EXTERNAL ECONOMIES AND THE DISTRIBUTION OF INDUSTRIAL GROWTH WITHIN THE METROPOLIS

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This paper begins with the recent empirical observation that individual manufacturing industries were spatially clustered within three major metropolitan areas in 1965. In particular it was found that the employment of every 2-digit (Standard Industrial Classification) industry examined was spatially concentrated in a few areas within each metropolitan area and that the specific locations of these concentrations varied significantly among industries. The diversity of the industrial structure, economic maturity and topography of the three SMSA's, Boston, Cleveland and Minneapolis-St. Paul, and the consistency of the findings indicate the presence of these concentrations to be non-random.[1] This paper seeks first to offer an argument to explain the observed distribution of industries in 1965 and then tests the hypothesis that the concentration of industries in given locations influenced the locational decisions of establishments in that and other industries for the sample SMSA's over the period 1965-1968.

The location decision of an individual manufacturer has been a much-studied phenomena and one which is demonstrably complex. At a very general level the firm seeks to locate so as to maximize profit, either attempting to minimize costs, such as labor and transportation, or to mazimize his market potential. The types of trade-offs involved in this process have been theoretically posed by Weber and Losch, and applied by Isard and others. The presence of an individual manufacturer in a given metropolitan area, however, implies that many of the most fundamental decisions have already been made. This being the case, local variation in tax rates, neighborhood characteristics, legal restrictions, the availability of specialized facilities, and economies possible from locating near other firms in the same or other industries become the important locational determinants. In this paper, the focus is upon the last of these factors, which will be referred to as external economies. It should be clear from the outset, however, that this is a very broad label.[2]

The problem of defining externalities in the real world has long been a vexing one for economists. Regional economists have concentrated on what Weber termed "economies of urbanization" -- economies which accrue to a firm from the level of overall economic activity in an area. Urban economists (with exceptions discussed below) have paid little attention to external economies, either economies of urbanization of "economies of localization" which accrue to firms of a given industry from the number and functions of firms of that industry present in a given area.[3] This is surprising given the numerous examples of externalities available in the metropolis. Firms of different industries may locate in close proximity to minimize transportation costs. In Cleveland, for example, the primary metals industry was concentrated in two separate zones with fabricated metals producers spread out between them. Also consultation between firms producing specialized machinery and their clients may group industries. Firms of the same and differ-

ent industries can minimize their search costs for replacements in their labor
force by being located where a large pool of workers exists, some of whom
will be searching for a different job. Firms of the same industry may also
aggregate to reduce the transportation costs of intermediate products. [4] For
some industries locating together may provide the leverage necessary to ob-
tain special utility rates or to have specialized loading faciltities provided.
Several studies for the New York area have documented the importance of
marketing and production aspects in causing establishments of the apparel
and printing and publishing industries to locate together. [5]

Attempting to identify external economies and their locational effects
would be difficult enough if that represented the only aspect of the problem.
However, whereas individual firms may enjoy the benefits of these external
economies, they certainly incur costs in doing so. If the market for urban
land was operating perfectly one would expect that at the margin the value of
these economies would be reflected in site rents. Because of the relatively
higher rents at such locations the firm may be forced to conserve on land.
Given the comparatively greater efficiency of single level plants for contin-
uous processing and material handling, conservation of land will impose a
production cost on the firm. This establishes a tradeoff between internal
and external economies. [6] Another type of cost imposed on the firm locating
so as to obtain the external economies available may be the increasing im-
portance of external diseconomies at such locations. This type of cost is
probably best thought of as congestion costs: an overabundance of trucks
relative to limited loading facilities and narrow streets, a dearth of parking
places for employees' cars, inadequate storage area of inputs and finished
products resulting in purchasing and shipping at above minimum rates, and
a general lack of space for expansion.

