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

USING THE DUN AND BRADSTREET
DATA TO ANALYZE THE EFFECTS
OF BUSINESS FLUCTUATIONS
ON FIRM EMPLOYMENT

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INTRODUCTION

The literature review entitled "The Sensitivity of Local Economic Activity to National Economic Cycles," by Peterson and Manson, identifies two gaps in the business cycle literature. One gap is in our knowledge of the cyclical sensitivity of central cities. The second is in our understanding of the effects of economic expansions and contractions on the decentralization of employment. Both topics will be addressed in this study.

A third issue to be explored here is the extent to which cross-area differences in plant closings occur during recessions and expansions. Since the literature review noted above addresses the first two topics, we will not retrace the authors' steps. Rather, this paper now turns to consider the literature on sensitivity of plant closings to the business cycle and the geographical distribution of plant closings. This literature review is followed by an outline of the questions addressed in this part of The Urban Institute's study and a discussion of the data used to carry it out.

The literature on plant closings finds that branch plants, not surprisingly, are more likely to close in recessions than expansions; branches are less likely to close than single establishment firms; and small branches are more likely to close than large branches. Finally, sparse evidence on the geographical distribution of plant closings suggests that, at least in the long run, shutdown rates do not vary by region.

A number of researchers have argued and at least two have found evidence to support the argument that branch plants are more likely to

close during recessions than expansions. In 1953, Picton posited that branches are used by firms to test market conditions in a new locale or to permit flexibility for future decisions. As such these branches are susceptible to shutdown during stringent economic conditions. Townroe [1975] claimed that since branches are easy to establish from a managerial standpoint, they are easily closed in the event of an economic slowdown.

Loasby [1967, p. 45] hypothesized that "it was pressure of demand that induced firms to begin thinking about establishing a branch plant, and it was pressure of (excess) capacity that induced them to think about closing it." House [1969, p. 187] argued in a study of Northeast England that head offices are prone "to exploit branch factories, using them as safety valves for changes in pressure of demand and closing them as recession sets in."

Erickson [1980] conducted an empirical test of the hypothesis that branch plants are susceptible to shutdown during recessions. Using data on branch plants in Wisconsin for the period 1959 to 1977, Erickson found branch plant closures peaked in the early 1960s and again in 1970 and 1975. These peaks coincided with downturns in the Wisconsin economy. In the same study, Erickson regressed the number of branch closures on Gross National Product (GNP). He found the coefficient on GNP to be significant at the 10 percent level and to explain 11 percent of the variation in branch plant closures over the period. Using a truncated sample, 1963 to 1977, the R^2 rose to 23 percent with the GNP coefficient significant at the 5 percent level. Erickson's results suggest that branch plant closures are somewhat sensitive to fluctuations in the national economy.

Another study [Clark, 1976] used data on branch plant closings in the County of Skaraborg in Sweden. This study found that these plants were

more likely to close during recessions than expansions. However, when the data were disaggregated by size of plant it was clear that it is small branches that are sensitive to the cycle rather than large plants. For example, over the period 1968 to 1973, 45 branches and headquarters closed in the 20 to 99 employee category. Thirty of these closures occurred during the 1970-71 recession. There were eight branch plant openings over the 1968 to 1973 period and six of them occurred during the 1972-73 expansion. Closings of large plants appear to be independent of the state of the national economy [Clark, 1976, p. 295].

These results are similar to those of Erickson, who also found that, at least in the long run, large branch plants are less likely to close than small branch plants. Erickson, using the Wisconsin data described above, found that "[c]losings of very large plants (e.g. greater than 500 employees) is indeed a rare occurrence. On the other hand, 30-40 percent of plants with less than 100 employees were closed during the study period," 1958 to 1977 [1980, p. 499].

While the tone of the hypothesis about branch plant closings hints that branches are more likely to close during recessions than single-establishment firms, researchers have found that in the long run, branch plants are less likely to close than single-establishment firms. Erickson [1980, p. 497] found that for his sample of manufacturing branches in Wisconsin, the annual average closure rate was 3.3 percent. Atkins [1973] analyzed data from 962 branch plants in Great Britain. These branches opened between 1945 and 1961. Atkins found an annual average closure rate of 2.1 percent a year. These death rates compare favorably with the 6.7 percent closure rate found by Birch [1979, p. D-57] for all manufacturing firms in the U.S. While these results don't address failure rates over

the various phases of the business cycle, they do suggest that branches are less likely to close during any phase of the cycle than are single-establishment operations. However, such comparisons would have to control for firm size and other factors, including national and regional location, to represent a true test of the hypothesis that branch plants are more vulnerable to closing than comparable single-location firms.

