor ratios, the extent to which labor forces are unionized, the existence of a labor shortage or surplus in peak years, the level of unemployment insurance benefits, and the concentration of headquarters versus branch plants.

## THE DUN AND BRADSTREET DATA

In its role as a credit rating company, Dun and Bradstreet (D&B) collects and maintains information on approximately 4.5 million establishments. This computerized data base, called the Dun's Market Indicators (DMI) file, includes: a Dun's number, a unique number assigned to each business establishment; the establishment's business address; the number of employees; the operation's major standard industrial classification(s) (SIC) at the four-digit level; and the establishment's status as a single establishment operation, a headquarters, a branch location, or a subsidiary.

We have obtained a sample of the Dun and Bradstreet file that includes all firms that listed either SIC 354 (machine tools), SIC 367 (electronic components) or SIC 371 (motor vehicles) as primary, secondary or tertiary activities. To permit an analysis of firm employment changes over the business cycle, the above data were obtained for the peak year of 1973, the trough year of 1975, the peak year of 1979 and the recession year 1982. The sample includes data on 27,014 firms in SIC category 354, 14,067 firms in SIC category 367, and 11,909 firms in SIC category 371.

These three industries were selected for a number of reasons. First, firms in SIC code categories 354, 367 and 371 are cyclically sensitive. Therefore, we were assured that a geographic comparison of employment fluctuations was possible. Second, the selected industries

are comprised of a substantial number of multiunit firms. Since a comparison of the behavior of branch plants with single establishment plants is one question to be addressed, it was important that the industries to be analyzed contain a sufficiently large sample of both types of operations. The percent of all establishments that were multiunit organizations in 1977 was 11 percent for SIC 354, 21 percent for SIC 367, and 28 percent for SIC 371 (Census of Manufacturers, 1977, pp. 7-64 to 7-78).

A third reason for selecting machine tools, electronic components and motor vehicles is that there has been a substantial number of permanent plant and firm closings in these industries. This allows comparisons of closings in branch plants with closings in single plant establishments during the cycle, as well as comparisons of establishment closing in downswings with rates of closing during expansions. Fourthly, the growth rates of the three industries vary. Motor vehicles is declining in terms of employment. Machine tools is relatively stable, while electronic components is a growing industry. Finally, motor vehicles is an industry that frequently responds to economic slow-downs with temporary plant closings. The inclusion of motor vehicles will permit a study of the regional distribution and determinants of temporary shutdowns.

#### CREATING THE FILE

In order to analyze employment contractions and expansions over the business cycle, the four Dun and Bradstreet files were merged to create histories for each firm.

The files were merged using the Dun's numbers, a number unique to an establishment. When an establishment closes the Duns number is permanently retired. Every new establishment is assigned an original Dun's number.

Each establishment was then flagged as to whether it closed, opened or moved within the nine year period. A firm was flagged as a mover if the firm had matching Dun's numbers in two consecutive years, but had moved from one zip code area to another in the interim. For example, if Jones Electronics Company was located in zip code area 02140 in 1975 and in 02267 in 1979, this company is noted as a 1975-79 mover. A firm for which there was a Dun's number in an early year but none in the following years was flagged as an establishment closing, and a firm that appeared for the first time in the data set in any year after 1973 was flagged as an establishment opening. The opening or birth records are less reliable than the plant closing data, however. Since Dun and Bradstreet are constantly expanding their coverage of firms, it is not clear whether a firm new to the file is actually new to the economy or a recent addition to the DMI file. There also is considerable delay—often several years—before a new firm enters the Dun and Bradstreet file.

There were 155 firms that showed up in the 1973 file but were absent in the 1975 file and reappeared in the 1979 file. There were 259 firms that appeared in the 1975 file, disappeared in 1979 and reappeared in 1982. This disappearance and reappearance of firms may have been due to changes in firms' major lines of business. For example, if a firm listed 3671 as one of its top three lines of business in 1973 but not in

a primary, secondary or tertiary line of business in 1975, then the firm would not appear in the 1975 file. If 3671 was again among the firm's three most important lines of business in 1979, the firm would reappear in the file. Since this problem of disappearing and reappearing establishments occurs in only .5 percent of the cases it is not a major concern here and is overlooked for purposes of this study. However, any firm that reappeared in the data base was treated as if it had a continuous history.

The merged Dun's files were then merged with the Bureau of the Census's City Reference File (CRF). The CRF assigns place descriptions to zip code areas. For example, the CRF file notes that zip code area 20003 is a central city. The place descriptions used for this study are central business districts and central cities, and suburbs (rest of SMSA).

A central city flag was attached to any establishment whose zip code identified it as being inside a central city of an SMSA. The Census definition of a central city is the largest city in an SMSA. One or two additional cities may be identified as central cities on the basis of the following criteria:

- "1. The additional city or cities must have a population of one-third or more of that of the largest city and a minimum population of 25,000, or

2. The additional city or cities must have at least 250,000 inhabitants" (Census Geography, 1979, p. 25).

Incorporated place is defined as "political units incorporated as cities, boroughs (excluding Alaska and New York), villages and towns (excluding the New England States, New York, and Wisconsin). Most incor-

porated places are subdivisions of the MCD (minor civil divisions) or CCD (census county divisions) in which they are located; for example, a village located within and legally part of a township. However, almost 4,000 incorporated places cross MCD and/or county lines, but no incorporated places cross state lines since they are chartered under the laws of a state." (Census Geography, 1979, p. 22.)

The Dun's file records a standard metropolitan statistical area (SMSA) code for each firm. Thus the Dun's file allows us to determine whether a firm is located in or outside an SMSA. Suburbs, for this study, are defined as the area within an SMSA as noted by the Dun's file but outside of the central city as noted by the CRF.

The 1977 boundaries of central business districts and central cities are used throughout this study, in order to maintain consistency in geographical comparisons. This created one problem.

The post office is constantly dividing zip code areas and creating new zip codes. For the zip codes created after 1977 there were no matches in the 1977 CRF. Since the majority of these new zip codes were outside SMSAs the problem was not as serious as it might have been. Out of 32,253 records in 1982, there were 204 firms located within SMSAs whose zip codes did not have matches on the City Reference File. The firms were eliminated from the central city/suburban analysis. The number of cases in this category is sufficiently small (.6 percent) that the elimination of these cases should not distort the results.

The report submitted earlier, entitled "Using the Dun and Bradstreet Data to Analyze the Effects of Business Fluctuations on Firm Employment," describes a number of problems with the D&B data. These shortcomings are

not to be repeated here except to report on how several problems were resolved in creating the merged file.

One problem with the DMI data is that many addresses were illegitimate, such as Esplanade Mall in place of a street name and number. Birch found that about 20 percent of all addresses were not legitimate street addresses (Birch 1979, p. 15). They were names of office buildings, industrial parks, shopping plazas, or street intersections. In other cases addresses were abbreviated in one year and not in another; for example, Skyline Rd was reported as the address for one firm in 1975 and Skyline Road was reported in 1979. Due to both of these problems, in combination with misspellings, the matching of street addresses to determine movers was problematic. For this reason we decided to match zip codes rather than addresses to identify movers.

Two complications arose. One is that occasionally firms use the zip code of the nearest post office rather than the code of the location of their facility. This creates a city bias in identifying the location of firms. The extent of this problem is not yet known but will be explored.

The second problem was that some zip code boundaries change over time. Thus it was difficult to determine whether a firm was an actual mover or whether its zip code was redefined. This problem was resolved through a hand editing process. This process was carried out as follows.

According to the post office, when changes are made in a geographical area's zip code, only the last two numbers of the zip code are affected, with one exception which will be mentioned below. For example, in 1979, 8611 8 Mile Drive in Detroit had a zip code of 48074. In 1982, the same address had a zip code of 48091.

In order to distinguish between an actual move and a redefinition of zip codes, each firm in which the last two digits changed during interim years and the addresses were not equal were printed out. Many non-movers were included in this file, due either to misspelled or to inconsistently reported addresses. For example, Jephco Manufacturing fell into this category. In 1975 Jephco's zip code was 74135. In 1979 the code was 74112. The address for Jephco Manufacturing was recorded as 3704 E 56th St. in 1975 and as 3704 E 56 St. in 1979. Jephco Manufacturing is clearly operating in the same location, however the addresses were reported slightly differently by Dun and Bradstreet in the two years. Firms such as Jephco were remerged with the file and flagged as non-movers.

The exception to zip code changes affecting only the final two digits occurred in 1980. During that year the post office revised the last three or four digits of a number of zip codes. Firms that were affected by these changes are accurately recorded as non-movers.

It is clear that the use of zip codes arbitrarily includes some short moves in the mover file and excludes others. For example, if a move across the street put the firm in a new zip code district it is included as a mover. The same distance move is overlooked when it was an intra-zip code district move. This should not have a substantial effect on our results. The study will analyze central city to suburb moves, SMSA to metropolitan moves, and inter-regional moves. The number of firms moving within a zip code district and yet changing type of geographical place should be very small.

A second shortcoming of the DMI file is that not all firms are interviewed every year. The data sets acquired from D&B are as they existed on December 31, 1973, December 31, 1975, December 31, 1979 and July 28,

1982. However, not all firms are interviewed during the year of the tape's date. So, for example, on the 1979 tape, information on a record may date from June 1978.

Fortunately, the D&B file records the date of firm interview so that a distribution of interview dates could be calculated. This information is presented for machine tools in Tables 1 and 2 below. The tables were calculated by region, in order to detect any regional biases in the final results that could occur due to regional differences in updating.

Tables 1 and 2 indicate that there is little regional difference in the updating of the DMI files and that about 80 percent of all firms are interviewed each year. In the 1975 tape, 79 percent of all firms in New England were updated in that year. Eight percent of the firms on the 1975 tape in New England were last interviewed in 1974, and 12 percent of the firms on the 1975 tape were last interviewed in the years 1967 to 1973. The distribution of interview dates in New England is similar to that of all other regions in 1975. The regional distributions of interview dates in 1982 are also similar across regions. In all regions, between 42 percent and 47 percent of all firms on the 1982 tape were interviewed in 1982. (Note that the 1982 tape includes the information as it stood on July 28 rather than December 31. For this reason only about 42 percent of all firms were interviewed in 1982.) The frequency of updating is similar for electronic components and motor vehicles, as well as for 1979 machine tools.

A third problem with the data were coding errors in the employment numbers. In the original D&B tape the number of employees was coded as YXXX, where Y is the number of zeros to be attached to XXX. Any error in coding Y could easily distort employment values by thousands of employees.

Table 1

Percent of Interviews taken in  
and Prior to 1975 as Recorded  
on the 1975 Dun and Bradstreet  
Tape, by Region For Machine Tools  
(SIC 354)

	1967-69	1970-72	1973	1974	1975
New England	1	5	6	8	79
Mid-Atlantic	2	5	5	8	80
South Atlantic	1	4	5	10	79
East South Central	0	3	2	10	85
East North Central	1	4	4	8	83
West South Central	1	5	4	8	82
West North Central	1	5	4	8	82
Mountain	1	4	4	9	83
Pacific	1	5	7	10	78

Table 2

Percent of Interviews taken in  
and Prior to 1982 as Recorded  
on the 1982 Dun and Bradstreet  
Tape, by Region For Machine Tools  
(SIC 354)

	1973-76	1977-79	1980	1981	1982
New England	5	6	7	38	44
Mid-Atlantic	4	5	6	39	46
South Atlantic	3	6	7	42	42
East South Central	2	4	6	42	47
East North Central	3	5	6	39	47
West North Central	3	6	5	39	46
West South Central	3	6	5	39	46
Mountain	6	8	6	35	46
Pacific	5	6	8	37	44

To check for such errors, employment for all firms that experienced employment changes of 1500 employees or greater between any two years was printed out. There were 304 firms or records that fell into this category for machine tools, 708 firms for electronic components, and 767 firms for motor vehicles. These large changes were reviewed for coding errors. In many cases the changes looked plausible and were left as coded by Dun and Bradstreet. For example one firm had 7,500 employees in 1973, 7,500 employees in 1975, 6,000 employees in 1979, and 6,400 employees in 1982. The 1975 to 1979 change in employees of 1,500 seemed plausible. In other cases only two years of employment were available so it was more difficult to determine if the employment values were reasonable. These cases were also left unchanged.

However, there were cases where coding errors were obvious. For example, one firm was recorded as having 260 employees in 1973, 300,000 employees in 1975, and 151 employees in 1979. Clearly the 1975 value was incorrectly reported. This number was changed to 300. Errors such as these could seriously distort the analysis. The number of cases where similar errors were detected and records revised was five cases for SIC 354, 17 cases for SIC 367, and 16 cases for SIC 371.

Coding errors were also discovered for a small number of SMSAs. This fourth problem surfaced during the central city/suburban and metropolitan/non-metropolitan comparisons, when establishments appeared as residents of central cities but not as residents of an SMSA. Further analysis of this inconsistency<sup>1</sup> indicated that a number of establishments located within

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1. As explained on page 22 above, a central city was defined by the Bureau of the Census and used in the City Reference File as the largest city in an SMSA.

SMSAs, as noted by their addresses, were recorded by Dun and Bradstreet as being outside of any SMSA.

This problem was easily circumvented when an establishment was located within a central city, because the central city code can be checked against the SMSA code. However, errors in SMSA codes for establishments outside of central cities could only be detected with a laborious process of matching city names with SMSA codes. For this reason no adjustments were made for firms that are recorded, incorrectly, as non-metropolitan but are located in suburban areas, and for firms that are recorded, incorrectly, as suburban firms but located in non-metropolitan areas.

To indicate the extent to which SMSA codes are misreported, out of 2023 electronic components establishments in central cities in 1973, 105 or 5 percent are misrecorded as being outside of SMSAs by the Dun and Bradstreet SMSA codes. In the 1982 data, only one out of 2,489 or .04 percent of central city electronic component establishments are miscoded. Clearly, there are fewer reporting errors at least for SMSA codes in later years than in earlier years.