From the above examples, the complexity of the problem is isolating
the positive effects of external economies in the face of offsetting forces can
be appreciated. In brief, the presence of significant and substantial exter-
nal economies may be more than offset by the costs of external diseconomies
and foregone internal economies. Thus a reduction over the observation per-
iod in the level of manufacturing activity in the zones offering the greatest
external economies is not unexpected. It is possible that at the present time
(as perhaps over the past two decades) the amount of industrial activity in
concentrated zones is adjusting itself to congestion costs of somewhat diff-
erent types than those existing when the maximum concentration of activity
was reached. If this were the case, an eventual "final" adjustment with a
reduced but substantial amount of activity remaining in these areas could be
expected.

Before proceeding further, it is reasonable to ask why the existence of
external economies of the kind described might be important in approaching
some of the problems of the cities. The evidence cited earlier showed that
the central cities in the sample SMSA's contained a large number of the con-
centrations of manufacturing industry and thus apparently enjoyed a compara-
tive advantage in the presence of these economies. With the well-documented
flight of industry from the central city with its consequent erosion of the local
tax base and increased commuting distances for central city poor, [7] it is vit-
al to explore whether the localization economies are continuing to effect the
location decision of firms or not. If they are, one immediate policy impli-
cation for the central cities is to work at improving the public services pro-
vided to the concentrated areas in order to maintain the competitive advan-
tage of these locations (i. e., to enhance the economies and reduce the dis-
economies) rather than devoting great energy and expense to attracting into
the city new firms which may move to a peripheral location in a relatively
short time.

DEFINITIONS AND APPROACH

A number of operational definitions must be adopted in order to test the hypothesis that locational activity within metropolitan areas is being influenced by the clustering of industry at specific locations and the externalities which accompany such concentrations. The first and most important definition concerns the definition of externalities. If one were to examine those available at a given location in a metropolitan area (analysis zone), three distinct types would emerge: (1) those available from special facilities such as docks and piers over which a firm has virtually no locational control; (2) those from the general type of activity in the zone or the zone's general location, including the characterization of the area as a traditional site of manufacturing activity and the location of the zone in a relatively centralized location; and (3) those resulting from firms of a single industry or different industries locating together which were discussed earlier. Although the first two types are conceptually quantifiable in relatively simple ways, they make isolation of the third type more complex. The third type is the most difficult to quantify but of greatest interest to us. For this work the presence of one or more concentrated industries in an analysis zone will be considered to be indicative of the third type of external economies being present.

An industry is defined as being concentrated when at least twice the fraction of its employment is present in an analysis zone (defined in footnote 1) than would be present if its employment were evenly distribution throughout the SMSA. [8] Two aspects of this definition require clarification in the context: use of employment as the classifying variable and use of a discrete level of employment instead of a continuous version. The use of employment to indicate clusterings instead of the number of establishments can be defended on two grounds. The first is simply that use of employment instead of the number of establishments does not significantly alter the results. [9] Second, since the type of external economies being discussed are basically production economies, the use of employment to define concentration, which weights the larger establishments more heavily, is appropriate as larger establishments are likely able to place more emphasis on such economies. The other dimension of the definition which needs to be examined is that it essentially is a threshold definition. That is, in each city a given percent of an industry's employment must be present in a zone for a concentration to be defined as existing in that zone. The advantage is using this approach is that it largely eliminates the problem of attributing external economies of the third type to exist when a relatively small degree of a specific type of industrial activity is present, since a small degree of such activity may be clustered on a random basis. [10] The limitation of this definition, on the other hand, is that the threshold has is arbitrarily determined. The external economies accruing within a given industry or among several industries at a given location, then, are to be represented by the amount of employment in the industries which are defined as being spatially concentrated at that location.

For our purposes "locational activity" in a zone of a city will be represented by the net change in employment in that zone over the observation period. A broad two-digit Standard Industrial Classification of industry is used here; this means that several distinct products and processes may be being carried out at a single plant complex implying that internal economies from joint products are accruing to the firm. Such internal economies should not effect the internal economies available from firms of the same or different industries from locating together.