Studies of the geographical pattern of plant closings are scarce. In fact, according to a 1981 survey of the plant closings literature by Gordus, et al., "Research in plant closings has been confined to the case study and evaluation tradition and as a consequence there is no comprehensive listing of plant closings and no statistics concerning the extent of unemployment directly or indirectly attributable to plant shutdowns." [Gordus, et al., 1981, p. 4.]

Existing studies of the spatial distribution of plant shutdowns yield conflicting results. One study, carried out by David Birch [1979] on all establishments in the U.S., not just branch plants, found that death rates did not vary geographically. These results are based on the Dun and Bradstreet data for 1969 and 1976. The annual average rate of establishment closing by major industry is presented in Table 1. It is clear from this table that establishment death rates vary little by region.

Another study using data on branch plant closures in the United Kingdom also found little regional difference in closure rates. Healey [1982] selected a sample of all textile and clothing companies operating three to 15 plants. Using the period 1967 to 1978, he found that the spatial pattern of plant closings "was not significantly different from the regional distribution of other plants of the enterprise." [Healey, 1972, p. 43.]

Table 1

ANNUAL PERCENT OF ALL FIRMS THAT DIED
DURING THE PERIOD 1969 TO 1976,
BY REGION

	Manufacturing	Trade	Services
Northeast	6.86	8.37	8.49
North Central	6.07	7.97	8.47
South	6.89	8.27	8.57
West	7.1	8.4	8.63

Source: Birch, David, "The Job Generation Process," 1979, Appendix D.

In contrast, a study of regional variations in establishment closings in the United Kingdom found that in the absence of public policy there were regional variations in closing rates. Sant found that prior to the allocation of locational subsidies to the peripheral areas, in the 1960s, peripheral areas had higher rates of plant closures. Due to subsidies, the disparity was reduced, and eventually the peripheral areas had lower rates of closure [Sant, 1974, p. 369]. Sant's results appear to contradict those of Healey. The discrepancy in results may be due to differences in the industries or time periods studied, or to differences between an analysis of branch plant and all establishments.

STUDY PURPOSES

The study to be carried out will use the Dun and Bradstreet file of firms to complement the analysis of central-city and metropolitan income fluctuations, described in the accompanying paper.

The study can be divided into three broad categories: a comparison of central city employment cycles with those of suburbs and non-metropolitan areas; a study of the effects of the business cycle on the decentralization of employment; and the effects of the cycle on plant closings. More specifically, the issues to be addressed under the first category are:

- (1) Do recessions and/or expansions have stronger employment effects in central cities than in suburbs?
- (2) Are recessions more severe and/or expansions stronger in SMSAs than in non-metropolitan areas?
- (3) Which components of firm employment change are most cyclically sensitive: firm births, firm deaths, or changes in the employment levels of continuing firms?

The second category of research questions--the effects of economic fluctuations on employment shifts--explores the following issues:

- (1) What happens to central city-to-suburban employment shifts during the expansionary and recessionary phases of the business cycle?
- (2) What happens to SMSA-to-non-metropolitan employment shifts during the expansionary and recessionary phases of the business cycle?
- (3) Can variations in employment growth be explained by differences in firm birth rates, death rates, firm contractions or firm expansions?

The third category of questions dealing with plant closings addresses the following questions:

- (1) Do plant death rates vary geographically during recessions?
This includes central city-suburban, SMSA-non-metropolitan, and other comparisons.
- (1a) Does the pattern of branch plant closures differ from that of all establishments?
- (2) Do plant death rates vary geographically during expansions?
This includes central city-suburban, SMSA-non-metropolitan, and regional comparisons.
- (2a) Does the pattern of branch plant closures differ from that of all establishments?

This part of The Urban Institute study will address these questions through analysis of employment changes at the firm level. We have created a file of firm employment in selected industries, identified by the three and four digit Standard Industrial Code, for four years capturing two full economic cycles. This data set, drawn from Dun and Bradstreet records, is discussed in the next section.