#### COVERAGE OF DATA BASE

Table 3 compares the coverage of employment and number of firms for the Dun and Bradstreet file with that of the County Business Patterns. The tables show the ratio of the D&B data to that of the County Business Patterns for machine tools by state. Table 3 indicates that the D&B data capture a large proportion of each state's employment in machine tools. Similar tables were presented for electronic components and motor vehicles

Table 3

Ratio of Number of Employees  
and Number of Firms Reported  
in the DMI File to that  
Reported by CBP for SIC 354,  
by State

	<u>1973</u>		<u>1975</u>		<u>1979</u>	
	Employment	Firms	Employment	Firms	Employment	Firms
Alabama	2.36	1.52	1.82	2.03	2011/G	1.80
Alaska	—	—	—	—	1/NA	1/NA
Arizona	.85	1.69	3.62	1.97	1.06	1.54
Arkansas	2.48	1.73	1.40	1.69	1.19	1.83
California	1.49	1.33	1.83	1.52	N/A	N/A
Colorado	3.14	2.06	1.72	1.59	1.17	1.61
Connecticut	1.95	1.56	2.61	1.58	2.30	1.60
Delaware	2.26	1.28	1.79	1.83	1.25	1.83
DC	15/NA	3/NA	—	—	4/NA	2/NA
Florida	1.04	1.39	1.59	1.59	1.30	1.47
Georgia	1.96	1.80	2.08	2.29		2.27
Hawaii	—	—	—	—	—	2.00
Idaho	72/NA	5/NA	60/NA	4/NA	71/B	1.60
Illinois	1.48	1.45	1.87	1.56	1.64	1.62
Indiana	1.60	1.42	1.75	1.53	1.31	1.40
Iowa	1.04	1.92	1.05	1.69	1.17	1.48
Kansas	2.20	1.83	2.07	1.73	3.27	1.92
Kentucky	1.71	1.37	2.26	1.44	2.45	1.30
Louisiana	6.05	1.60	189/C	1.42	.36	1.71

Table 3 (continued)

	<u>1973</u>		<u>1975</u>		<u>1979</u>	
	Employment	Firms	Employment	Firms	Employment	Firms
Maine	2.46	1.08	1.29	1.25	.89	.93
Maryland	1.63	2.00	—	—	1.44	2.29
Massachusetts	1.94	1.58	1.77	1.67	1.52	1.61
Michigan	1.29	1.41	1.44	1.50	1.33	1.50
Minnesota	1.20	1.31	1.32	1.49	1.31	1.43
Mississippi	1.95	2.00	1031/E	1.54	1859/F	1.34
Missouri	1.63	1.52	1.50	1.42	2.16	1.49
Montana	9/NA	2/NA	20/NA	2/NA	66/NA	5/NA
Nebraska	1.23	1.63	5.22	1.83	3.23	2.50
Nevada	29/NA	6/NA	30/B	3.00	.14	1.3
New Hampshire	1.60	1.56	NA	NA	1.13	1.49
New Jersey	1.78	1.46	2.09	1.52	1.95	1.39
New Mexico	119/NA	9/NA	1.46	3.50	1.18	2.29
North Carolina	1.26	1.53	1.30	1.58	1.06	1.48
New York	1.42	1.43	NA	NA	1.48	1.56
North Dakota	211/NA	6/NA	57/NA	2.00	90/B	1.75
Ohio	1.47	1.48	1.57	1.58	1.38	1.54
Oklahoma	2.44	1.90	2.92	1.91	4.17	2.34
Oregon	2.65	2.19	2.10	2.83	2.68	2.89
Pennsylvania	2.3	1.37	2.62	1.43	1.54	1.31
Rhode Island	1.90	1.91	1.76	1.78	1.44	1.75

Table 3 (continued)

	<u>1973</u>		<u>1975</u>		<u>1979</u>	
	Employment	Firms	Employment	Firms	Employment	Firms
South Carolina	1.05	1.66	2.30	1.54	1.27	1.44
South Dakota	168/D	2.00	1.07	1.60	.92	1.80
Tennessee	2.05	1.49	1.56	1.48	1.49	1.31
Texas	.96	1.51	1.17	1.66	1.54	1.80
Utah	131/NA	14/NA	2.4	3.37	5.13	2.61
Vermont	1.02	1.37	NA	NA	NA	NA
Virginia	6.26	2.2	1.13	1.93	2.04	1.42
Washington	2.49	2.64	1.42	2.85	2.44	2.68
West Virginia	1.98	.92	1.7	1.00	6.45	1.31
Wisconsin	1.25	1.44	1.59	1.56	1.63	1.43
Wyoming	4/NA	1/NA	4/NA	1/NA		2.00

\* A:0-19; B:20-99; C:100-249; E:250-499; F:500-999; G:1,000-2,499; H:2,500-4,999; I:5,000-9,999; J:10,000-24,999; K:25,000-49,999; L:50,000-99,999; M:100,000 or more.

\* Figures reported as NA or D are unavailable due to negligability or avoidance of disclosure, respectively.

in Appendix B of the earlier report "Cyclical Effects at the Local Level: A Microeconomic View," (Howland, 1983). The results for all industries indicate the D&B data has good cross-state coverage for all industries.

Coverage appears to be substantially higher for the D&B data primarily because the D&B data base includes firms that listed the three-digit SIC code as a primary, secondary, or tertiary line of business. The County Business Patterns records only those firms that list a particular SIC code as a primary line of business. Since the 1982 County Business Patterns is not yet out, the 1982 ratios could not be calculated.

Table 3 also allows us to check for any major problems in the Dun and Bradstreet file. For example, unusually large or small ratios or large fluctuations in ratios across years would signal possible coding errors. As demonstrated in Table 3 the majority of the ratios are reasonable. Several ratios do however, stand out as potential problems. For example, for SIC 354, the employment ratio for West Virginia for 1979 is high at 6.45.

Table 4 compares the regional distribution of industry employment recorded by Dun and Bradstreet with the regional distribution of employment as recorded in the Census of Manufacturers (CM).

The table demonstrates that the regional distribution for machine tools, electronic components, and motor vehicles employments as reported by D&B is very similar to that of the figures reported by CM. There is, however, some tendency for D&B to have greater coverage of the New England, Mid-Atlantic, and Pacific states. For example, 15.1 percent of D&B's machine tool employment is in New England whereas the CM records only 13.0 percent of national employment in New England.

Table 4

Comparison Between The Regional Distribution  
of Employment As Recorded by Dun and  
Bradstreet and the Census of  
Manufacturers, 1973

	<u>Machine Tools</u>		<u>Electronic Components</u>		<u>Motor Vehicles</u>	
	D&B (1973)	CM (1972)	D&B (1973)	CM (1972)	D&B (1973)	CM (1972)
New England	15.1	13.0	11.1	12.1	1.4	1.2
Mid Atlantic	19.6	15.9	30.1	29.0	10.3	8.8
East No. Central	48.1	54.2	19.7	16.3	66.9	65.8
West No. Central	3.6	4.3	4.5	4.1	4.5	6.7
South Atlantic	4.5	4.8	4.9	7.8	5.1	5.9
East So. Central	2.1	NA	2.1	2.1	3.0	3.5
West So. Central	1.6	NA	6.6	6.7	2.7	2.1
Mountain	0.5	0.4	2.0	5.6	0.3	0.4
Pacific	5.0	4.4	19.0	16.3	5.8	5.6

This regional bias in the D&B file is expected to have diminished in the later years of the data set, since D&B has made an effort to expand their coverage of firms. However, as is clear from Table 4, even in the worst case the regional biases in data collection are not major.

To conclude, The Urban Institute has created a unique data set to study spatial differences in business cycles. This data set includes employment histories for machine tools, electronic components, and motor vehicle industries. These establishment employment histories include data for 1973, 1975, 1979 and 1982. This data set has been merged with the Bureau of the Census' City Reference File to note whether firms are located in central business districts or central cities. We now turn to the regional and central city by region.

## RESULTS

The results of the regional and central city by region analysis is divided into several sections. First, the secular shifts in regional in machine tool, electronic components and motor vehicle employment is summarized. Second, the pattern of national employment changes over the cycle are analyzed. This section addresses the importance of net expansions, (or contractions) in continuing in-place firms, of employment gains due to establishment births, and of employment losses due to establishment closings in explaining cyclical fluctuations in national employment. These first two sections provide background and a point of reference for the regional and central city analysis that follows.

The third section of the paper addresses regional variations in employment fluctuations over the cycle. Topics covered under this portion of the paper are: which regions are most cyclically sensitive; do net expansions and contractions and establishment birth and closing rates vary by region; and which of these components is responsible for regional differences in employment fluctuations?

The fourth and final section considers regional comparisons of central city employment fluctuations—which central cities are most cyclically sensitive; and which of the components of employment change explain these regional variations.

REGIONAL SHIFTS IN MACHINE TOOLS, ELECTRONIC COMPONENTS AND MOTOR  
VEHICLE EMPLOYMENT

Table 5 measures peak to peak shifts in regional employment shares in machine tools, electronic components and motor vehicles. As shown, machine tool employment is concentrated in the East North Central, Mid-Atlantic and New England Regions. New England's share of national machine tool employment has been relatively stable over the 1970's, whereas the Mid-Atlantic's and East North Central's shares have declined. All other regions captured larger shares of national machine tool employment over the period with the West North Central, West South Central, and Pacific regions being the largest gainers.

The Mid-Atlantic, East North Central, and Pacific regions have the largest shares of national electronic components employment. Again New England's share of this industry has been stable from 1973 to 1979, whereas the Mid-Atlantic regions' share has declined precipitously from 30.1 to 20.5. The Pacific region has captured a disproportionate share of employment growth in electronic components over the period, growing from 19 percent to 27.2 percent. Other large gainers of electronic components employment have been the South Atlantic and Mountain regions.

As is well known, motor vehicles employment is heavily concentrated in the East North Central region. In 1979, approximately 61 percent of total employment in motor vehicles was located in the East North Central states. The data also shows that the East North Central's employment losses in this industry are greater than the losses in other regions. This region began the period with 66.9 percent of the employment and ended the period with only 60.8 percent of the national employment. The Pacific region is another net loser. The Pacific region's share declined from 5.8 percent to 5.3 percent. Regions that captured larger shares of motor

Table 5

Regional Distribution of National  
Employment, for Machine Tools,  
Electronic Components, and  
Motor Vehicles, 1973 to 1979\*  
(Percent)

	<u>Machine Tools</u>		<u>Electronic Components</u>		<u>Motor Vehicles</u>	
	1973	1979	1973	1979	1973	1979
New England	15.1	15.0	11.1	11.1	1.4	1.4
Mid Atlantic	19.6	16.2	30.1	20.5	10.3	11.4
East No. Central	48.1	46.6	19.7	15.9	66.9	60.8
West No. Central	3.6	4.8	4.5	4.0	4.5	7.2
South Atlantic	4.5	5.1	4.9	7.3	5.1	5.2
East So. Central	2.1	2.7	2.1	2.7	3.0	4.4
West So. Central	1.6	2.6	6.6	6.6	2.7	3.8
Mountain	0.5	0.9	2.0	4.8	0.3	0.4
Pacific	5.0	6.1	19.0	27.2	5.8	5.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

\*Calculated from the Dun and Bradstreet DMI file.

vehicle employment are the West North Central, the East South Central, and the West South Central.

#### COMPONENTS OF NATIONAL EMPLOYMENT CHANGE

Employment growth in the national economy occurs when expansions in existing establishments are greater than contractions, and when employment gains due to establishment births exceed employment losses due to establishment closings. Decline occurs when net expansions are negative and when losses due to closings exceed gains due to births. Before turning to a discussion of regional and central city cycles a consideration of the relative importance of expansions, births and deaths in explaining swings of the national economy will provide a point of reference for the discussion that follows.

Table 6 disaggregates annual coverage employment growth rates in the 1973-75 and 1979-82 recessions and the 1975-79 recovery into its component parts. To what extent is growth and decline over the cycle determined by expansions or contractions in continuing firms, employment gains due to births, and establishment losses due to establishment closings. The results are surprising.

For the machine tools and electronic components industries employment changes in continuing establishments are positive during both recessions and expansions. Moreover, in continuing machine tool and electronic component establishments, employment changes behave countercyclically with net expansions in continuing establishments rising during recessions and falling during expansions.

Employment decline during recessions is explained solely by rising employment losses due to establishment closings and falling employment

Table 6

Annual Average National Growth Rates Over  
the Cycle—Subdivided into Expansions,  
Births and Closings for all Industries

	1973-75	1975-79	1979-82
<b>Machine Tools</b>			
Net Expansions*	2.08	0.63	1.76
Births	3.76	5.99	5.35
Deaths	<u>-8.32</u>	<u>-4.67</u>	<u>-7.57</u>
Total	-2.48	1.95	-0.46
<b>Electronic Components</b>			
Net Expansions*	2.68	1.92	2.13
Births	3.30	7.15	6.22
Deaths	<u>-10.36</u>	<u>-6.32</u>	<u>-6.74</u>
Total	-4.38	2.75	1.61
<b>Motor Vehicles</b>			
Net Expansions*	1.44	-0.78	-2.57
Births	0.24	0.47	0.56
Deaths	<u>-4.13</u>	<u>-5.19</u>	<u>-7.17</u>
Total	-2.45	-5.50	-9.18

gains due to establishment births. Employment expansions in the national economy are caused by an increase in births over deaths. This pattern is demonstrated in Table 6, where employment growth rates for each industry for each phase of the cycle are subdivided into the rates of change due to net expansions, births, and deaths. The pattern for machine tools for the 1973-73 and 1975-79 period is typical.

Machine tool employment declined by an annual average rate of 2.48 percent during the 1973-75 recession. During this period the rate of employment change for in-place firms was a positive 2.1 percent. Employment gains due to the births contributed 3.8 percent to total employment whereas employment losses due to establishment closings reduced employment by an annual average rate of -8.3 percent. Thus employment in stayput firms was stabilizing and the national employment decline can be explained by an excess of deaths over births.

During the 1975-79 expansion, employment in in-place establishments grew at .63 percent. Note that this rate was lower during the expansion than it was during the recession. Employment gains due to establishment births rose to 6 percent and losses due to establishment closings fell to -4.7 percent. Total machine tool employment, therefore, grew by an annual average rate of approximately 2 percent over the period. The pattern is similar for both industries for both recessions and the expansions. Motor vehicles differs slightly from the pattern in that net expansions play a more important role in employment fluctuations than do births and deaths.

Table 6 indicates that establishment birth and death rates fluctuate over the cycle. Employment growth due to births expands during the recovery and falls during the downswing. For example, for machine tools, the rate of employment gains due to births rose from 3.8 percent in the

1973-75 recession to 6 percent during the recovery then fell to 5.4 percent during the 1979-82 recession. Employment losses due to establishment closings also fluctuate with the cycles. The rates for machine tools declined from 8.3 in the recession to 4.7 percent in the expansion and then rose again to 7.6 percent in the later recession. Clearly, the swings in the business cycle are explained by fluctuations in "national increase" (births over deaths) rather than fluctuations in continuing establishments.

Why is it that, contrary to expectations, employment rises in continuing in-place firms during recessions rather than contracts? Not only is employment growth in continuing in-place firms positive during recessions, but it behaves countercyclically with net expansions greater during recessions than expansions. One hypothesis is that there are two sectors in industries with a highly skilled and organized labor force. One sector is comprised of large well established firms and a second sector is comprised of many small marginal firms (Piore, 1978).

Both the highly skilled nature of workers in machine tools, electronic components, and motor vehicles as well as the high rate of unionization in these industries make it particularly expensive and difficult for companies to deal with flux. If workers are laid-off during downturns in the economy, retraining is expensive, in terms of search costs, time lost during retraining, and direct outlays for training. The alternative to rehiring and retraining, is carrying nonproductive workers on the payroll. This option is also expensive. Moreover, union seniority rules require that the last hired be the first fired, and job descriptions are often so rigidly defined that managers cannot readily lay off redundant workers and spread workers around to fill vacated tasks. One alternative

to the rigidities created by unions and high layoff costs is subcontracting. Well-established firms may subcontract during expansions, and then reduce and eliminate these subcontracts when the downturn begins.

Thus a sector of small marginal firms is created that start up and grow during expansions as they pick up contracts from the well-established firms. These firms then shrink and go out of business as the economy slows and contracts dry up. It is possible, therefore, that a marginal sector, bears the costs of flux and uncertainty over the business cycle. Employment in the established sector is not only stable but expands during recessions to cover production previously carried out in the marginal sector.

This as well as other hypotheses bear testing and is suggested here as one possible explanation for the counter intuitive result that employment in continuing in-place establishments expands rather than contracts during recessions. We now turn to consider regional variations in business cycles.

#### REGIONAL VARIATIONS

Regional Annual Growth Rates. The results of the regional analysis suggests, although by no means conclusively, that the faster growth regions are more cyclically sensitive than the slow growth regions. Employment growth rates in the three 3-digit industries studied here appear to fluctuate less over the cycle in the Northern than the Southern regions. The numbers that suggest this preliminary conclusion are reported here. Annual average growth rates during the 1973-75 recession, the 1975-79 expansion, and the 1979-82 recession are reported here for machine tools, electronic components and motor vehicles employment for the regions. The

reader should be aware that these annual growth rates are not precise measures of regional businesses cycles, rather they are intended to be suggestive; to provide a framework for the findings on regional patterns of establishment births, closings, expansions, contractions and in and out migration that follow; and to provide a consistency check between the D&B data and other sources of data in regional cycles. If regional comparisons of aggregate employment cycles were the major focus of this paper there are other data sources that are more reliable for this purpose. For example, the Bureau of Labor Statistics publishes Employment and Earnings which provides monthly employment totals for three digit industries by state. Also the Bureau of Economic Analysis publishes quarterly income data by state which have been used in another phase of this project. Both of the data sets measure regional cycles more precisely than the annual D&B data. As stated earlier the strength of the D&B data are that it allows an analysis of the underlying components of employment change. Its weakness is that the data are available only annually, with approximately 80 percent of the records updated randomly within a given year and the remaining 20 percent of the records updated in prior years. The D&B data, therefore, does not permit, a sensitive estimate of a region's employment peaks and troughs.