Conceptually there appear to be two ways of empirically isolating the effect of external economies associated with the spatial clustering of industry. The first would be to examine the growth of a single industry at differ-

ent locations within the SMSA and, after controlling for other factors influencing the competitive position of each location, to determine statistically if the concentration of the industry in some locations significantly effects the growth rate. The problem with pursuing this type of analysis is that of properly measuring all of the factors which effect the attractiveness of a particular location as a site for manufacturing activity. [11] The second approach (and the one employed here) adopts the strategy opposite to that of the first by examining the growth rates of industries which are and are not concentrated within a single analysis zone. This approach holds the attributes of the zone constant while examining the differential performance of the two types (concentrated and nonconcentrated) of industry within it. In particular it holds the specialized facilities and the location of the zone vis-a-vis other economic phenomena in the area fixed while determining if the clustering of industry is exerting significant influence. Evidently, the comparision of the two types of industry might be heavily influenced by the overall regional growth rates of industries included in each class. For this reason some of the analysis uses changes in employment standardized for the area-wide growth of each industry.

EMPIRICAL METHODS AND RESULTS

Background

The three metropolitan areas contained a total of fifty-one analysis zones in which one or more industries were concentrated and in which, therefore, the behavior of concentrated and nonconcentrated could be contrasted. A simple examination of the percentage change in employment of each type (concentrated and nonconcentrated) industry adjusted for the industry mix present yields highly suggestive information. [12] In over a quarter of the zones (14) the concentrated industries show changes greater than (or less negative than) those of the nonconcentrated industries; and of those over half were in the four central cities, as compared with 23 of the 51 comparison zones being central city zones. A further examination of these central city zones shows that 7 of the 8 zones in which the concentrated industries have done relatively better are "traditional" manufacturing areas;[13] none of the more rapidly growing, concentrated industries outside of the central cities are in traditional zones. This indicates that such concentrations are continuing to be relatively more important for more centralized locations.

Method

To test the hypothesis that the location decision of concentrated and nonconcentrated industries at the same location are being differentially affected by external economies the net change in employment has been regressed on several factors reflecting special characteristics of the location. [14] Because the two types of industry are in all cases located in the same zone, most of the factors affecting the competitiveness of the zone as a location are held constant. This leaves us free to examine the importance of several factors reflecting external and internal economies. The following list presents most of the variables included in the actual analysis and shows the phenomena which was to be included and the manner in which it was operationally measured. Each of these is elaborated later in the text.

Phenomena	Measure
external diseconomies resulting from congestion	(total manufacturing employment in zone)^2 / 1×10^5
internal economies available from large scale operations	average firm size

general externalities present due to location or history of location

zone type: Central city or traditional site of manufacturing activity

general recent prosperity of the zone

"comparative industrial structure" of zone[15] which shows industry mix to be faster and slower growing than expected

specific industry effects, e. g. , the presence of the apparel and printing industries may indicate special capital and their decline might indicate the availability of space. Also, this controls broadly for industry type: market oriented, footloose, or input oriented.

additive dummy variables for concentrated industries important in all the sample SMSA's.

of the results. Not included in this list is a measure of the external economies available from the firms and functions of a single industry being located together. The significance of such economies will be evident indirectly from the regression results as explained below.

There are two conceptually equivalent ways to actually estimate the regression model in which one is trying to differentiate between two classes of response in the dependent variable. One is to pool the observations and to distinguish between responses by introducing additive or multiplicative dummy variables. The second is to estimate a model separately for each putatively different class of response and test the estimated coefficients for significant differences. The later method has been used here to conserve on degrees of freedom and to simplify the analysis. Significant differences in the estimated coefficients between the models for concentrated and nonconcentrated industries will demonstrate that the two types of industry are responding differently to the same economic factors. Further, since the regressions are holding other zonal characteristics constant for the analysis, the differences in the coefficients will also in part indicate differences in the importance of external economies arising from the clustering of the firms. Because in two-thirds of the zones more than one industry is concentrated, it is not possible to assume a close correspondence between the importance of these economies in general and those for a single industry.