THE DUN AND BRADSTREET DATA

In its role as a credit rating company, Dun and Bradstreet (D&B) maintains information on approximately 4.5 million firms. 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 firm's business address; the number of employees; the firm's major standard industrial classification(s) (SIC) at the four-digit level; and the firm's status as a single establishment operation, a headquarters, a branch location, or a subsidiary.

THE SAMPLE

The focus of this study is to document cross-area differences in firm responses to business cycles--holding industry mix constant. To circumvent the problem of cross-area differences in industry composition we have limited the sample to all firms in the DMI file in three three-digit SIC industries. All firms that listed either SIC 354 (machine tools), SIC 367 (electronic components) or SIC 371 (motor vehicles) as primary, secondary or tertiary activities are included in our sample. 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. For each year, the sample includes approximately 32,500 firms; 17,500 of which are in SIC category 354, 8,000 of which are in SIC category 367, and 7,000 of which are in SIC category 371.

These three industries were selected for three 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. Secondly, 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 focus of this project 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 plant with closings in single plant establishments during the cycle, as well as comparisons of establishment closings in downswings with rates of closings during expansions.

Finally, Motor Vehicles is an industry that frequently responds to economic slowdowns with temporary plant closings. The inclusion of motor vehicles will permit a study of the regional distribution and determinants of temporary shutdowns.

CREATING THE FILES

In order to analyze employment contractions and expansions over the business cycle, the four years of data were merged and records were allocated to three files: a mover file, a death file, and a historical file. These files were created by matching and identifying non-matching Dun's numbers across the four years.

The mover file contains all firms that had matching Dun's numbers in two consecutive years but had moved from one zip code area to another in the interim. So, for example, if Jones Electronics Company was located in zip code area 02140 in 1975 and in 02267 in 1979, this company is assigned to the mover file. Firms for which there was a Dun's number in the early year but not in the next year were assigned to the death file and a firm that had matching Dun's numbers for two consecutive periods and operated within the same zip code area for both years were assigned to the historical file. A firm could be assigned to the mover, the historical and the death file, if matching Dun's numbers were located in the 1973, 1975, and 1979 tapes but not in the 1982 tape and if the firm was located in zip code area 22222 in 1973 and in 99999 in 1975 and 1979.

ADVANTAGES AND DISADVANTAGES OF THE DMI DATA

Advantages

The DMI file, as any data set, has advantages and shortcomings. One advantage is that Dun and Bradstreet has a strong incentive to report information accurately. D&B could be, and has been, sued for providing potential creditors with inaccurate information about a particular firm. A second advantage is that the data is collected by 1700 full-time reporters. This reporting staff is well trained and experienced because they are on the job year-round. A third advantage is that D&B's coverage of the manufacturing sector is quite high and frequently exceeds estimates made by other sources such as County Business Patterns or the Census of Manufacturers. For example, Table 2 presents comparisons of D&B with

Table 2

PERCENTAGE DIFFERENCE BETWEEN
DUN AND BRADSTREET AND COUNTY BUSINESS PATTERNS
EMPLOYMENT ESTIMATES BY COUNTY

County	Manufacturing
Fairfield	+10.3
Hartford	-14.6
Litchfield	+12.3
Middlesex	-3.9
New Haven	+10.6
New London	+1.4
Tolland	-5.6
<u>Windham</u>	<u>+11.6</u>
Total	+1.8

Source: James Mahoney, "Subaggregate Employment Changes in the Connecticut Economy," Connecticut Department of Commerce, 1978.

County Business patterns by county for all manufacturing in Connecticut [Mahoney, 1978]. Table 2 shows that total employment as recorded by the D&B file was 1.8 percent greater than total employment as recorded by the County Business Patterns for the State of Connecticut.

Comparisons of coverage between the Dun and Bradstreet data and the County Business Patterns (CBP), indicate that for 1970 and 1972 Dun and Bradstreet's measure of manufacturing employment is very close to employment levels and the number of firms as reported by CBP and low for rates of change as reported by CBP. The ratio of Dun and Bradstreet's employment to CBP employment was 1.039 in 1970 and .945 in 1972. The ratio of number of firms as reported by Dun and Bradstreet to number as reported by CBP was 1.247 and 1.151 in 1970 and 1972. The annual rate of change in employment between the two years was $-.03$ for the Dun and Bradstreet data and $.01$ for the CBP.