The annual growth rates were estimated by compiling the various components of employment change; adding net expansions to employment gains due to establishment births, subtracting out employment losses due to deaths, adding in-migration and subtracting out migration. The underlying figures for these calculations are shown in Appendices I-A through 3-C.

The annual growth rates were calculated by combining components rather than by calculating aggregate employment changes for one important

reason. The D&B data is a sample rather than a census and every year D&B increases their coverage of establishments. Therefore, the economy can be losing employment due to a decline in national output, while total employment as recorded by D&B expands due to the addition of establishments to the data set. This would not be a problem except the D&B DMI data base does not allow the user to distinguish between new additions of older established branch plants to the file and the addition of newly established branch plants. Thus a consistent over-time sample cannot be obtained by simply extracting recent additions of old branches and firms from the file.

Another shortcoming of the D&B DMI file, described earlier is that D&B does not capture all new establishment births. In fact only a small portion of new establishments are entered in the DMI file in the early years of their existence. Thus a great deal of new employment growth escapes record. To adjust for this problem, an estimate was made of how much employment would have to be created due to new births to make growth rates calculated from the D&B file consistent with growth rates calculated from the Census of Manufacturers. The resulting estimate was that D&B captures approximately 13.7 percent of all new machine tool and electronic components employment in the first two to three years after the establishment's inception. For motor vehicles, employment growth rates calculated from an unadjusted DMI file were similar to growth rates calculated from the Census of Manufacturers. These estimates are consistent with those of David Birch. Considering the whole DMI file, involving retail, services, wholesale and manufacturing employment, Birch estimates that D&B captures

about 10 percent of all new employment. He also found the capture rate for manufacturing to be above that of retailing, wholesaling, and services.<sup>1</sup>

D&B appears to capture a higher proportion of new employment due to births in slow growth industries, as suggested by the high coverage in motor vehicles. Therefore, we would also expect the coverage of new births to be better in slow growth regions. This suggests a potential spatial bias in the birth adjustment process. For machine tools and electronic component, new employment due to births was adjusted upwards by 13.7 percent. It is likely that for fast growth regions D&B captures less than 13.7 percent of new birth employment and for slow growth region captures more than 13.7 percent of new birth employment. The net effect would be to underestimate growth in the fast growth regions. With these caveats in mind, we turn to regional differences in employment growth over the business cycle.

The annual average growth rates are reported in Tables 7, 9, and 11 for machine tools, electronic components, and motor vehicles respectively. The expected cyclical pattern is evident. Employment growth declines or slows during the recessions and accelerates during the 1975-79 recovery. For example machine tool employment declined at an average annual rate of 6.7 percent during the 1973-75 recession, grew at an annual average rate of .1 during the recovery, and then declined by an average of 6.4 percent per annum in the latest recession.

The annual average growth rates of Table 7, 9, and 11 are not trend adjusted figures, making it difficult to compare cyclical variability

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1. Phone conversation with David Birch (1/23/83).

Table 7

Annual Average Growth Rates\*  
 During the Business Cycle,  
 By Region, for Machine Tools

Region	1973-75 Recession	1975-79 Expansion	1979-82 Recession
New England	-6.71	0.06	-6.42
Mid Atlantic	-4.39	-2.99	-0.48
East North Central	-1.14	1.17	-1.14
West North Central	-2.67	6.33	-2.05
South Atlantic	-1.52	8.01	5.91
East South Central	6.98	6.97	11.64
West South Central	-6.19	21.86	5.44
Mountain	14.43	17.54	13.37
Pacific	-1.85	7.61	2.28
Total	-2.47	1.95	-0.46

Source: Calculated from Dun and Bradstreet DMI file, See Appendix 1-A through 1-C.

across regions. For example in Table 7, employment growth for machine tool employment is positive in all three periods in the rapidly growing Mountain region. In the slow growth Mid-Atlantic states employment growth is negative in all periods. These growth rates represent not only regional differences in cyclical employment swings but large cross-regional differences in long run employment growth.

When quarterly or monthly data series are available, this trend adjustment process is often made by calculating fluctuations around five-year moving averages of the series. Since a continuous data series is not available in this case, an adjustment for regional differences in long run employment is made by calculating absolute differences in growth rates between phases of the cycle.

The difference or "swing" measures, reported in Tables 8, 10, and 12 represent differences in annual average growth rates between the recessionary and expansionary phases of the cycle. So for example, between the 1973-75 recession and the 1975-79 expansion the annual average growth rate for machine tool employment swung from -6.7 to .06 for a difference measure of 6.8. The larger the "swing" or absolute difference between two annual average growth rates, the more sensitive the regional economy is to the business cycle.

Table 8 shows the swing measures for machine tools. The West South Central, West North Central, and Pacific regions appear to have the most cyclically sensitive employment whereas machine tool employment in the Mid-Atlantic appears relatively stable.

The swing measures for electronic components are calculated from the growth rates in Table 9 and reported in Table 10. New England's electronic components industry is the most cyclically stable, as shown by

Table 8

Differences in Annual Average Growth Rates between Recessions and the Expansion, for Machine Tools

	1973/75- 1975/79	1975/79- 1979/82	Ranking (9 = most cyclically sensitive region)
New England	6.77	6.48	6
Mid Atlantic	1.4	2.51	1
East North Central	2.31	2.31	2
West North Central	9.0	8.38	8
South Atlantic	9.53	2.1	5
East South Central	.01	4.67	3
West South Central	28.05	16.42	9
Mountain	3.11	4.17	4
Pacific	9.46	5.33	7

Source: Calculated from Table 7.

Table 9

Annual Average Growth Rates  
During the Business  
Cycle, By Region,  
for Electronic Components

Region	1973-75 Recession	1975-79 Expansion	1979-82 Recession
New England	0.40	3.19	5.43
Mid Atlantic	-11.88	-4.25	0.54
East North Central	-7.41	3.04	-4.05
West North Central	-5.07	-1.84	-8.03
South Atlantic	-6.88	7.05	1.35
East South Central	-2.48	24.75	-3.80
West South Central	8.15	0.29	3.76
Mountain	4.23	14.88	-1.95
Pacific	0.00	4.75	-6.75
Total	-4.38	2.75	-1.71

Source: Dun and Bradstreet DMI file, See Appendix 2-A through 2-C.

Table 10

Differences in Annual Average Growth  
Rates between Recessions and  
the Expansion, for  
Electronic Components

	1973/75- 1975/79	1975/79- 1979/82	Ranking (9 = most cyclically sensitive region)
New England	2.79	2.24	1
Mid Atlantic	7.63	4.79	5
East North Central	10.45	7.09	4
West North Central	3.23	6.19	2
South Atlantic	13.93	5.70	7
East South Central	27.23	28.55	9
West South Central	7.86	3.47	3
Mountain	10.65	16.83	8
Pacific	4.75	11.50	6

Source: Calculated from Table 9.

Table 11

Annual Average Growth Rates\*  
During the Business Cycle,  
By Region, for Motor Vehicles

Region	1973-75 Recession	1975-79 Expansion	1979-82 Recession
New England	0.94	-3.64	7.96
Mid Atlantic	-6.68	-3.09	-6.29
East North Central	-0.75	-8.14	-10.77
West North Central	-8.71	5.63	-12.21
South Atlantic	-7.65	-0.87	-2.70
East South Central	-0.87	3.89	-4.13
West South Central	-9.05	2.44	-4.59
Mountain	-20.47	0.66	9.62
Pacific	-4.41	-6.52	-16.50
Total	-2.45	-5.50	-9.18

Source: Dun and Bradstreet DMI file, See Appendix 3-A through 3-C.

Table 12

Differences in Annual Average Growth  
Rates between Recessions and the  
Expansion, for Motor Vehicles

	1973/75- 1975/79	1975/79- 1979/82	Ranking (9 = most cyclically sensitive region)
New England	4.58	11.60	6
Mid. Atlantic	3.59	3.20	1
East North Central	7.39	2.63	3
West North Central	14.34	17.84	9
South Atlantic	6.78	1.83	2
East South Central	4.78	8.02	5
West South Central	11.49	7.03	7
Mountain	21.13	8.96	8
Pacific	2.11	9.98	4

the "1" ranking. The East South Central and Mountain region appears to be the most cyclically sensitive. However, these large fluctuations may be due to the small porportion of employment in the electronic components industry in these two regions. The East South Central region has 2.1 percent of total electronic components employment while the Mountain region has 2 percent of total employment. Because of a small base, statistical errors in the numerator could produce large fluctuations in growth rates.

The results for motor vehicles are displayed in Tables 11 and 12. The annual average growth rates are displayed in Table 11 and swing measures are presented in Table 12. For motor vehicles, the Mid-Atlantic states appear to be most stable while the West North Central and Mountain regions are most cyclically sensitive, ranking "9" and "8" in terms of cyclical swing measures, respectively.

Several implications can be drawn from these tables. First, after controlling for industry mix at the 3-digit level there does appear to be substantial variations in the amplitude of regional cycles. For example, for electronic components, in Table 9, the 1973-75 recession and the 1975-79 expansion ranges from 2.79 for New England to 27.23 percentage point difference for the East South Central Region.

Secondly, the relatively low swing measures for the frostbelt regions contradict the hypothesis that old capital regions fail to compete in a slow growth national economy and therefore suffer more severe recessions. Either the Mid-Atlantic or the New England region rank the least cyclically sensitive region for all three industries and the East North Central ranks as the second most stable economy in terms of machine tool employment and the third most stable economy in terms of motor vehicle

employment. While the number of observations are too small for an adequate statistical test, the reverse argument seems more plausible. That is, the rapidly growing economies are more likely to experience large fluctuations in employment growth than are the older industrialized economies.

These findings are consistent with those of Manson (1983). Manson, in another phase of this same project used Bureau of Economic Analysis Income data and found the Mountain and South Atlantic regions to be the most cyclically volatile census regions and the Mid-Atlantic, New England, and West South Central regions to be the most stable. Although his results control for industry mix at the 1-digit Standard Industrial Code (SIC) level, whereas this data considers fluctuations of industries at the 3-digit SIC code level, the general comparability of results is encouraging.

Thirdly, the regional pattern of annual average growth rates are consistent with well known trends. The rapidly growing "sunbelt" regions are shown to be experiencing strong growth during the expansion, while the slow growth "Frostbelt" states show slow growth or decline. For example, New England and the Mid-Atlantic have been losing their share of national machine tool employment. The growth rate during the recovery is recorded in Table 7 as .06 percent for New England and -2.99 percent for the Mid-Atlantic. For the rapidly growing mountain and West South Central regions the growth rates during the recovery are 17.54 and 21.86 percent respectively. Similar patterns can be observed in Tables 9 and 11 as well. The reasonableness of these figures imply that the underlying figures of net

expansions and employment gains and losses due to births and closings are reliable. We now turn to consider these underlying components of employment change.

Net Expansions and Contractions in Continuing In-Place Establishments by Region. Annual employment changes in continuing in-place firms were calculated for machine tools, electronic components and motor vehicles for each phase of the business cycle. These expansion rates, displayed in Table 13 were calculated from only those establishments that were updated in the peak and trough years. This restriction eliminated 4 percent of the continuing establishments.

As expected after reviewing the national pattern in Table 6, employment in continuing in-place firms was stabilizing. That is, more often than not employment expanded rather than contracted during the recessions. Frequently employment changes in the continuing firms was countercyclical. For example, for machine tools, employment in the East North Central region grew at an annual average rate of 3.5 percent during the recession, growth fell to .97 percent during the expansion, and then increased to 2.1 percent during the 1979-82 recession. Similarly motor vehicle employment grew at 8.4 percent during the first recession in the East North Central, declining to a negative 7.0 percent growth rate during the expansion, and increasing again to 1.7 percent in the 1979-82 recession. The countercyclical pattern in the East North Central is significant because this region contributes the major share of national employment in these two industries. Approximately 50 percent of national machine tools employment and 65 percent of national motor vehicles employment is located in the East North Central states. In several cases

Table 13

ANNUAL AVERAGE RATE OF EMPLOYMENT EXPANSION IN CONTINUING ESTABLISHMENTS OVER THE BUSINESS CYCLE, BY REGION  
FOR MACHINE TOOLS, ELECTRONIC COMPONENTS, AND MOTOR VEHICLES

	New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
<b>Machine Tools (359)</b>									
1973-75 Recession	1.42	-0.22	3.48	3.76	1.17	7.72	8.55	15.60	6.94
1975-79 Expansion	2.51	-2.98	0.97	3.04	3.18	2.96	8.62	6.95	5.55
1979-82 Recession	2.60	2.49	2.12	1.49	3.58	5.03	0.84	0.77	0.24
<b>Electronic Components (367)</b>									
1973-75 Recession	8.25	2.27	-0.82	0.26	7.14	11.13	20.14	12.81	11.61
1975-79 Expansion	7.17	-6.51	4.27	1.74	6.34	5.26	7.00	12.34	8.19
1979-82 Recession	3.47	1.29	-0.67	4.58	9.76	-10.21	2.70	11.83	7.88
<b>Motor Vehicles (371)</b>									
1973-75 Recession	3.79	-4.24	8.41	-6.81	-5.12	5.11	0.86	-12.00	4.56
1975-79 Expansion	-5.57	-2.20	-7.02	5.17	3.41	5.07	5.18	2.63	2.52
1979-82 Recession	35.33	-7.27	1.66	-8.54	5.02	1.90	-2.52	6.04	-4.33

employment does behave procyclically. This is the case in the East North Central for electronic components and the West North Central for motor vehicles.

In general, expansions in all phases of the cycle appear to be greater in the fast growth states than in the industrialized North. For example, machine tool employment grew at 1.4 percent during the 1973-75 recession in New England and at 8.5 percent during the same period in the West South Central. The figures for the 1975-79 recovery were 2.5 and 8.6 respectively. This suggests that on site investment is one cause of long run regional growth in the Southern and Western regions.

Employment Gains Due to Firm Births. Firm birth rates are calculated as the number of births occurring in the period divided by the total number of establishments in the region at the end of the period. The rate of employment gained due to births is the total number of employees due to births divided by the number of employees in the region at the end of the period. These figures, which are unadjusted for the under reporting of new firms, are reported in Table 14.

The results of Table 14 suggest several general patterns. First, births are, in general, cyclically sensitive. Birth rates rise during expansions and fall during recessions. The pattern for employment gains due to births is similar. Secondly, new firms tend to be smaller than the industry average. This is indicated by higher firm birth rates than new employment rates. For example, in New England in 1973-75, new firms comprised an unadjusted 2 percent of all establishments at the end of the period. However these 2 percent of establishments contributed only 0.2 percent of all employment. This pattern of new births being small

Table 14

## ESTABLISHMENT BIRTHS AND EMPLOYMENT GAINED DUE TO FIRM BIRTHS\* OVER THE BUSINESS CYCLE, BY REGION

	New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
RATE OF ESTABLISHMENT BIRTHS*									
<b>Machine Tools</b>									
1973-75 Recession	1.95	1.82	2.97	4.53	4.03	6.28	6.86	6.64	3.96
1975-79 Expansion	2.76	2.34	3.55	4.42	4.89	4.71	6.18	5.61	4.55
1979-82 Recession	1.95	1.96	2.19	2.78	3.62	3.64	4.51	11.30	3.86
<b>Electronic Components</b>									
1973-75 Recession	3.83	2.71	3.53	5.22	4.31	4.40	6.18	5.46	5.82
1975-79 Expansion	3.22	2.78	3.89	5.14	5.38	6.35	6.10	6.70	6.14
1979-82 Recession	3.68	2.94	3.55	3.70	4.52	5.15	6.08	6.36	5.38
<b>Motor Vehicles</b>									
1973-75 Recession	3.19	2.50	2.73	3.40	4.91	3.64	5.78	4.29	4.68
1975-79 Expansion	3.21	2.98	2.97	3.96	5.61	4.38	5.29	7.06	4.76
1979-82 Recession	4.20	2.41	2.30	2.20	3.73	2.74	4.05	4.49	2.98
RATE OF EMPLOYMENT GAINED**									
<b>Machine Tools</b>									
1973-75 Recession	.18	.24	.44	.82	.63	1.24	1.62	.96	1.12
1975-79 Expansion	.45	.59	.81	.82	1.28	.89	2.74	3.32	1.15
1979-82 Recession	.41	.40	.56	.57	1.21	2.10	.84	3.46	1.74
<b>Electronic Components</b>									
1973-75 Recession	.63	.30	.22	.51	.33	.19	.31	.90	.58
1975-79 Expansion	.97	.58	1.08	.53	1.00	4.01	.90	1.02	.98
1979-82 Recession	1.18	.75	.93	.35	.68	.60	.52	.75	.83
<b>Motor Vehicles</b>									
1973-75 Recession	2.41	.11	.10	.19	.28	.21	.52	1.87	.85
1975-79 Expansion	.33	.55	.24	.59	.63	.57	1.62	2.85	1.16
1979-82 Recession	.52	1.53	.21	.26	.64	1.03	1.28	3.12	1.11

\*No adjustments in birth rates have been made. These figures represent births as reported in the DMI file.