Results

Two different dependent variables were used in both the concentrated regression models. The variables are the simple change in employment in the industry type (concentrated and nonconcentrated) between 1965 and 1968 in an analysis zone and the same change expressed as a percent of the base employment and weighted for the SMSA-wide growth rates of the included industries.

The estimated regression models are presented in Table 1. The fit for the "concentrated" model was markedly superior when the level of change form of the dependent variable was used, while the nonconcentrated was marginally better when the net change in employment was weighted for industry mix and expressed as a percent. These results provide some information on the extent to which scale effects, i. e. , the absolute size of the change in employment, influences the functional relationship with the independent variables. The models estimated using the first form generally provided better

Table 1. Regression Results for Change in Employment for All
Industries in Concentrated and Non-Concentrated Locations for
Cleveland, Boston, Minneapolis-St. Paul

	Concentrated Locations		Non-Concentrated Locations	
	Change in Employment 1965-1968	Industry Weighted % change in Employment 65-68	Change in Employment 1965-1968	Industry Weighted % Change in Employment 65-68
Constant	-802.1	-15.15	454.6	24.06
Boston area dummy	1057.5 (1.88)	13.75 (1.45)	118.1 (.20)	-10.95 (1.28)
Minneapolis-St. Paul	-24.5 (.04)	5.84 (.56)	-47.6 -(.07)	-1.51 (.16)
Traditional area dummy	1072. (1.82)	44.09 (1.47)		-14.22 (2.08)
Central City dummy			-665.3 (1.44)	
Comparative Industrial Structure[a]	..54 (2.99)	.006 (1.90)	.004 (.02)	-.004 (1.58)
Average Firm Size	2.51 (4.76)	.012 (1.26)	-.75 (1.44)	-.005 (.48)
Total Employment squared/ 1 x 10^6	-1.98 (2.48)	.003 (.23)	.190 (.27)	.008 (.75)
Dummy for Concentrated SIC's 20,21,22	-1143. (2.21)	-10.58 (-1.22)	257.5 (.55)	-1.62 (.23)
Dummy for Concentrated SIC's 23,27	-1882. (2.98)	-8.05 (.76)	-871.3 (1.63)	-18.85 (2.34)
Dummy for Concentrated SIC's 35,36	-1624. (3.03)	-21.44 (2.60)	230.0 (.51)	-5.01 (.74)
R^2	.783	.520	.460	.576

Note: t statistics in parentheses   a defined in the Appendix

fits for the concentrated industries and less explanatory power for the non-concentrated, suggesting the reinforcing nature of external economies for the concentrated industries.

Before discussing what information the significance and sign of the individual coefficients holds, two general comments on the quality of the estimates are in order. A t-test of the equality of the coefficients common to both models for each of the dependent variables shows that with only two exceptions the coefficients are different at the .005 level of significance.[16] This definitely supports the hypothesis that the two types of industry are responding differently to the same economic factors. The second point concerns the level of significance of the individual coefficients. In this exploratory analysis a .20 significance level for a two tail test is being used as the minimum acceptable; the corresponding value of the t-statistic is about 1.28.

The additive dummy variables for the SMSA's, relative to Cleveland were included to account for general differences in net employment change between the sample cities. Different dummy variables for zone types were included in the concentrated (traditional vs. nontraditional) and nonconcentrated (central city vs. other) simply because each performed better in the particular model. The differences in these variables and their signs confirms that concentrated industries do comparatively well in traditional manufacturing areas in which they are concentrated which may also be in the central city, while employment growth of the same industries in central city locations in general is relatively retarded.

The coefficient of the "comparative industrial structure" variable (described in footnote 15) is positive and significant in both models for concentrated industries and insignificant in one of the nonconcentrated models and significant but with a negative sign in the other. For the concentrated industries these results show them growing or declining with the area: as the area becomes less attractive, they leave it making it yet less attractive to the firms by further reducing the externalities available at that location. For nonconcentrated industries the industry mix of the zone does not seem to make much difference; it anything these industries are attracted to areas with little rapidly growing industry, possible areas in which formerly occupied buildings are now available.