The geographic coverage for the 1973 and 1975 D&B tape can also be compared with employment as recorded in those years by the Annual Survey of Manufacturers (ASM). A report on this comparison will be submitted in the near future.

Biases and Shortcomings of the Dun and Bradstreet DMI File

Changes in Dun's Numbers Prior to 1974

Prior to 1974 a firm in the DMI file was assigned a new Dun's number if it altered its status. This presented problems for matching acquisitions for the 1973 to 1975 period. This problem was handled in the following manner.

First, all records with matching Dun's numbers in 1973 and 1975 were assigned to the historical file. Among the subset of non-matches, business names and zip codes were checked. If a duplication was found, it was assumed the firm had been acquired during the interim two years and two records were merged under the 1975 Dun's number and assigned to the historical file. The remainder of the 1973 file was assigned to the death file.

Incorrect Identification of Movers as Births and Deaths

Another bias of the data set is the incorrect identification of movers as new firms. D&B's policy has been to assign movers the same Dun's number. However, a non-trivial number of movers are instead assigned new numbers. This can occur when the Dun's office at the old location delays sending the information to the new location and the later assigns the mover a new number.

Even where Dun's field workers are conscientious and efficient, many plant moves are missed. Conceptually, a move is not always easy to identify. Take, for example, the case where a multiplant firm cuts investment in its old northern plant and opens a new southern plant. Profits generated at the northern plant are invested in the south until finally the northern plant is closed. While in an economic sense one could argue the northern plant moved, D&B would assign the southern plant a new Dun's number and the Dun's number for the northern plant would be retired. Most likely moves by branches of multiplant firms are of this type. Moves, of the type where capital equipment is loaded on a truck and physically moved, are rare. The data set will, therefore, underestimate moves, identifying some moves as deaths. The bias is expected to be particularly serious for branch plant relocations. Although this bias has

great importance for some purposes (e.g., Birch's use of the DMI file to argue that firm migration is of little economic significance), it will not affect most file analysis planned for this study.

Underrepresentation of New Firms

An important bias of the data set is that it underrepresents new firms. D&B makes no effort to include recent entrants to the economy in the DMI file unless credit information on the firm is required. Thus, the age distribution of firms in the D&B file is older than the population as a whole. One problem caused by the underrepresentation of new firms is an undercount of births and deaths. For example, Pickle and Abrahamson [1976] found that 56 percent of all new enterprises that fail, fail within the first five years. This suggests that many firm births and deaths occur before the firms ever enter the DMI file. In some areas this could bias our results. Take, for example, an area of rapid growth that has a large proportion of its employment in new firms. These new firms are more susceptible to bankruptcy during recessions than are established firms. This rapid growth area could experience a severe percentage decline in employment during the recession that would not show up in the analysis of the D&B file.

Purging of Unused Records

In 1979 D&B purged their tape of firms that had not generated credit inquiries and that had not been updated in recent years. This purging could cause serious problems in identifying deaths between 1975 and 1979. The extent of this problem is under investigation.

Changes in SIC Categories

It is possible that firms change SIC categories over time. So, for example, a firm that belonged to 367 in 1973 may change to SIC 207. This should not present a major problem, because our DMI subset includes all firms that list 367 as a primary, secondary or tertiary line of business. Thus, 367 would have to become a quarternary or non-existent line of business to be dropped from our sample. In his work with the DMI file David Birch found that about 2.5 percent of the firms changed primary SIC categories between 1969 and 1972 [Allaman, 1975, p. 12].

Out of Date Records

Another 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. A distribution of interview dates will be prepared prior to work with the file.

Underrepresentation of the Number of and Employment in Branch Plants

The Dun and Bradstreet data file is collected to provide credit information to a firm's potential creditors. Therefore, D&B may overlook biases or errors in the data that do not influence the assessment of a firm's credit worthiness. This leads to another disadvantage of the D&B data; the data set underrepresents branch plants.

Branch plants, unlike subsidiaries, typically do not borrow funds. Rather, they depend on a diffusion of funds from their headquarters, so

from a credit standpoint, branches do not exist. Although in recent years D&B has made an effort to identify branch plants, since the file is now sold for marketing purposes, the underrepresentation of branch plants is still a problem.