\*\*As an annual percentage of all establishments at the end of the period.

\*\*\*As an annual percentage of all employees at the end of the period.

firms holds for all industries and all regions. Thirdly, as expected birth rates and new employment rates are generally higher in the sunbelt regions than the frostbelt. For example, the birth rates for the Northern regions range between 1.8 and 4.5 during the 1973-75 recession for motor vehicles. The sunbelt rates range between 4 and 6.9 for the same period and industry. The pattern of relatively high birth rates in the sunbelt holds for both expansionary and recessionary phases of the cycle.

Establishment Closings. Establishment closing rates are calculated as the number of establishments that went out of business during the period divided by the number of establishments at the beginning of the period. The rate of employment loss is equivalent to jobs lost in the region due to closings divided by the total number of employees in the region at the beginning of the period.

These closing rates, reported by region in Table 15 show plant closings as well as plant openings to be cyclically sensitive. Establishment closing rates rise during the recessions and fall during expansions.

Another point of interest from Table 15 is that plant closing rates appear to be higher in the sunbelt than the northern regions. For example, for machine tool employment for the 1973-75 recession the establishment closing rates for New England, Mid-Atlantic and East North Central range between 8 and 9.9. The comparable rates for the southern states range between 13.4 and 17.4. The relatively high closing rates in the fast growth regions holds for all phases of the cycle, recession as well as expansion, and the employment losses due to closings as well as establishment losses.

Table 15

## ESTABLISHMENT CLOSINGS AND EMPLOYMENT LOSS DUE TO ESTABLISHMENT CLOSINGS OVER THE BUSINESS CYCLE, BY REGION

	New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
RATE OF ESTABLISHMENT CLOSINGS*									
<b>Machine Tools</b>									
1973-75 Recession	8.00	9.94	9.07	12.10	13.39	11.85	17.35	13.06	12.15
1975-79 Expansion	5.76	6.62	6.01	6.44	7.54	6.22	9.13	8.18	7.52
1979-82 Recession	8.50	7.93	7.47	9.26	10.92	8.96	10.58	11.62	10.31
<b>Electronic Components</b>									
1973-75 Recession	11.77	14.03	13.08	15.69	16.93	18.90	19.41	17.66	15.42
1975-79 Expansion	8.18	7.73	8.29	8.40	9.07	7.42	10.66	9.21	8.77
1979-82 Recession	11.23	9.96	11.98	11.09	13.13	14.43	12.98	11.74	12.00
<b>Motor Vehicles</b>									
1973-75 Recession	10.65	11.29	10.93	14.71	14.72	11.75	16.84	18.18	15.51
1975-79 Expansion	8.25	8.60	8.05	8.88	8.92	7.09	8.10	8.63	8.86
1979-82 Recession	11.43	9.90	10.01	9.46	10.88	8.75	12.79	9.00	11.72
RATE OF EMPLOYMENT LOSS**									
<b>Machine Tools</b>									
1973-75 Recession	8.26	6.27	7.14	12.07	10.04	9.90	23.01	8.25	14.33
1975-79 Expansion	2.58	5.16	5.23	4.42	4.49	3.49	7.02	9.32	7.00
1979-82 Recession	8.72	7.48	6.50	7.81	6.45	9.77	7.30	12.43	11.63
<b>Electronic Components</b>									
1973-75 Recession	8.60	14.04	7.25	8.88	10.60	10.58	3.67	13.08	8.79
1975-79 Expansion	5.99	4.26	5.98	6.84	8.21	1.50	10.32	3.96	9.22
1979-82 Recession	6.70	5.14	10.49	6.82	5.54	7.33	3.29	4.82	7.71
<b>Motor Vehicles</b>									
1973-75 Recession	7.89	5.35	2.98	4.39	5.89	4.98	10.09	13.83	7.17
1975-79 Expansion	2.58	3.26	4.93	3.16	6.06	2.13	5.04	5.10	7.87
1979-82 Recession	3.82	5.86	6.64	4.78	4.29	5.24	10.12	3.08	8.85

\*As an annual percentage of all establishments at the beginning of the period.

\*\*As an annual percentage of all employees at the beginning of the period.

Comparable establishment closing rates and employment loss rates in Table 15 indicate that it is not just small establishments that are closing during expansions and recessions. For example, New England lost 8 percent of its establishments due to closings and the closing of these operations resulted in a loss of 8.3 percent of employment. This indicates that the closing firms represent the average sized establishment.

To explore further this question of size of firm and regional variations in plant closings over the cycle, establishment closing rates and employment losses due to closings were rerun eliminating all firms with less than thirty employees. The point was to determine whether the closing rates for large establishments were lower than for all establishments, as discovered by Birch (1979, Appendix D). The closing rates of these remaining "over 30 employee" establishments are reported in Table 16. Large firms' closing rates are in fact systematically lower than the rates for all firms. However, both sets of firms follow similar paths over the cycle. It is not just very small firms that are susceptible to closing.

Another interesting finding from a comparison of Tables 15 and 16 is that regional differences in plant closing rates narrow when the closings of under 30 employee establishments are eliminated from the sample. Plant closing rates range from 8 percent to 12.1 percent in the North and 11.9 to 17.4 percent in the North when all closings are considered. When the small establishments are removed from the numerator of the plant closing rates the Northern rates range between 7 percent and 10.9 percent in the North and 10.1 to 12.5 percent in the South. This suggests that the high Southern closing rates in the South are due to the susceptibility of small firms to shutdowns and the high proportions of small firms in the South. The fact that small firms and establishments are more likely to close than

Table 16

## ESTABLISHMENT CLOSINGS AND EMPLOYMENT LOSS OF LARGE\* ESTABLISHMENTS DUE TO CLOSINGS OVER THE BUSINESS CYCLE, BY REGION

	New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
RATE OF ESTABLISHMENT CLOSINGS**									
<b>Machine Tools</b>									
1973-75 Recession	9.67	7.47	7.00	10.87	12.37	12.50	10.64	10.71	11.57
1975-79 Expansion	3.78	5.10	4.57	5.00	6.03	3.63	6.70	8.82	7.31
1979-82 Recession	7.57	7.70	5.95	8.77	9.64	9.38	7.62	13.85	10.37
<b>Electronic Components</b>									
1973-75 Recession	8.46	12.20	10.37	13.70	12.98	16.67	16.25	15.25	11.15
1975-79 Expansion	6.39	5.57	6.66	5.75	7.64	6.88	10.00	6.05	8.33
1979-82 Recession	7.88	7.82	10.34	8.72	8.17	12.31	7.59	11.37	9.58
<b>Motor Vehicles</b>									
1973-75 Recession	7.89	9.69	7.61	10.00	8.41	9.26	12.62	13.16	11.35
1975-79 Expansion	5.26	5.73	6.50	5.43	6.78	3.37	7.72	7.95	7.14
1979-82 Recession	10.00	8.74	8.77	8.51	7.01	5.85	10.86	2.96	10.59
RATE OF EMPLOYMENT LOSS***									
<b>Machine Tools</b>									
1973-75 Recession	8.60	5.69	6.97	12.47	9.74	10.11	24.10	7.30	16.12
1975-79 Expansion	2.22	5.11	5.34	4.11	4.01	3.03	6.54	10.82	7.49
1979-82 Recession	8.81	7.53	6.34	7.71	5.57	10.12	5.93	12.70	12.31
<b>Electronic Components</b>									
1973-75 Recession	8.28	14.07	7.05	8.77	10.10	10.25	3.10	12.48	8.31
1975-79 Expansion	5.86	4.11	5.91	6.75	8.19	1.34	10.37	3.51	9.31
1979-82 Recession	6.38	4.91	10.41	6.56	5.01	7.15	2.76	4.52	7.38
<b>Motor Vehicles</b>									
1973-75 Recession	7.59	5.20	2.89	3.88	5.46	4.71	9.49	12.52	6.43
1975-79 Expansion	2.10	3.15	4.90	2.90	3.59	1.82	4.94	4.05	7.87
1979-82 Recession	2.93	5.71	6.59	4.54	3.82	5.08	9.64	0.89	8.41

\*Over 30 employees.

\*\*As an annual percentage of all large establishments at the beginning of the period.

\*\*\*As an annual percentage of all employees in large establishments at the beginning of the period.

large firms is shown in Appendices 7A 7B, and 7C. The relatively high firm birth rates in the South and the tendency for new firms to be small are demonstrated above, in Table 14.

Interregional Migration. The final component of employment change is interregional migration. Interregional migration rates during the recessions and recovery are reported in Table 17. The two most conspicuous findings from the interregional migration patterns are that 1) migration is not a significant factor in regional growth and decline and 2) migration is not sensitive to the business cycle.

The rates of regional in and out migration are small. For example, only .04 percent of New Englands machine tool employment in 1979 could be attributed in in-migration during the 1975-79 period. Out-migration in the same period avounted to only 1.44 percent of total employment. It is important to note, however, that these figures do not represent capital migration. Rather they represent a lower bound on the sequential movement of an establishment from one region to another. The distinction is important.

When an establishment announces it is closing, the Dun and Bradstreet office is supposed to find out whether the managers tend to reopen the establishment elsewhere. If the closing is actually a relocation the procedure is for the local Dun and Bradstreet office to relay the establishments records to the Duns office nearest the new location. For numerous reasons these transactions may not be carried and a relocation is listed as a death and new birth. One reason is that the Duns office may not keep current data on the activities of a firm, and therefore fails to recognize a move and to pass on records to the new Duns office. The new headquarters therefore issues the establishment a new number and the old

Table 17

ANNUAL AVERAGE RATES OF INTERREGIONAL MIGRATION. IN AND OUT MIGRATION FOR THE NINE CENSUS REGIONS  
FOR MACHINE TOOLS, ELECTRONIC COMPONENTS, AND MOTOR VEHICLES

	New England		Mid Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT*
<b>Machine Tools</b>																		
1973-75 Recession	.0	.01	.00	.17	.00	.04	.00	0	.84	0	.21	.03	0	.01	.09	0	.02	0
1975-79 Expansion	.04	1.44	1.30	.10	.03	.26	.09	.03	.40	0	.17	.05	.02	.07	.09	0	1.55	.04
1979-82 Recession	.08	.08	.01	.06	.02	.20	.01	.03	.71	.12	1.46	.03	.33	0	.40	0	.07	.12
<b>Electronic Components</b>																		
1973-75 Recession	.47	.04	.16	.11	0	.43	0	0	.14	0	.56	0	0	.00	.19	.06	.12	.06
1975-79 Expansion	.19	.00	.06	.13	.08	.69	.01	.06	.35	.32	0	.01	.64	.01	.01	.76	.24	.00
1979-82 Recession	.01	.01	.10	.14	.13	.41	0	0	.68	.06	.27	0	.01	.18	.02	.04	.06	.06
<b>Motor Vehicles</b>																		
1973-75 Recession	2.40	0	.16	.02	.00	.10	0	0	.25	0	.04	.01	0	0	0	0	0	0
1975-79 Expansion	.04	0	0	.08	.02	.02	.15	0	.22	.15	.01	.17	.15	.01	.02	.03	.00	.10
1979-82 Recession	.06	.02	.01	.11	.02	.00	.01	.18	.02	.01	.24	.02	.17	.01	.86	0	0	.20

\*In - as a percentage of total employment in the region at the end of the period.

Out - as a percentage of total employment in the region at the beginning of the period.

number is retired. A second reason moves are not noted is that firms fearing employee retaliation do not notify D&B that a closing is in fact a relocation.

More important than these two factors, however, is the fact that relocations are rarely characterized by the physical movement of capital equipment. Rather, relocations are more likely to take place as a firm establishes a new plant in a more efficient location and then disinvests in the old location while reinvesting profits at the new site. Meanwhile D&B has issued a second Dun's number to the new plant and then finally retires the old number when full depreciation and shutdown occurs at the old site. This second phenomenon is a capital shift but not an establishment migration. Thus the limitations of the regional migration rates reported in Table 17 should be recognized.

A second finding from Table 17 is that migration does not slow during recessions. These findings are consistent with the results of the city/suburban and metropolitan/non-metropolitan analysis reported earlier.

### SYNTHESIS

In order to explain the general process of growth and decline over the cycle and draw together findings presented thus far, the components of employment change for a fast growth and a slow growth region are calculated for machine tools and motor vehicles. The annual average growth rate for these industries are subdivided into the contribution of net expansions, of births and closings, and of migration.

The "representative" regions are New England and the West South Central regions for machine tools and the East North Central and West South Central for motor vehicles. New England's share of machine tool employment

declined slightly from 15.1 to 15.0 percent of national employment from 1973 to 1979. The West South Central's share increased from 1.6 to 2.6 percent. The East North Central's share of motor vehicle employment declined from 66.9 percent to 60.8 percent, whereas the West South Central share of motor vehicle employment grew from 2.7 percent to 3.8 percent. The results are displayed in Table 18. Machine tool employment in New England declined by 6.71 percent during the 1973-75 recessions. Net expansions in continuing establishments contributed .6 percent to growth, births contributed 1.3 percent to growth, and closings reduced employment by 8.8 percent for a total decline of machine tool employment of 6.71 percent.

A number of interesting conclusions can be drawn from this as well as earlier tables. First a comparison of the components of change in the fast growth region with the components of change in the slow growth region indicate that secular employment growth can be explained by net expansions of in-place establishments and the natural increase of new establishments. The fast growth West South Central region experienced substantially higher expansion rates in in-place establishments during all phases of the cycle than did the slow growth New England and East North Central regions. Clearly expansions are an important factor in the relatively high employment growth to the West North Central region.

Additionally, employment gains due to establishment births minus closings is a major contributor to growth in the Southern region. During the expansion, the national increase in machine tool employment in the West South Central region was 17.24 percent (21.19-3.95) whereas in the slow growth New England region national increase was .76 percent (3.34-2.58). The migration of firms into the Southern region plays a small but positive role in the region's growth, while out-migration in the North plays a small

Table 18  
 Components of Employment Change for  
 Selected Regions and Industries

	1973-75 Recession	1975-79 Expansion	1979-82 Recession
<b>Machine Tools</b>			
New England			
Net Expansions*	0.58	0.70	0.17
Births	1.32	3.34	2.84
Closings	-8.81	-2.85	-9.42
Net Migration	0.00	-1.40	-0.01
Total	-6.71	0.06	-6.42
West South Central			
Net Expansion*	6.01	4.64	3.49
Births	12.25	21.19	8.30
Closings	-24.43	-3.95	-6.80
Net Migration	0.00	-0.02	0.45
Total	-6.19	21.86	5.44
<b>Motor Vehicles</b>			
East North Central			
Net Expansions*	2.25	-2.65	-3.50
Births	0.11	0.24	0.24
Closings	-3.00	-5.73	-7.54
Net Migration	-0.10	0.00	0.05
Total	-0.74	-8.14	-10.78
West South Central			
Net Expansions	0.93	4.69	4.41
Births	0.29	2.34	1.51
Closings	-11.00	-4.80	-10.70
Net Migration	0.00	0.20	0.19
Total	-9.75	2.43	-4.59

\*In continuing establishments.

but negative role in decline. Long run regional shifts therefore appear to be explained primarily by the relatively high expansion rates in Southern establishments as well as relative high rates of natural increase in the South.