Average firm size was included to account crudely for the strength of internal economies as an offset to the external economies of concentrated locations. To support this use of the variable, after controlling for congestion (discussed next) the sign of the coefficient should have been negative for concentrated industries and positive for nonconcentrated. The results are just the opposite. This probably is caused by the use of employment to measure the presence of concentrations with larger firms contributing heavily to classification of industry as concentrated. At the same time, it may be that some localization economies accrue to the largest firms, which as a class have a lower propensity to move. Such economies might include the presence of specialized loading facilities from which they reap disproportionate benefits because of their higher volume of inputs and outputs. The positive effect of firm size of concentrated industries and its negative effect on the nonconcentrated, combined with the findings for the "comparative industrial structure" variable suggest that firms of concentrated industries are willing to bid up land rents as they expand, forcing out those with relatively less economic reason for remaining.

Congestion was measured by the square of the total manufacturing employment in the analysis zone to reflect the nonlinear nature of the increase in congestion costs. The variable was significant only in the first of the reported, estimated models having a negative effect on the growth on concen-

trated industries. The lack of significance for the nonconcentrated industries was, however, expected. They have less incentive in terms of realizing external economies of locating or expanding in highly congested areas so that their growth rate is not adversely affected as they simply can locate elsewhere. The concentrated firms would, assuming increased demand, like to expand in the same zones; and for them congestion costs become a factor retarding expansion. [17]

From the above analysis, it is evident that firms at the two types of location (concentrated and nonconcentrated) are responding differently to the same economic factors. In addition, this indirectly indicates that external economies accruing from firms locating together are more important to the firms located in concentrated areas, which are presumably located there in part to capture these economies. Several reasons can be advanced to explain this differential response within the same industries. One has been alluded to above; it may be that firms of the same industry differ significantly in their technology between the two types of location, the more land-extensive operations permitting greater internal economies in nonconcentrated areas. A more basic reason may be that the employment at the two types of location are producing for different markets and, therefore, are constrained in different ways. Within all manufacturing industries there are firms which are definitely producing for highly localized markets. The production location constraints of these firms is generally the same set as those found by their counterparts producing for national markets but they must simultaneously be much more sensitive to local markets considerations as well. Finally, it is possible that the response between the two types of location can be partly attributed to firm size, those at concentrated locations being about 10 percent larger on average.

One truly important point stands out from the analysis. Firms of concentrated and nonconcentrated industries at the same location are responding differently to the same economic factors. This differential behavior in part is attributable to the importance of external economies resulting from firms of the same and other industries locating together, although other factors may also be important. This finding has two important implications. First, in a policy context, it suggests that central cities might do well to improve the services they provide their industrial enclaves in order to exploit the comparative advantage of external economies they currently enjoy. Such aid might extend even to facilitating land assembly for expansion and other forms of assistance beyond the simple tax incentives now used. Second, in a research context, the results imply a potentially powerful dichotomy for predicting future industrial location. Given the greater stability and the consistent responses of firms at concentrated locations to economic forces, resources should be expended primarily on predicting the locations of the nonconcentrated firms which are apparently more influenced by changes in transportation facilities (access provided by highways and airports), locational shifts in local markets, and "neighborhood effects." This dichotomous relationship clearly needs to be more fully explored, and if possible, exploited.

FOOTNOTES

[1]These findings are summarized in R. Struyk, "Spatial Concentrations of Manufacturing Employment in Metropolitan Areas: Some Empirical Evidence"; Economic Geography, April 1972. The data set used in this study was the Dun's Market Identifier data, assembled by the Dun and Bradstreet Corporation which provides employment and exact address on an establishment basis for a nearly exhaustive sample of manufacturing enterprises in a number of metropolitan areas. For the present study, the files for 1965 and 1968 were matched to obtain information on net change in employment and locational changes. A complete description of the DMI data and the procedures followed in adapting it to the study of intrametropolitan industrial location can be found in F. James, Use of the DMI File for Studying Urban Industrial Location. National Bureau of Economic Research, unpublished paper, 1970.