A more serious and related problem is that total employment is missing for many of the branches that are reported. Again, D&B does not force the issue since firms' credit worthiness doesn't depend on branch employment.

Frequently employment that is not assigned to branch plants is consolidated into total firm employment at the headquarters. This leads to an overestimate of employment at the headquarters and an underestimate of total employment in branch plants. In an analysis of the 1969 and 1976 DMI files, Birch found that about 58 percent of the headquarters in the file do not report individual branches. Further analysis of a sample of 1,000 such firms suggests that it is, in general, small headquarters/branches that fail to disaggregate employment. For example, Birch found that in 1976, non-disaggregated headquarters employed only 16 percent of all employees in headquarters/branch firms. Their branches accounted for only 5 percent of all headquarters/branch employment and about 8 percent of all branch employment. Thus, the total number of employees involved is much lower than the number of firms would suggest [Birch, 1979, p. 12]. Any results utilizing the branch plant data must be interpreted with the recognition that the sample of branches overrepresents branches of large firms and that employment at the headquarters of small firms is likely to be overrepresented.

Biases in City Codes

Another shortcoming of the data is related to geocoding. The DMI file contains state, county and city codes for the location of every firm. In his work with the file, Birch found that D&B does a good job of assigning state and county codes to establishments, within the limits of normal clerical error. However, below the county a problem was encountered with the city codes. City codes do not always identify the city location of a firm. For example, many firms were located in New Haven but their city codes did not denote this. The city code allocated these firms to postal annexes, or well-defined residential areas rather than as New Haven. Thus, firms could be a city resident and not recognized as such by the city codes. Anyone performing an analysis of a city must scan all codes in the state in which the city is located and ferret out all codes that fall within the city limits [Birch, 1979, p. 14]. This study will not use the city codes, therefore this shortcoming will not influence the results of this analysis.

Unreadable Addresses

Another problem exists with the quality of the addresses on the DMI file. In some cases the address is reported with a street address in 1973 and then with an illegitimate address such as Esplanade Mall in 1975. Thus, the matching of actual street addresses is problematic. Birch found that about 20 percent [Birch, 1979, p. 15] of all addresses were not legitimate street addresses. They were names of office buildings, industrial parks, shopping plazas, or street intersections. For this reason we have decided to match zip codes, deciding for our purposes that intra zip code zone moves can be overlooked. The two complications with using zip

codes are that some zip code boundaries change over time and that occasionally firms use the zip code of the nearest post office rather than the code of the location of their facility. The second problem is assumed to affect few observations and therefore will be ignored. The first problem will be resolved through a hand editing process.

Coding Errors

Clerical errors are inevitable, but many of them can be caught with an over-time data base. For example, the number of employees is coded as yxxxx, where y is the number of zeros to be attached to xxxx. An error in coding y could seriously distort employment values. Major discrepancies between, for example, 1973 and 1975 employment values for a firm will be reviewed for possible coding error.

Firm Misrepresentation

Finally, there is always the possibility that a firm has not provided D&B with an accurate representation of their employment totals. There is no way to check on the extent of this problem without an expensive on-site validation.

CONCLUSIONS

The data used for this study are a subset of the Dun and Bradstreet, Dun's Market Indicator File (DMI). The subset includes all firms reporting SIC categories 354, 367 and 371 as primary, secondary, or tertiary lines of business in 1973, 1975, 1979 and 1982. In order to analyze employment expansions, contractions, and firm deaths, the data are assigned to a historical file when Dun's numbers and locations remained

unchanged between any two years; a mover file when firms have the same Dun's number but a new address in the second year; and a death file when firms exist in the file in a prior year but not in a later year.

In spite of the long list of biases and shortcomings of the DMI file, it is a unique and a rich resource. The data permit an analysis of firm employment changes over time. The fine geographical detail allows central city-suburban and SMSA-non-SMSA comparisons, as well as an analysis of intra- and inter-employment shifts. Finally, the fact that it identifies employment and locations of branch plants permits an analysis of the geographical distribution of plant closings. The shortcomings are outlined here in order to identify problems that require compensation and to draw attention to results that require judicious interpretation.

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