The West South Central's higher rates of natural increase in establishments is primarily due to high establishment birth rate rates relative to closings because the West South Central also experienced closing rates that were generally higher than that of the Northern regions. For example, the closing rate for machine tool employment in New England was 8.81 percent in 1973-75. The comparable rate for the West South Central was 24.2. While this example is one of the more extreme cases the general pattern of Southern regions experiencing higher closing rates through the Northern regions can be seen from Table 15.

Slow employment growth in the Northern region, therefore is explained by low rates of expansion or decline in the case of motor vehicles in in-place establishments and low rates of natural increase or natural decrease. Closing rates in the Northern region are relatively low but so are birth rates.

Evidence reported earlier suggests that the Southern regions are more cyclically sensitive than the Northern regions. The figures in Table 18 can shed some light on the apparent relative cyclical sensitivity of the sunbelt regions. As mentioned earlier, employment in in-place establishments is generally stabilizing over the cycle. Table 13 indicated a tendency for net expansion to increase during recessions and contract during expansions. This pattern is generally observable in Table 18 although the 1979-82 recession is an exception for machine tools in the West South Central region and for motor vehicles in the East North Central region.

North South variations in the cyclical behavior of net expansions do not appear to play a role in the tendency for fast growth regions to be more cyclically volatile than the Northern regions. Rather the volatility of the Southern regions appears to be explained by greater relative fluctuations in natural increase (or decrease). For example employment gains due to an increase in births over deaths fluctuated from -7.3 to .8 to -6.6<sup>2</sup> in New England over the three periods of the cycle. The comparable figures for the West North Central region were -12.2, 17.2 and 1.5.<sup>3</sup> For the two regions and motor vehicles the pattern is similar. Clearly fluctuations in rates of natural increase are greater in the sunbelt region. Employment growth (or decline) due to births minus closings fluctuates less in the East North Central region than in the West South Central. These rates of natural decrease fluctuate from -2.9 to -5.5 to -7.3<sup>4</sup> in the Northern region and from -10.7 to -2.5 to -9.2<sup>5</sup> in the West South Central region for motor vehicles.

To summarize, secular growth appears to be caused by greater net expansions and employment gains due to births minus closings in the Southern regions. Interregional movements of establishments play a small but positive role in the growth of the sunbelt. The Southern, fast growth regions tend to be more cyclically sensitive than the Northern regions and this relative volatility is due to greater fluctuations in the rate of employment gains due to births minus closings over the cycle.

- 
2. (1.32-8.81, 3.34-2.58, 2.84-9.42)
  3. (12.25-24.43, 21.29-3.95, 8.3-6.8)
  4. (0.11-3.0, 0.24-5.73, 0.24-7.54)
  5. (0.29-11.0, 2.34-4.8, 1.51-10.7)

CENTRAL CITY CYCLES BY REGION

Table 19 shows the shares of national employment in the central cities of each region. The largest concentration of central city employment for all three industries is in the East North Central region. Approximately 20 percent of machine tool employment, 7 percent of electronic components employment and 28 percent of motor vehicles employment is in the central cities of the East North Central region.

Few central cities are showing employment gains in these industries. Central cities of the Mountain and Pacific regions are gaining in shares of electronic components employment and the central cities of the West North Central region is capturing a larger share of motor vehicles employment. However, as expected for the suburbanizing industries of machine tools and motor vehicles, the central cities in most regions are losing relative shares of employment.

As shown in the earlier study, "Cyclical Effects at the Local Level: A Microeconomic View," electronic components employment appears to be centralizing when all Standard Metropolitan Statistical Areas are combined. The results of Table 19 indicate that this centralizing trend is localized in four regions; South Atlantic, East South Central, Mountain and Pacific. In the remaining five regions employment in this industry is decentralizing.

Annual Growth Rates Over the Business Cycle by Region. Tables 20, 22, and 24 show the average annual growth rates for the three phases of the business cycle. These growth rates are consistent with regional trends. Due to the secular decline in machine tool employment in Northern central cities, growth rates are negative during the expansionary as well

Table 19

National Share of Employment in Central Cities  
by Region, for Machine Tools, Electronic Components,  
and Motor Vehicles  
(Percentages)

	<u>Machine Tools</u>		<u>Electronic Components</u>		<u>Motor Vehicles</u>	
	1973	1979	1973	1979	1973	1979
New England	6.6	6.5	3.6	2.7	0.7	.5
Mid Atlantic	9.5	6.0	6.0	5.3	3.4	4.0
East No. Central	21.8	20.1	8.8	6.9	38.7	28.7
West No. Central	1.7	1.5	2.5	1.9	2.0	3.1
South Atlantic	1.2	1.3	1.3	1.6	3.1	3.1
East So. Central	0.8	0.9	1.5	1.7	0.9	0.8
West So. Central	1.1	1.3	5.7	5.1	1.4	1.7
Mountain	0.4	0.3	0.9	2.8	0.2	0.2
Pacific	<u>1.9</u>	<u>2.4</u>	<u>4.3</u>	<u>7.3</u>	<u>1.9</u>	<u>1.8</u>
Total in Central Cities	45.0	40.3	34.6	35.3	52.3	43.9

\*Calculated from the Dun and Bradstreet DMI File.

Table 20  
 Annual Average Growth Rates During the Business  
 Cycle in Central Cities by Region for  
 Machine Tools

	1973-75 Recession	1975-79 Expansion	1979-82 Recession
New England	-5.26	-3.09	-12.08
Mid Atlantic	-11.12	-6.11	-.64
East North Central	-1.11	-1.96	2.04
West North Central	-10.25	5.84	-7.24
South Atlantic	-3.11	9.55	-5.05
East South Central	-4.34	5.36	.51
West South Central	-16.38	24.25	6.34
Mountain	2.92	-.91	35.70
Pacific	-2.43	4.23	2.39

Source: Dun and Bradstreet DMI file, See Appendix 4-A through 4-C.

as recessionary phases of the cycle for these regions. Growth rates during the expansion phases are positive and relatively high for the more rapidly growing regions. For electronic components, growth during the expansionary phase of the cycle is strongest in the East South Central and Mountain regions and for motor vehicles, the rapid suburbanization of this industry, in combination with its long-run national secular decline shows up in negative growth rates for both recessions and the expansion.

The cyclical pattern for most regions is, as predicted. Growth declines or slows during economic downswings and increases during expansions. Although there are regional variations in central city cycles, no clear regional patterns are evident from the rankings of cyclical sensitivity in Tables 21, 23, and 25. The apparent cyclical variability of some areas may be due to the small number of employees in these central cities. With a small base, relatively small errors in the numerators can lead to distortions in the annual growth rates. For example, for machine tools, central cities in the West South Central and Mountain regions appear to be most cyclically variable. These areas also have small proportions of national machine tool employment, at 1.1 and .4 respectively.

Annual Average Growth Rates Over The Cycle. Table 26 shows the annual average rates of expansion in central city establishments that continued in-place throughout each phase of the cycle. As described earlier, these net expansions include only establishments that were updated by D&B during the peak and trough years.

Clear plant expansion patterns do not emerge from Table 26. More often than not central city machine tool and electronic components establishments behave countercyclically, however, there are exceptions. For

Table 21

Absolute Differences in Annual Average Growth Rates between Recessions and the Expansion, for Machine Tools

	1973/75- 1975/79	1975/79- 1979/82	Ranking (9 = most cyclically sensitive)
New England	2.17	8.99	4
Mid Atlantic	5.01	5.47	3
East North Central	0.85	4.0	1
West North Central	16.09	13.08	7
South Atlantic	12.66	14.60	6
East South Central	9.70	4.85	5
West South Central	41.13	17.91	9
Mountain	3.83	36.61	8
Pacific	6.66	1.84	2

Source: Calculated from Table 20.

Table 22

Annual Average Growth Rate During the Business  
Cycle in Central Cities by Region,  
for Electronic Components

	1973-75 Recession	1975-79 Expansion	1979-82 Recession
New England	4.99	6.82	6.29
Mid Atlantic	-14.63	4.54	-0.81
East North Central	-12.49	3.28	-11.50
West North Central	-9.62	-7.72	1.37
South Atlantic	3.12	6.94	-22.22
East South Central	-6.53	29.37	-8.37
West South Central	8.23	-5.33	2.55
Mountain	8.75	19.06	3.46
Pacific	-8.68	7.93	4.71

Source: Dun and Bradstreet DMI file, See Appendix 5-A through 5-C.

Table 23

Absolute Differences in Annual Average Growth Rates between Recessions and the Expansion, for Electronic Components

	1973/75- 1975/79	1975/79- 1979/82	Ranking (9 = most cyclically sensitive)
New England	1.83	0.53	1
Mid Atlantic	19.17	3.73	5
East North Central	15.77	14.78	7
West North Central	1.9	9.09	2
South Atlantic	3.82	29.16	8
East South Central	35.90	37.74	9
West South Central	13.56	7.88	4
Mountain	10.31	15.60	6
Pacific	16.61	3.22	3

Source: Calculated from Table 22.

Table 24

Annual Average Growth Rate During the Business  
Cycle in Central Cities by Region,  
for Motor Vehicles

	1973-75 Recession	1975-79 Expansion	1979-82 Recession
New England	-18.95	-4.54	0.95
Mid Atlantic	10.81	-8.35	-9.70
East North Central	3.19	-11.29	-8.77
West North Central	-0.08	5.05	-11.78
South Atlantic	-9.07	-0.46	-1.62
East South Central	-7.61	4.50	-3.13
West South Central	-14.41	-0.48	-0.32
Mountain	-29.19	-2.47	6.31
Pacific	-3.37	-4.38	-15.01

Source: Dun and Bradstreet DMI file, See Appendix 6-A through 6-C.

Table 25

Absolute Differences in Annual Average Growth  
Rates between Recessions and the  
Expansion, for Motor Vehicles

	1973/75- 1975/79	1975/79- 1979/82	Ranking (9 = most cyclically sensitive)
New England	14.41	5.49	6
Mid Atlantic	19.16	1.35	7
East North Central	14.88	2.52	4
West North Central	5.13	16.83	8
South Atlantic	8.61	1.16	1
East South Central	12.11	7.63	5
West South Central	13.93	0.16	3
Mountain	26.72	8.78	9
Pacific	1.01	10.63	2

Source: Calculated from Table 24.

example, central city employment in continuing machine tool establishments declined by 10 percent in the Mid-Atlantic region during the 1973-75 recession.

Plant expansions for machine tools and electronic components are often countercyclical, as in the case of New England, where net expansions are equal to 2.83 percent during the first recession declining to 1.02 percent during the expansion and then increasing to 2.23 percent during the 1979-82 recession for machine tools. However, in most cases there is no clear cyclical pattern, and occasionally net expansions are pro-cyclical as in the case of electronic components in the East North Central region.

As in the aggregate regional results described above, employment in continuing motor vehicles establishments often declines during recessions as well as expansions. For example, employment in East North Central grew by 15.87 percent during the 1973-75 recession but then declined by 13.12 percent during the expansion and by .31 percent during the 1979-82 recession. These net contractions reflect both the long-run disinvestment in central cities and in the motor vehicles industry.

Table 26

## ANNUAL RATE OF EXPANSIONS IN CONTINUING ESTABLISHMENTS IN CENTRAL CITIES OVER THE BUSINESS CYCLE, BY REGION

	New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
<b>Machine Tools</b>									
1973-75 Recession	2.83	-10.00	4.77	3.52	1.43	0.54	8.37	11.18	7.15
1975-79 Expansion	1.02	-4.48	0.04	3.02	3.32	4.67	6.93	6.30	4.51
1979-82 Recession	2.23	0.90	3.51	5.21	-0.50	-3.87	-1.83	6.92	2.10
<b>Electronic Components</b>									
1973-75 Recession	4.28	3.31	-4.12	-5.15	9.06	9.75	23.44	13.53	14.83
1975-79 Expansion	5.96	0.78	6.51	-0.94	8.95	7.20	4.47	12.77	3.26
1979-82 Recession	5.38	3.82	-2.82	1.46	7.19	-20.25	2.92	14.22	4.30
<b>Motor Vehicles</b>									
1973-75 Recession	-17.48	3.20	15.83	-4.47	-5.37	0.41	-2.82	-18.74	6.85
1975-79 Expansion	-5.87	7.54	-13.12	1.31	1.39	6.76	2.86	-2.74	1.10
1979-82 Recession	-15.18	-13.91	-0.31	-0.19	8.41	-4.59	-13.88	-2.24	-2.88

In four out of the five regions, employment in continuing central city establishments behaved pro-cyclically. This pro-cyclical pattern holds for New England, West North Central, West South Central, and Mountain regions.

Thus the generalizations to be made from employment changes in central city establishments are that central city machine tool and electronic components establishments generally expands during recessions and expansions, and frequently net expansions in these two industries are countercyclical. For motor vehicles, employment in continuing establishments is likely to contract during both recession and expansions and to behave pro-cyclically.

As in the case for the regional totals, Table 13, expansions appear to be slightly greater in the Southern central cities than in the Northern regions' central cities, with expansions in the West South Central, Mountain, and Pacific regions being the highest. As expected, the expansion rates during all phases of the cycle are generally lower for central cities than for the regions as a whole.

Central City Birth Rates by Region. As expected rates are lower for central cities than for the respective regions as a whole. Differences between central city and regional birth rates are particularly dramatic for motor vehicles establishments. For example, the 1973-75 establishment birth rate for machine tools in East North Central was 2.97 for the region as a whole and 2.05 percent for the central cities of the region. The comparable figures for motor vehicles were 2.73 and .02 respectively. As shown by the large number of zeros in the second half of Table 27, the

Table 27

ESTABLISHMENT BIRTHS AND EMPLOYMENT GAINED DUE TO ESTABLISHMENT BIRTHS IN CENTRAL CITIES OVER THE BUSINESS CYCLE, IN ALL REGION

	New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
RATE OF ESTABLISHMENT BIRTHS*									
Machine Tools									
1973-75 Recession	2.07	1.51	2.05	2.47	2.70	6.44	7.48	3.91	3.62
1975-79 Expansion	2.23	2.35	2.66	3.85	4.51	3.51	6.16	3.76	4.25
1979-82 Recession	1.92	1.59	1.67	2.24	2.70	3.85	4.42	6.06	3.59
Electronic Components									
1973-75 Recession	3.66	2.55	2.95	3.38	5.74	5.32	6.10	4.31	5.57
1975-79 Expansion	3.10	2.79	3.12	6.82	5.27	7.55	5.18	6.25	6.26
1979-82 Recession	3.83	2.01	3.43	3.23	5.05	5.42	6.46	5.17	5.87
Motor Vehicles									
1973-75 Recession	.01	.02	.02	.03	.06	.04	.06	.03	.04
1975-79 Expansion	.02	.02	.02	.04	.05	.04	.05	.06	.05
1979-82 Recession	.05	.03	.02	.02	.04	.03	.04	.04	.03
RATE OF EMPLOYMENT GAINED**									
Machine Tools									
1973-75 Recession	.11	.13	.22	.38	1.11	.66	1.98	.32	1.11
1975-79 Expansion	.24	.38	.56	1.24	1.45	.74	3.63	1.80	.89
1979-82 Recession	.49	.24	.44	.71	.65	1.01	.92	6.06	2.36
Electronic Components									
1973-75 Recession	.22	.19	.26	.07	.39	.05	.09	1.01	1.24
1975-79 Expansion	2.25	1.21	.39	.26	1.02	5.99	.39	.79	1.64
1979-82 Recession	.94	.22	.37	.13	.39	.79	.90	.47	1.01
Motor Vehicles									
1973-75 Recession	.00	.00	.00	.00	.00	.00	.01	.01	.01
1975-79 Expansion	.00	.00	.00	.01	.00	.01	.03	.03	.01
1979-82 Recession	.01	.00	.00	.00	.01	.02	.01	.01	.01

\*As an annual percentage of all establishments at the end of the period.