Each of the sample metropolitan areas was divided into analysis zones which consisted of aggregate of postal zip-code areas on the basis of the following criteria: limiting the fraction of total manufacturing employment in any zone to a 15 percent maximum regardless of the employment density, and normally to only 10 percent; insuring that a zone contained a minimum amount of manufacturing employment, normally 2 percent; limiting the land area of each zone from becoming so large that it lost identity as a community or industrial area; to the greatest extent possible matching zip code and legal boundaries; where necessary grouping several legal entities together; taking various natural demarcations such as lakes and ocean inlets into account; and grouping zip code areas with the same broad economic social and industrial characteristics together. The definition of a "concentration" is set forth later in the text.

[2]The strongest argument against the assertion that external economies have been an important locational factor might be termed the "physical constraint argument." The thesis is that the requirement for certain natural resource inputs (e.g., water) or complementary facilities (e.g., railroads) by industries so constraints their locational possibility set that they have only a few areas in which to locate; and they concentrate there. This argument certainly has strength for industries like primary metals which require heavy transportation facilities for their inputs and finished products and great quantities of water and other utility inputs obtained through their own sources or public utilities with adequate capacity. However, the force of this argument is diminished when it is observed that the electrical machinery industry, which has really only emerged since the end of the second World War and which is not constrained significantly by the need for specialized facilities, has tended to agglomerate within metropolitan areas much like other industries.

[3]Alfred Weber, Carl J. Friedrich (TR) Theory and Location of Industry, (Chicago: University of Chicago Press, 1956).

[4]This argument is supported by the fraction of direct interindustry inputs which industries (defined on a 2-digit basis) receive from themselves. For the major industries (i.e., accounting for 5 percent or more of total manufacturing employment) concentrated in one or more of the sample cities, such inputs account for from 11 to 29 percent, except for fabricated metals for which it is only 5.2 percent.

[5]These studies include: E. M. Hoover and R. Vernon, Anatomy of a Metropolis, (Cambridge: Harvard University Press, 1956); Vernon, Metropolis 1985, (Cambridge: Harvard Press, 1960); and Leone, Location of Manufacturing Activity in the New York Metropolitan Area, unpublished Yale Ph. D. Thesis, 1971. The nature of the external economies which has been

.discussed as influencing the location decision differs basically from those referred to by Vernon. According to Vernon's view, externalities and centrality of location are highly correlated, and the reason for a central location is to provide a high degree of access to services provided by other industries or access to customers. For this reason he lists industries such as high fashion apparel, printing and publishing, and military electronics as prime candidates for centralized locations. Whereas this type of externality undoubtedly is a factor influencing highly centralized locations, the concentrations of firms and employment of a particular industry in an area outside the CBD indicates that other favorable externalities must be available from such groupings.

[6]The idea that external economies available at some locations may be offset by internal economies available to larger plants at other locations is not new. R. F. Muth has provided the theoretical argument in Cities and Housing (Chicago: University of Chicago Press, 1969) and M. Goldberg has tested and supported it empirically in Intrametropolitan Industrial Location: Plant Size and the Theory of Production (Berkeley: University of California Center for Real Estate and Urban Economics, 1969).

[7]See John F. Kain, "Housing Segregation, Negro Employment, and Metropolitan Decentralization" Quarterly Journal of Economics, May 1968, pp. 175-198.

[8]For example, for Boston, the area was divided into 20 analysis zones. If an industry were evenly distributed across the area, 5 percent of its employment would be in each zone. For an industry to be concentrated in a zone, 10 percent or more of its employment must be in the zone.

[9]The same criteria was applied using the number of establishments (instead of employment) as the classifying variable. In about 60 percent of the cases, a zone classified as having a particular industry concentrated in it was so classified using both employment and establishments as the classifying variable. More importantly, almost universally (2 exceptions) there were more than 10 establishments present in any zone with a concentration defined on the basis of employment. In most cases the number of establishments was substantially greater, frequently over 30 and occasionally over 100. Thus even where employment and establishment counts produce differing zone classifications, those zones with "employment concentrations" are not composed exclusively of enormous establishments in any case.