\*\*As an annual percentage of all employees at the end of the period.

contribution of new births of motor vehicles firms to central city employment is negligible. This result is not surprising. The assembly line technology is more suitable to sites where large parcels of land can be acquired at low cost. Thus motor vehicles establishments with sizeable employment are locating in suburban and non-metropolitan areas rather than in central cities.

Employment gains due to births are cyclically sensitive for central cities in the machine tool and electronic components industries. In almost every region births behave as expected. New births appear to be particularly sensitive to the cycle in the West North Central, South Atlantic, and West South Central. These fluctuations may, however, be due to the small number of employees in central cities in these regions. Electronic component births appear to be particularly sensitive to the cycle in New England, the Mid-Atlantic, and East South Central regions.

Establishing Closing Rates for Central Cities by Region. The pattern of central city closing rates are similar to those of the aggregate regional economies. Firstly, central city rates, in Table 28, are comparable to the all region closing rates, in Table 15. For example, for New England's machine tool industry in the 1973-75 recession the closing rate was 8.27 for the central cities and 8.0 for the region as a whole. This result is consistent with findings reported in the report "Cyclical Effects at the Local Level: A Microeconomic View" (Howland, 1983) that closing rates do not vary substantially within regions. Secondly, as is the case for the regions as a whole, central city closing rates fluctuate with the business cycle. Establishing closing rates are approximately 50 percent higher during recessions than expansions. Thirdly, closing rates

Table 28

## ESTABLISHMENT CLOSINGS AND EMPLOYMENT LOSS DUE TO ESTABLISHMENT CLOSINGS IN CENTRAL CITIES OVER THE BUSINESS CYCLE, BY REGION

	New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
RATE OF ESTABLISHMENT CLOSINGS*									
<b>Machine Tools</b>									
1973-75 Recession	8.27	9.43	8.78	11.28	14.29	11.74	19.11	11.70	11.16
1975-79 Expansion	5.23	7.31	6.33	7.03	7.43	5.11	9.72	9.35	7.58
1979-82 Recession	8.00	8.73	7.23	8.92	9.66	9.94	10.41	11.68	10.79
<b>Electronic Components</b>									
1973-75 Recession	9.73	13.95	13.81	13.08	17.05	18.27	20.31	19.92	16.73
1975-79 Expansion	8.54	7.91	9.15	9.12	8.78	7.98	10.68	7.97	9.75
1979-82 Recession	10.67	9.39	14.49	9.09	15.35	15.85	14.06	11.84	12.26
<b>Motor Vehicles</b>									
1973-75 Recession	11.61	10.73	10.0	13.06	14.91	10.76	16.41	19.86	7.29
1975-79 Expansion	9.21	9.03	7.76	9.76	7.68	7.50	8.47	7.91	4.86
1979-82 Recession	11.15	9.91	8.70	9.53	11.54	9.29	12.16	8.38	10.69
RATE OF EMPLOYMENT LOSS**									
<b>Machine Tools</b>									
1973-75 Recession	16.72	4.70	6.47	14.37	11.68	10.27	28.47	19.23	15.20
1975-79 Expansion	1.86	6.87	5.70	5.28	6.50	4.48	8.25	13.93	7.14
1979-82 Recession	12.77	8.50	6.95	8.54	7.20	7.02	6.74	14.68	14.41
<b>Electronic Components</b>									
1973-75 Recession	3.82	14.30	9.10	5.51	6.64	10.76	2.78	15.12	17.89
1975-79 Expansion	7.47	4.32	4.00	7.41	6.72	13.60	10.49	4.48	10.16
1979-82 Recession	8.34	4.78	10.43	3.16	11.81	7.22	3.04	4.19	8.78
<b>Motor Vehicles</b>									
1973-75 Recession	10.41	8.05	2.45	4.10	4.67	7.81	11.69	10.36	15.10
1975-79 Expansion	3.58	3.53	4.92	3.30	3.11	2.32	7.34	4.53	8.42
1979-82 Recession	5.19	5.58	4.82	2.46	2.16	5.01	7.86	3.84	12.76

\*As an annual percentage of all establishments at the beginning of the period.

\*\*As an annual percentage of all employees at the beginning of the period.

well as employment loss due to closings are higher in the Sunbelt regions during all phases of the cycle. The lowest closing rates tend to be in the New England and the East North Central regions whereas the Mountain and the West South Central regions experience the highest closing rates.

A comparison of establishment closings and employment loss due to those closings indicates the size of firms that shutdown. It appears that among machine tools in New England, it is the relatively large establishments that are closing. In 1973-75, 8.3 percent of New England's machine tool establishments closed leading to a 16.7 percent loss in New England's machine tool employment. This result is the exception, however. The most dramatic example of the size of establishments that are closing is for central city motor vehicles employment in East North Central.

Approximately 10 percent of the firms in this category went out of business, which represented only approximately 2.5 percent of employment.

Table 29 shows the closing rates for establishments with thirty or more employees. The closing rates for these large firms are slightly smaller than for all establishments indicating that in central cities it is more likely for smaller than larger establishments to close. This is in contrast to the aggregate regional pattern where the closing rates for large establishments are roughly comparable to those of all establishments.

Migration In and Out of Central Cities by Region. As shown in Table 30, migration in and out of central cities plays a minor role in central city growth and decline. In and out migration rates are very low and often zero. Furthermore, there is no evidence that these rates vary with the business cycle.

Table 29.

ESTABLISHMENT CLOSINGS AND EMPLOYMENT LOSS IN LARGE ESTABLISHMENTS DUE TO CLOSINGS  
IN CENTRAL CITIES OVER THE BUSINESS CYCLE, BY REGION

	New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
RATE OF ESTABLISHMENT CLOSINGS*									
Machine Tools									
1973-75 Recession	6.87	4.10	6.25	15.74	11.76	6.25	3.10	10.22	18.02
1975-79 Expansion	1.61	6.99	5.84	5.02	6.69	5.84	7.59	18.19	7.86
1979-82 Recession	13.43	8.76	6.88	8.75	6.26	6.88	4.57	17.96	15.49
Electronic Components									
1973-75 Recession	3.41	14.43	9.00	5.35	6.08	10.52	2.34	14.20	18.00
1975-79 Expansion	7.41	4.11	3.85	7.43	6.59	1.27	10.53	4.10	10.42
1979-82 Recession	8.09	4.55	10.24	2.90	11.27	7.00	2.58	3.98	8.42
Motor Vehicles									
1973-75 Recession	10.25	8.00	2.41	3.59	4.27	7.90	11.65	7.64	6.30
1975-79 Expansion	2.94	3.47	4.92	3.18	2.82	1.92	7.56	3.90	4.54
1979-82 Recession	4.27	5.50	4.77	2.25	1.72	4.32	7.04	2.01	10.13
RATE OF EMPLOYMENT LOSS**									
Machine Tools									
1973-75 Recession	11.24	7.50	6.42	12.71	17.19	13.33	11.67	13.64	11.57
1975-79 Expansion	3.49	5.99	5.00	5.00	6.43	4.03	6.73	12.50	7.31
1979-82 Recession	7.62	9.32	4.96	6.67	9.09	8.24	4.71	13.33	10.37
Electronic Components									
1973-75 Recession	5.56	11.94	11.99	4.76	12.20	18.73	19.57	15.71	16.09
1975-79 Expansion	6.79	4.42	7.43	6.25	5.81	8.33	9.38	5.17	9.60
1979-82 Recession	7.52	6.77	11.11	5.33	10.71	13.33	8.48	10.71	10.00
Motor Vehicles									
1973-75 Recession	9.38	8.46	7.67	6.67	6.10	10.71	14.04	12.50	11.18
1975-79 Expansion	7.14	7.09	6.53	5.45	5.21	4.41	9.68	8.33	6.80
1979-82 Recession	7.50	8.96	7.42	9.41	5.93	5.41	9.73	6.67	10.71

\*As an annual percentage of all establishments at the beginning of the period.

\*\*As an annual percentage of all employees at the beginning of the period.

Table 30  
 ANNUAL AVERAGE RATES OF INTERREGIONAL MIGRATION. IN AND OUT OF CENTRAL CITIES BY REGION,  
 FOR MACHINE TOOLS, ELECTRONIC COMPONENTS, AND MOTOR VEHICLES

	New England		Mid Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
<b>Machine Tools</b>																		
1973-75 Recession	0	0	.01	.03	0	.05	0	0	.71	0	.65	0	0	.01	0	0	.04	0
1975-79 Expansion	.06	3.32	3.52	.19	.06	.05	.05	.04	.72	0	0	0	0	0	0	0	0	0
1979-82 Recession	0	.18	.01	0	.03	.05	0	.03	2.37	.46	0	.01	.61	0	.79	0	0	.01
<b>Electronic Components</b>																		
1973-75 Recession	.32	0	.31	.18	0	.72	0	0	0	0	0	0	0	0	.18	.06	.18	.26
1975-79 Expansion	.13	0	0	.27	0	.19	0	.12	.66	1.00	0	0	.09	.01	0	.06	.02	.01
1979-82 Recession	.02	0	.05	0	0	.16	0	0	4.02	.25	.20	0	0	.23	0	.06	.14	0
<b>Motor Vehicles</b>																		
1973-75 Recession	0	0	.23	.06	0	.11	0	0	.07	0	.03	0	0	0	0	0	0	0
1975-79 Expansion	.12	0	0	.03	0	.01	0	0	.12	.01	.04	0	.33	.02	.04	.07	0	.35
1979-82 Recession	.08	.40	.01	0	0	0	.01	0	0	.01	0	0	0	0	.05	0	0	.53

### SYNTHESIS

The central city, by region, results do not suggest a regional pattern of cyclical variability. That is, Southern central cities do not appear to be more or less cyclically sensitive than Northern Central Cities. The long run growth of Southern States is explained by both on-site expansions and a net increase in births minus deaths, even though Southern employment loss due to plant closing are high relative to that of the Northern Central Cities.

### AREAS FOR FUTURE RESEARCH

A major area for further work is to explore the reasons for regional differences in plant closings. The results of this study indicate that fast growth regions experience persistently higher establishment closings than the industrialized North and that Southern closings are relatively cyclically sensitive. This finding contradicts the expectation that "old capital" regions do not compete well in a slack in the national economy and thus are susceptible to high rates of shutdowns during recessions. In contrast, old capital regions appear to be more cyclically stable than new capital regions.

A preliminary analysis of the size of establishments that close indicates that it is not just the small establishment that has a high probability of closing. It is hypothesized that high growth areas have higher proportions of their employment in new small marginal firms that experience high rates of failure and are particularly sensitive to the business cycle. These marginal firms lack access to capital and are not well established with suppliers or markets. In addition, their owners or managers may lack entrepreneurial experience. Thus the probability that

these firms would fail is high and particularly high during slowdowns in national economic growth. Future analysis of the size of a firm that is closing will have to separate firms from establishments, which has not yet been done.

Another area for immediate analysis is the effects of age of firm on plant closings. It is hypothesized that new firms are relatively susceptible to shutdown, explaining higher shutdown rates in the South. Age of firm is available for parent companies and single plant firms. Thus, this analysis will be possible.

Another hypothesis to be tested is that high closure rates in the fast growth regions is due to rapidly rising wages and input costs in the South. Less efficient firms may be squeezed out by the rising costs caused by greater competition for available labor, land, and other inputs.

Another area for research is to explain why expansions remain positive and often behave countercyclically over the cycle. One theory was suggested earlier and further research will be carried out to determine the characteristics of the firms that expand versus the firms that are newly established and the establishments that shutdown.

#### CONCLUSIONS

A general pattern of growth emerges from the preceding analysis of the Dun and Bradstreet data. In the long run, regional growth differentials favoring the Sunbelt are caused by relatively high expansion rates in the Southern states as well as by high employment gains due to births net of losses due to closings. The physical and sequential movement of a plant from one region to another plays a positive but small role in the growth of the Sunbelt.

The Southern regions appear to experience cycles that are relatively volatile as compared to those of the Northern region, when industry mix is controlled at the 3-digit level. However, contrary to the case of long run regional growth differentials, expansions and contractions in continuing Southern firms do not appear to play a role in the relative cyclical variability of the fast growth regions. In other words, although net expansions in continuing establishments are secularly higher in the South than the North, these net expansions do not fluctuate with the cycle. In both Northern and Southern regions, employment changes in continuing establishments are for most industries and recessions, positive. In fact in several cases employment in continuing establishments behave countercyclically, expanding at higher rates during recessions than expansions.

The cyclical sensitivity of the Southern regions is better explained by the volatility of employment growth due to establishment births minus establishment closings. During periods of strong national economic growth net investment rises. This new net investment takes place unevenly across space, with the Southern regions attracting approximately twice as many new establishments as the Northern regions. Plant closing rates are also higher in the Sunbelt than the Frost belt, but the high Southern birth rates more than compensate for the employment losses due to plant closings.

During slowdowns in the national economy unadjusted-for-trend growth rates in the Southern region frequently fall below the Northern regions' growth rates. The primary reason for this dramatic slowdown in Southern growth during recessions is due in part to falling birth rates, which drop to about one-half of the expansionary level. However, fluctuations in

closing rates appear to play an equally important role in the relatively severe recessions in Southern regions. For example, for machine tool employment in the West South Central region rates of employment loss due to plant closing were 9 percent during the expansion and then rose to approximately 17 and 11 percent during the two recessions. For motor vehicles, the same rates for the West South Central were 8 percent during the expansion rising to 17 percent and 13 percent during the recessions. The fluctuations in rate of employment loss due to plant closings are not as dramatic in the North. For example, motor vehicles' closing rates for the East North central were approximately 8 percent during the expansion rising to only 11 and 9 percent during the two recessions (see Table 15). Thus fluctuations in natural increase is the primary determinant of the relative cyclical sensitivity of the Southern regions.

The patterns for central cities are less clear. Regional differences in the cyclical sensitivity of employment are evident, however, no North-South patterns arise. The expansion birth and closing data are consistent with the long run decline and slow growth of the Northern central cities, and as expected employment growth due to births and net expansions are higher in central cities of the South than the North. Plant closing rates are also higher in Southern central cities than Northern central cities as in the case of the national and regional data, employment in continuing establishments tend to be stable over the cycle. However, the counter-cyclical pattern is not as strong in the central city case as it is for the regions and the nation.

Several hypotheses of regional differences in employment cycles were put forward in the second section of this paper. The results presented

thus far contradict or are inconsistent with several of these hypothesis, are consistent with others, and leave others untested.

The hypothesis that spatial differences in the age and size of firms influence an area's cyclical sensitivity has not yet been tested. The results clearly indicate that small establishments do not bear a disproportionate share of plant closings during recessions and expansions. Because small establishments may belong to a large firm this finding does not bear on the hypothesis.

The results presented are inconsistent with the hypothesis that old-capital regions are more cyclically sensitive than new-capital regions. The results clearly indicate that New England, the East North Central, and West North Central regions are not more cyclically sensitive than the new capital regions of the West and South.

The results are also inconsistent with the hypothesis that labor intensive, low wage regions are more cyclically sensitive than high wage capital-intensive regions. While the South, with its relatively low wages and labor-intensive production process, at least for machinery manufacturing is more cyclically sensitive, the hypothesis predicts large procyclical fluctuations in branches of continuing firms, not fluctuations explained by employment changes due to births and closings. Thus the stability and countercyclical behaviour of continuing establishments leads to a contradiction of this hypothesis.

The results are not consistent with the hypothesis that heavily unionized high unemployment insurance benefit (UI) regions are relatively cyclically sensitive. While the Pacific region is heavily unionized and

offers relatively generous UI benefits the Southern region does not. The hypothesis of regional differences in the distribution of headquarters influencing business cycles has not been tested, and the findings thus far shed little light on this hypothesis.

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and  
APPENDICIES

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Appendix 1-A

ANNUAL AVERAGE EMPLOYMENT GROWTH RATES DURING THE 1973-75 RECESSION FOR MACHINE TOOLS  
BY CENSUS REGIONS - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS, AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total		Continuing Firms			Births	Births Adjusted <sup>2</sup>	Closings	In-Migration	Out-Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Net Expansion								
New England	71,255	62,287	25,843	26,622	779	278	2,029	11,771	5	10	-8,968	-6.71
Mid Atlantic	92,329	84,557	78,589	79,080	491	496	3,620	11,582	8	309	-7,772	-4.39
East North Central	226,760	221,664	181,466	192,630	11,164	2,232	16,292	32,388	6	170	-5,096	-1.14
West North Central	16,812	15,938	12,562	13,525	963	299	2,182	4,059	40	0	-874	-2.67
South Atlantic	21,131	20,498	15,726	16,904	1,178	282	2,058	4,244	375	0	-633	-1.52
East South Central	9,725	11,184	7,630	8,981	1,351	273	1,993	1,926	47	6	1,459	6.98
West South Central	7,531	6,653	4,013	4,865	852	238	1,737	3,466	0	1	-878	-6.19
Mountain	2,411	3,224	1,930	2,601	671	73	533	398	7	0	813	14.43
Pacific	23,591	22,735	14,074	15,767	1,693	576	4,204	6,761	8	0	-856	-1.85
Total	471,545	448,740			19,142		34,648	76,595	496	496	-22,805	-2.47

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/2)

## Appendix 1-B

ANNUAL AVERAGE EMPLOYMENT GROWTH RATES DURING THE 1975-79 EXPANSION FOR MACHINE TOOLS  
BY CENSUS REGIONS - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total		Continuing Firms			Births	Births Adjusted <sup>2</sup>	Closings	In-Migration	Out-Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Net Expansion								
New England	78,898	79,097	25,903	28,109	2,206	1,447	10,562	8,155	126	4,540	199	.06
Mid Atlantic	105,300	93,405	80,088	71,028	-9,060	2,023	14,766	21,741	4,552	412	-11,895	-2.99
East North Central	252,259	264,356	189,663	197,911	8,248	8,067	58,883	52,763	312	2,583	12,097	1.17
West North Central	18,251	23,549	13,807	16,159	2,352	837	6,109	3,229	91	25	5,298	6.33
South Atlantic	22,390	30,926	17,822	19,830	2,008	1,386	10,117	4,020	431	0	8,536	8.01
East South Central	11,020	14,589	9,365	10,608	1,243	519	3,788	1,536	96	22	3,569	6.97
West South Central	7,332	18,725	5,019	7,436	2,417	1,513	11,044	2,059	11	20	11,393	21.86
Mountain	3,797	7,899	2,355	3,037	682	660	4,818	1,415	17	0	4,102	17.54
Pacific	25,752	34,997	16,780	20,390	3,610	1,490	10,876	7,207	2,009	43	9,245	7.61
Total	524,999	567,543			13,706		130,963	102,125	7,645	7,645	42,544	1.95

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/4)

Appendix 1-C

ANNUAL AVERAGE EMPLOYMENT GROWTH RATES DURING THE 1979-82 RECESSION FOR MACHINE TOOLS  
BY CENSUS REGIONS - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total		Continuing Firms		Net Expansion	Births	Births Adjusted <sup>2</sup>	Closings	In- Migration	Out- Migration	Total <sup>3</sup> Change	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period									
New England	79,969	68,089	33,613	33,925	312	721	5,263	17,439	143	159	-11,880	-6.42
Mid Atlantic	86,193	85,164	68,656	77,186	8,530	909	6,635	16,108	40	126	-1,029	-0.48
East North Central	248,368	241,403	203,405	212,211	8,806	3,525	25,730	40,341	99	1,259	-6,965	-1.14
West North Central	25,583	24,307	20,398	21,422	1,024	371	2,708	4,994	4	18	-1,276	-2.05
South Atlantic	27,141	31,469	22,613	23,815	1,202	961	7,015	4,373	564	80	4,328	5.91
East South Central	14,577	19,543	10,983	12,361	1,378	896	6,540	3,561	620	11	4,966	11.64
West South Central	13,800	15,812	11,225	12,517	1,292	421	3,073	2,518	165	0	2,012	5.44
Mountain	4,974	6,971	3,363	3,406	43	472	3,445	1,545	54	0	1,997	13.37
Pacific	32,459	34,359	22,189	23,125	936	1,430	10,438	9,438	58	94	1,900	2.28
Total	533,064	527,117			23,523		70,847	100,317	1,747	1,747	-5,947	-0.46

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/2.5)

## Appendix 2-A

ANNUAL AVERAGE EMPLOYMENT GROWTH RATES DURING THE 1973-75 RECESSION FOR ELECTRONIC COMPONENTS  
BY CENSUS REGIONS - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS, AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total		Continuing Firms			Births	Births Adjusted <sup>2</sup>	Closings	In-Migration	Out-Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Net Expansion								
New England	78,648	79,273	35,105	40,604	5,499	1,083	7,905	13,524	810	65	625	.40
Mid Atlantic	213,210	167,935	149,306	155,405	6,099	1,145	8,358	59,883	615	464	-45,275	-11.88
East North Central	139,557	120,303	109,012	106,946	-2,066	583	4,255	20,236	0	1,207	-19,254	-7.41
West North Central	31,453	28,420	24,725	24,788	63	341	2,489	5,585	0	0	-3,033	-5.07
South Atlantic	34,908	30,415	25,078	26,141	1,063	239	1,745	7,401	100	0	-4,493	-6.88
East South Central	14,481	13,780	10,270	12,112	1,842	51	372	3,065	150	0	-701	-2.48
West South Central	46,976	55,310	43,028	52	9,078	370	2,701	3,443	0	2	8,334	8.15
Mountain	14,098	15,343	9,159	11,963	2,804	290	2,117	3,688	30	18	1,245	4.23
Pacific	134,103	137,400	10,799	119,963	11,965	2,036	14,861	23,580	205	154	3,297	0.00
Total	707,434	648,179			36,347		44,803	140,405	1,910	1,910	-59,255	-4.38

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/2)

Appendix 2-B

ANNUAL AVERAGE EMPLOYMENT GROWTH RATES DURING THE 1975-79 EXPANSION FOR ELECTRONIC COMPONENTS  
BY CENSUS REGIONS - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total		Continuing Firms			Births	Births Adjusted <sup>2</sup>	Closings	In- Migration	Out- Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Net Expansion								
New England	85,815	97,493	33,563	40,333	6,770	3,401	24,825	20,557	654	14	11,678	3.19
Mid Atlantic	188,345	158,859	150,184	125,938	-24,246	3,759	27,438	32,094	412	996	-29,486	-4.25
East North Central	130,933	147,860	86,929	99,123	12,194	5,376	39,241	31,302	403	3,609	16,927	3.04
West North Central	33,562	31,179	24,110	26,137	2,027	662	4,832	9,184	17	75	-2,383	-1.84
South Atlantic	36,496	48,468	23,026	30,062	7,036	2,272	16,584	11,978	799	469	11,972	7.05
East South Central	13,430	39,750	12,614	14,951	2,337	3,397	24,796	808	0	5	26,320	24.75
West South Central	59,446	60,138	33,797	44,235	10,438	1,847	13,482	24,531	1,325	22	692	.29
Mountain	16,045	29,640	12,124	17,574	5,450	1,529	11,161	2,541	15	490	13,595	14.88
Pacific	174,720	211,424	104,759	142,753	37,994	8,368	61,080	64,425	2,074	19	36,704	4.75
Total	738,792	824,811			60,000		223,439	197,420	5,699	5,699	86,019	2.75

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/4)

## Appendix 2-C

ANNUAL AVERAGE EMPLOYMENT GROWTH RATES DURING THE 1979-82 RECESSION FOR ELECTRONIC COMPONENTS  
BY CENSUS REGIONS - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total		Continuing Firms			Births	Births Adjusted <sup>2</sup>	Closings	In- Migration	Out- Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Net Expansion								
New England	87,426	100,149	49,623	55,627	6,004	2,926	21,358	14,651	34	22	12,723	5.43
Mid Atlantic	161,707	163,914	134,299	135,756	1,457	2,973	21,701	20,770	403	584	2,207	.54
East North Central	124,616	112,602	89,336	87,973	1,363	2,768	20,204	32,680	380	1,281	-12,014	-4.05
West North Central	31,413	25,681	25,645	28,292	-2,647	311	2,270	5,355	0	0	-5,732	-8.03
South Atlantic	57,074	59,038	47,665	47,371	-294	1,235	9,015	7,907	1,230	80	1,964	1.35
East South Central	21,166	19,246	16,938	16,686	-252	285	2,080	3,878	130	0	-1,920	-3.80
West South Central	51,531	56,620	46,438	49,528	3,090	885	6,460	4,240	12	233	5,089	3.76
Mountain	37,648	35,854	3,302	36,262	-3,235	822	6,000	4,535	17	41	-1,794	-1.95
Pacific	213,792	180,533	16,689	196,940	-30,041	5,203	37,978	41,231	353	318	-33,259	-6.75
Total	786,373	753,637			-24,555		127,066	135,247	2,559	2,559	-32,736	-1.71

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/2.5)

Appendix 3-A

ANNUAL AVERAGE GROWTH RATES DURING THE 1973-75 RECESSION FOR MOTOR VEHICLES,  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS, AND MIGRATION

Region	(1) Total		(3) Continuing Firms			(5) Difference	(6) Births	(7) Closings	(8) In-Migration	(9) Out-Migration	(10) Total Change <sup>2</sup>	(11) Annual Percentage Change in Employment <sup>3</sup>
	Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	End of Period							
New England	15,892	16,195	8,191	9,400	1,209	803	2,509	800	0	303	.94	
Mid Atlantic	114,499	100,168	91,038	88,310	-2,728	299	12,252	395	45	-14,331	-6.68	
East North Central	741,780	730,766	639,993	673,134	33,141	1,549	44,247	5	1,462	-11,014	-.75	
West North Central	49,901	41,901	40,676	36,863	-3,813	197	4,384	0	0	-8,000	-8.71	
South Atlantic	56,594	48,551	43,507	41,541	-1,966	308	6,665	280	0	-8,043	-7.65	
East South Central	33,104	32,530	27,835	30,371	2,536	159	3,296	32	5	-574	-.87	
West South Central	29,429	24,546	20,736	21,236	500	554	5,937	0	0	-4,883	-9.05	
Mountain	3,620	2,390	2,588	2,220	-368	139	1,001	0	0	-1,230	-20.47	
Pacific	64,297	58,865	49,049	51,695	2,646	1,142	9,220	0	0	-5,432	-4.41	
Total	1,109,116	1,055,912			31,157	5,150	89,511	1,512	1,512	-53,204	-2.45	

1. (Col. 1 + Col. 11)

2. (Col. 5 + Col. 6 - Col. 7 + Col. 8 - Col. 9)

3. ((Col. 11/((Col. 1 + Col. 2)/2))/2)

## Appendix 3-B

ANNUAL AVERAGE GROWTH RATES DURING THE 1975-79 EXPANSION FOR MOTOR VEHICLES.  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS, AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Total		Continuing Firms				Births	Closings	In-Migration	Out-Migration	Total <sup>2</sup> Change
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Net Expansion							
New England	16,674	14,409	8,637	7,859	-778	208	1,719	24	0	-2,265	-3.64
Mid Atlantic	120,950	106,887	103,497	102,873	-624	2,737	15,777	0	399	-14,063	-3.08
East North Central	787,724	567,035	561,638	489,751	-71,887	6,402	155,223	614	595	-220,689	8.14
West North Central	53,215	66,731	45,606	63,508	17,902	1,881	6,729	462	0	13,516	5.63
South Atlantic	55,451	53,546	38,234	43,310	5,076	1,452	8,596	505	342	-1,905	-0.87
East South Central	37,163	43,431	32,882	41,436	8,554	1,119	3,170	15	250	6,268	3.89
West South Central	27,782	30,634	21,794	27,282	5,488	2,730	5,604	250	12	2,852	2.44
Mountain	3,708	3,807	2,904	3,248	344	513	756	3	5	99	0.66
Pacific	67,096	51,622	37,734	40,945	3,211	2,708	21,123	5	275	-15,474	-6.52
Total	1,169,763	938,102			-32,714	19,750	218,697	1,878	1,878	-231,661	-5.50

1. (Col. 1 + Col. 11)

2. (Col. 5 + Col. 6 - Col. 7 + Col. 8 - Col. 9)

3. ((Col. 11/((Col. 1 + Col. 2)/2))/4)

Appendix 3-C

ANNUAL AVERAGE GROWTH RATES DURING THE 1979-82 RECESSION FOR MOTOR VEHICLES,  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS, AND MIGRATION

Region	(1) Total		(3) Continuing Firms			(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Net Expansion	Births	Closings	In-Migration	Out-Migration	Total Change <sup>2</sup>	Annual Percentage Change in Employment <sup>3</sup>	
New England	15,670	19,133	9,626	14,261	4,635	301	1,497	32	8	3,463	7.96	
Mid Atlantic	125,570	107,269	101,187	97,558	-3,629	4,028	18,383	33	350	-18,301	-6.29	
East North Central	672,774	513,060	581,368	529,518	-51,850	3,551	111,727	370	58	-159,714	-10.77	
West North Central	79,717	58,611	69,662	57,988	-11,674	435	9,525	10	352	-21,106	-12.21	
South Atlantic	57,902	54,110	51,265	52,695	1,430	960	6,206	35	11	-3,792	-2.70	
East South Central	48,960	44,152	41,198	41,417	219	1,194	6,472	275	24	-4,808	-4.13	
West South Central	42,120	37,549	31,176	35,566	4,390	1,503	10,657	200	7	-4,571	-4.59	
Mountain	4,493	5,721	4,129	5,026	897	531	346	146	0	1,228	9.62	
Pacific	58,525	38,510	44,155	35,979	-8,176	1,397	12,945	0	291	-20,015	-16.50	
Total	1,105,731	878,115			-63,758	13,900	177,758	1,101	1,101	-227,616	-9.18	

1. (Col. 1 + Col. 11)

2. (Col. 5 + Col. 6 - Col. 7 + Col. 8 - Col. 9)

3. ((Col. 11/((Col. 1 + Col. 2)/2))/2.5)

## Appendix 4-A

ANNUAL AVERAGE GROWTH RATES DURING THE 1973-75 RECESSION FOR MACHINE TOOLS IN CENTRAL CITIES.  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS, AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total		Continuing Firms			Births	Births Adjusted <sup>2</sup>	Closings	In-Migration	Out-Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Difference								
New England	30,986	27,887	9,306	9,830	524	74	540	4,163	0	0	-3,099	-5.26
Mid Atlantic	44,961	35,908	39,877	34,193	-5,684	120	876	4,225	8	28	-9,053	-11.12
East North Central	102,694	100,438	81,049	88,414	7,365	517	3,774	13,285	0	110	-2,256	-1.11
West North Central	8,119	6,609	5,771	6,186	415	56	409	2,334	0	0	-1,510	-10.25
South Atlantic	5,614	5,275	3,551	3,643	92	111	810	1,311	70	0	-339	-3.11
East South Central	3,832	3,513	2,909	2,980	71	48	350	787	47	0	-319	-4.34
West South Central	5,005	3,596	2,338	2,730	392	144	1,051	2,850	0	1	-1,409	-16.38
Mountain	1,646	1,745	1,284	1,585	301	14	102	304	0	0	99	2.92
Pacific	8,792	8,375	4,901	5,601	700	212	1,547	2,672	8	0	-417	-2.43

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/2)

## Appendix 4-B

ANNUAL AVERAGE EMPLOYMENT GROWTH RATES DURING THE 1975-79 EXPANSION FOR MACHINE TOOLS. IN CENTRAL CITIES,  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS, AND MIGRATION

Region	(1) Total		(3) Continuing Firms			(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Difference	Births	Births Adjusted <sup>2</sup>	Closings	In-Migration	Out-Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
New England	34,222	30,233	16,421	10,969	548	338	2,467	2,542	78	4,540	-3,989	-3.09
Mid Atlantic	47,514	37,163	32,557	27,539	-5,018	485	3,540	13,053	4,540	360	-10,351	-6.11
East North Central	116,099	107,358	86,292	86,408	116	2,411	17,598	26,449	237	243	-8,741	-1.96
West North Central	7,302	9,233	5,284	5,959	675	383	2,796	1,542	14	12	1,931	5.84
South Atlantic	4,964	7,308	3,791	4,292	501	402	2,934	1,291	200	0	2,344	9.55
East South Central	3,641	4,515	2,971	3,519	548	134	978	652	0	0	874	5.36
West South Central	3,628	10,461	2,452	3,270	818	988	7,212	1,197	0	0	6,833	24.25
Mountain	2,188	2,110	962	1,227	265	120	876	1,219	0	0	-78	-.91
Pacific	9,484	11,236	6,390	7,535	1,145	454	3,314	2,707	0	0	1,752	4.23

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/4)

## Appendix 4-C

ANNUAL AVERAGE GROWTH RATES DURING THE 1979-82 RECESSION FOR MACHINE TOOLS, IN CENTRAL CITIES,  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS AND MIGRATION

Region	(1) Total		(3) Continuing Firms			(6) Births	(7) Births Adjusted <sup>2</sup>	(8) Closings	(9) In-Migration	(10) Out-Migration	(11) Total Change <sup>3</sup>	(12) Annual Percentage Change in Employment <sup>4</sup>
	Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Difference							
New England	34,581	25,510	12,741	12,543	-198	319	2,328	11,043	0	158	-9,071	-12.08
Mid Atlantic	32,209	31,701	24,955	29,886	4,931	192	1,401	6,848	8	0	-508	-.64
East North Central	106,977	101,660	86,006	90,939	4,933	1,148	8,380	18,579	78	129	-5,317	2.04
West North Central	7,713	6,433	6,012	5,515	-497	119	869	1,646	0	6	-1,280	-7.24
South Atlantic	6,909	6,089	5,593	4,957	-636	104	759	1,241	381	80	-820	-5.05
East South Central	4,526	4,584	3,737	3,699	-38	122	891	794	0	1	58	.51
West South Central	6,803	7,975	5,750	6,132	382	243	1,774	1,146	162	0	1,172	6.34
Mountain	1,665	4,349	1,077	1,282	205	416	3,036	611	54	0	2,684	35.70
Pacific	12,789	13,578	7,937	8,505	568	662	4,832	4,607	0	4	789	2.39

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/2.5)

## Appendix 5-A

ANNUAL AVERAGE GROWTH RATES DURING THE 1973-75 RECESSION FOR ELECTRONIC COMPONENTS, IN CENTRAL CITIES,  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS, AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total		Continuing Firms			Births	Births Adjusted <sup>2</sup>	Closings	In- Migration	Out- Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Difference								
New England	25,268	27,920	13,498	15,322	1,824	106	774	1,930	160	0	2,652	4.99
Mid Atlantic	42,543	31,681	28,577	29,673	1,096	153	1,117	12,165	250	160	-10,862	-14.63
East North Central	62,162	48,354	48,885	45,197	-3,688	288	2,102	11,309	0	903	-13,808	-12.49
West North Central	17,379	14,329	16,383	15,044	-1,339	28	204	1,915	0	0	-3,050	-9.62
South Atlantic	9,343	9,945	7,775	9,040	1,265	79	577	1,240	0	0	602	3.12
East South Central	10,394	9,119	7,046	7,953	907	8	58	2,240	0	0	-1,275	-6.53
West South Central	40,430	47,681	37,899	46,649	8,750	103	752	2,249	0	2	7,251	8.23
Mountain	6,265	7,466	3,275	5,422	2,147	128	934	1,894	22	8	1,201	8.75
Pacific	30,056	25,255	25,637	24,274	-1,363	1,003	7,321	10,752	147	154	-4,801	-8.68

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/2)

## Appendix 5-B

ANNUAL AVERAGE GROWTH RATES DURING THE 1975-79 EXPANSION FOR ELECTRONIC COMPONENTS, IN CENTRAL CITIES,  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total		Continuing Firms			Births	Births Adjusted <sup>2</sup>	Closings	In- Migration	Out- Migration	Total <sup>3</sup> Change	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Difference								
New England	24,272	31,940	9,394	10,153	759	1,924	14,044	7,248	113	0	7,668	6.82
Mid Atlantic	39,585	47,488	31,604	32,068	464	2,014	14,701	6,833	0	429	7,903	4.54
East North Central	55,007	62,726	38,524	49,317	10,793	845	6,168	8,809	0	433	7,719	3.28
West North Central	19,586	14,349	13,666	13,189	-477	154	1,124	5,809	0	75	-5,237	-7.72
South Atlantic	10,047	13,283	6,580	8,997	2,417	512	3,737	2,701	183	400	3,236	6.94
East South Central	8,421	32,393	7,960	9,697	1,737	3,109	22,693	458	0	0	23,972	29.37
West South Central	51,679	41,727	29,912	36,023	6,111	628	4,584	21,690	1,065	22	-9,952	-5.33
Mountain	6,285	14,028	5,003	8,771	3,768	701	5,117	1,127	0	15	7,743	19.06
Pacific	40,575	55,881	24,287	28,513	4,226	3,771	27,526	16,482	46	10	15,306	7.93

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/4)

Appendix 5-C

ANNUAL AVERAGE GROWTH RATES DURING THE 1979-82 RECESSION FOR ELECTRONIC COMPONENTS, IN CENTRAL CITIES,  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS AND MIGRATION

Region	(1) Total		(3) Continuing Firms			(6) Births	(7) Births Adjusted <sup>2</sup>	(8) Closings	(9) In-Migration	(10) Out-Migration	(11) Total Change <sup>3</sup>	(12) Annual Percentage Change in Employment <sup>4</sup>
	Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Difference							
New England	21,352	24,997	12,441	15,697	3,256	661	4,825	4,451	15	0	3,645	6.29
Mid Atlantic	41,542	40,713	58,354	59,817	1,463	354	2,584	4,961	85	0	-829	-.81
East North Central	54,463	40,778	39,566	37,152	-2,414	432	3,153	14,204	0	220	-13,685	-11.50
West North Central	14,929	15,451	13,739	15,024	1,285	57	416	1,179	0	0	522	1.37
South Atlantic	12,557	7,417	22,907	18,106	-4,801	278	2,029	3,707	1,010	80	-5,549	-22.22
East South Central	12,966	10,509	10,626	9,021	-1,605	197	1,438	2,340	50	0	-2,457	-8.37
West South Central	40,070	42,708	36,369	38,660	2,291	497	3,628	3,048	0	233	2,638	2.55
Mountain	22,107	24,103	20,232	22,482	2,250	287	2,095	2,314	0	35	1,996	3.46
Pacific	57,525	64,722	43,748	49,638	5,890	1,875	13,686	12,632	253	0	7,197	4.71

1. (Col. 1 + Col. 11)

2. (Col. 6 divided by .137)

3. (Col. 5 + Col. 7 - Col. 8 + Col. 9 - Col. 10)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/2.5)

## Appendix 6-A

ANNUAL AVERAGE GROWTH RATES DURING THE 1973-75 RECESSION FOR MOTOR VEHICLES, IN CENTRAL CITIES,  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS, AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Total		Continuing Firms			Births	Closings	In- Migration	Out- Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Difference							
New England	7,808	5,320	3,611	2,749	-862	0	1,626	0	0	-2,488	-18.95
Mid Atlantic	37,516	46,614	30,701	33,552	2,851	190	6,042	250	45	9,098	10.81
East North Central	429,218	457,533	401,845	451,890	50,045	233	21,043	0	920	28,315	3.19
West North Central	22,120	22,083	20,169	18,404	-1,765	12	1,814	0	0	-37	-.08
South Atlantic	33,989	28,338	25,903	23,386	-2,517	3	3,177	40	0	-5,651	-9.07
East South Central	10,197	8,755	11,083	11,189	106	37	1,592	7	0	-1,442	-7.61
West South Central	15,698	11,743	9,335	8,818	-517	233	3,671	0	0	-3,955	-14.41
Mountain	2,423	1,328	1,919	1,300	-619	26	502	0	0	-1,095	-29.19
Pacific	21,097	19,723	12,496	13,719	1,223	480	3,077	0	0	-1,374	-3.37

1. (Col. 1 + Col. 11)

2. (Col. 5 + Col. 6 - Col. 7 + Col. 8 - Col. 9)

4. ((Col. 11/((Col. 1 + Col. 2)/2))/2)

Appendix 6-B

ANNUAL AVERAGE GROWTH RATES DURING THE 1975-79 EXPANSION FOR MOTOR VEHICLES, IN CENTRAL CITIES,  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Total		Continuing Firms			Births	Closings	In-Migration	Out-Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Difference							
New England	4,609	3,842	1,656	1,486	-170	39	660	24	0	-767	-4.54
Mid Atlantic	54,277	38,735	47,351	39,375	-7,976	159	7,667	0	58	-15,542	-8.35
East North Central	504,118	318,343	361,031	274,525	-86,506	31	99,175	0	125	-185,775	-11.29
West North Central	27,206	33,320	22,843	31,343	8,500	1,207	3,593	0	0	6,114	5.05
South Atlantic	26,754	26,268	24,468	26,736	2,268	411	3,323	165	7	-486	-.46
East South Central	12,536	15,014	11,317	14,423	3,106	520	1,163	15	0	2,478	4.50
West South Central	12,436	12,200	8,687	9,940	1,253	1,924	3,651	250	12	-236	-.48
Mountain	1,914	1,734	1,562	1,419	143	26	347	3	5	-180	-2.47
Pacific	19,924	16,713	12,626	12,883	257	678	3,871	0	275	-3,211	-4.38

1. (Col. 1 + Col. 11)

2. (Col. 5 + Col. 6 - Col. 7 + Col. 8 - Col. 9)

3. ((Col. 11/((Col. 1 + Col. 2)/2))/4)

## Appendix 6-C

ANNUAL AVERAGE GROWTH RATES DURING THE 1979-82 RECESSION FOR MOTOR VEHICLES, IN CENTRAL CITIES,  
BY CENSUS REGION - SUBDIVIDED INTO EXPANSIONS, BIRTHS, CLOSINGS AND MIGRATION

Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Total		Continuing Firms			Births	Closings	In-Migration	Out-Migration	Total Change <sup>3</sup>	Annual Percentage Change in Employment <sup>4</sup>
Beginning of Period	End of Period <sup>1</sup>	Beginning of Period	End of Period	Difference							
New England	5,036	3,740	2,721	2,021	-700	47	653	18	8	-1,296	.95
Mid Atlantic	44,013	34,492	34,094	30,573	-3,521	133	6,141	8	0	-9,521	-9.70
East North Central	317,195	254,496	277,073	251,585	-25,488	997	38,201	18	25	-62,699	-8.77
West North Central	34,199	25,417	31,986	25,214	-6,772	82	2,099	7	0	-8,782	-11.78
South Atlantic	34,138	32,785	32,012	32,118	106	391	1,842	0	8	-1,353	-1.62
East South Central	9,106	8,421	7,866	7,907	41	414	1,140	0	0	-685	-3.13
West South Central	18,812	18,661	15,165	18,353	3,190	356	3,697	0	0	-151	-.32
Mountain	2,092	2,450	2,316	2,805	489	65	201	5	0	358	6.31
Pacific	20,584	14,079	14,330	12,955	-1,375	646	5,503	0	273	-6,505	-15.01

1. (Col. 1 + Col. 11)

2. (Col. 5 + Col. 6 - Col. 7 + Col. 8 - Col. 9)

3. ((Col. 11/((Col. 1 + Col. 2)/2))/2.5)

## Appendix 7A

Annual Percent of All Single Unit Firms  
 Closings and Employment Loss Due to  
 Closings by Size of Firm

Number of Employees	1973-75		1975-79		1979-82	
	Employees	Firms	Employees	Firms	Employees	Firms
<b>Machine Tools</b>						
0-20	8.5	9.8	5.1	6.2	7.8	8.3
21-50	6.6	6.5	3.8	3.8	6.5	6.5
51-100	6.5	6.1	3.3	3.4	8.0	8.0
101-500	9.8	8.9	5.2	4.6	7.4	7.0
501+	0	0	0	0	0	0
<b>Electronic Components</b>						
0-20	14.7	15.9	7.2	8.0	12.6	12.7
21-50	12.4	12.4	5.8	5.9	8.1	8.1
51-100	10.1	10.1	6.3	6.2	8.4	8.3
101-500	10.3	10.1	5.9	5.6	3.4	5.6
501+	3.0	3.6	5.6	6.3	1.2	1.5
<b>Motor Vehicles</b>						
0-20	13.8	15.5	7.2	8.5	11.1	10.8
21-50	11.0	10.7	6.1	6.0	8.6	8.6
51-100	6.9	7.2	6.4	6.3	10.4	10.5
101-500	9.0	10.2	4.4	4.3	6.1	7.3
501+	9.9	15.0	2.8	3.9	5.6	6.0

## Appendix 7B

Annual Percent of Multiunit Firms  
Closings and Employment Loss Due  
to Closings by Size of Firm

Number of Employees	1973-75		1975-79		1979-82	
	Employees	Firms	Employees	Firms	Employees	Firms
<b>Machine Tools</b>						
0-20	9.6	11.2	8.3	8.6	9.6	9.5
21-50	10.0	10.2	5.2	5.1	7.9	7.8
51-100	6.3	6.6	3.8	6.3	7.7	7.8
101-500	7.0	7.2	4.3	4.3	6.0	6.0
501+	2.7	8.4	1.0	2.1	2.8	7.8
<b>Electronic Components</b>						
0-20	14.0	13.3	9.7	9.9	12.1	12.2
21-50	14.0	14.7	5.4	5.2	9.1	9.1
51-100	14.7	13.7	4.2	7.9	12.5	12.3
101-500	11.4	11.5	4.5	4.7	11.2	11.0
501+	2.2	6.9	2.7	4.4	3.0	4.7
<b>Motor Vehicles</b>						
0-20	17.1	18.4	8.8	10.1	10.4	10.7
21-50	16.2	15.3	6.6	6.5	11.3	10.8
51-100	9.4	10.3	4.3	8.4	7.7	8.4
101-500	7.3	8.4	3.9	3.9	3.3	3.9
501+	0.4	5.2	0.7	1.9	.9	5.0

## Appendix 7C

Annual Percent of Establishment Closings and  
Employment Loss Due to Establishment Closing  
by Size of Establishment

Number of Employees	1973-75		1975-79		1979-82	
	Employees	Firms	Employees	Firms	Employees	Firms
<b>Machine Tools</b>						
0-20	8.9	10.2	5.5	6.5	8.3	8.8
21-50	7.9	7.7	4.5	4.5	7.2	7.2
51-100	7.8	7.6	4.8	4.7	8.1	8.0
101-500	11.0	9.9	5.7	5.5	6.7	6.7
501+	5.6	8.1	4.1	5.1	7.8	6.7
<b>Electronic Components</b>						
0-20	15.8	16.8	8.0	8.7	13.0	13.4
21-50	13.5	13.4	6.7	6.9	9.0	9.1
51-100	12.2	12.0	7.7	7.7	10.0	9.9
101-500	11.6	11.1	6.9	6.9	9.1	9.0
501+	8.7	8.6	6.4	6.4	4.9	6.7
<b>Motor Vehicles</b>						
0-20	14.2	15.8	7.8	8.9	11.8	11.6
21-50	11.2	11.0	7.1	7.1	9.7	9.7
51-100	8.7	8.9	7.9	7.8	10.4	10.5
101-500	8.9	9.5	5.8	5.9	7.9	8.2
501+	2.7	5.5	4.2	4.3	5.6	6.0