[10]Thus far by implication a clustering of employment has connoted the presence of the third type of external economies. More formally, such clustering, beyond some minimal (random) level, is taken to be a sufficient but not necessary condition for the presence of such external economies.

[11]In experimenting with the first approach, the change in the level of employment of an industry at various locations within a metropolitan area was regressed against variables such as the fraction of its total employment in each zone and the type of zone (traditional manufacturing site, etc.). The analysis was unsatisfactory because it ultimately resolved into a comparison of the competitive position at the margin of centralized locations (where most industries were concentrated) and other locations as sites for manufacturing. Lost really was the effect which external economies were having on the competitiveness of alternative locations because it could not be isolated. The results of this analysis, however, underscored what the data on net change in employment in a zone classified by the amount of the industry's employment showed; namely that in most cases in industry was

growing more slowly at locations where it was concentrated. Of the 17 major industries for which comparisons were made this proved to be the case for 13 of them. The reasons for the poor performance of these locations is attributed to congestion costs and potential internal economies from more land intensive production processes outweighing the effects of external economies.

[12]Because of space limitations a table displaying the basic data for each of the included analysis zones has not been included; this table is available upon request from the author.

To measure the relative growth of manufacturing employment in each zone adjusted for its industrial structure, a hypothetical figure is calculated for each zone based on the SMSA-wide rate of growth of each industry taken separately, and weighted by the industrial structure (employment in each industry) in each zone. The difference between actual growth and this hypothetical one measures the comparative gain or loss adjusted for industrial structure. In the table this change is expressed as a percent of a weighted '65 and '68 base. For a full description see Victor Fuchs The Location of Manufacturing Activity in the United States, 1929-1964, (New York: National Bureau of Economic Research, 1960), pp. 38-43.

[13]A "traditional" manufacturing area was defined generally on the basis of the area (analysis zone) having obtained a degree of total manufacturing employment by a particular historical data. In some instances such definitions relied of necessity on the opinions of informed individuals. A statement of the actual criteria used for each SMSA is available upon request.

[14]To clarify, the hypothesis being tested is not that industries concentrated in a zone will be growing faster than the nonconcentrated industries as a result of the presence of external economies. The central hypothesis is rather than the two types of industry are responding differently to the same economic factors owning in part to external economies. The assumption is that the effect of the externalities is to make the location more attractive to the concentrated industries, and the results interpreted below appear to support this assumption. Testing whether the concentrated industries are growing faster is really a test of whether the external economies are sufficient to offset the negative aspects of the location relative to the same comparison for the nonconcentrated industries. From what has been stated earlier it is evident that this type of test is not appropriate for the purposes at hand.

[15]This "comparative industrial structure" measure is the complement to the "growth adjusted for industrial mix" variable described in footnote 12; together they sum to the growth of the zone's employment relative to that of the SMSA. The "comparative industrial structure" of a zone is calculated as the difference between the hypothetical figure described in footnote 12 and an expected growth in manufacturing employment based on all industries growing at the SMSA average, expressed as a percent. A positive sign for a given zone's measure means that it had a "good" i.e., fast growing industry mix compared to that of the SMSA. This measure is defined in the appendix to this paper; for further discussion, see Fuchs, op. cit.

[16]The variables which were not significantly different between the concentrated and nonconcentrated models are: in the models for the level of the dependent variable, the coefficients of the dummy variable for Minneapolis-St. Paul did not differ significantly; and in the models for industry mix-adjusted percentage change form of the dependent variable, the coefficient of the congestion variable (employment^2/1×10^6) were not significantly different.

[17]Except for the dummy variable for the printing and publishing and apparel industries, the results for the industry dummy variables show little relation between changes in a specific concentrated industry and nonconcentrated industries in general. For apparel and publishing, however, their decline appears to have caused a decline in employment of complementary, nonconcentrated industries. In general, it was believed that a declining major industry would open up usable space for nonconcentrated industries which would produce a positive relation in the nonconcentrated regression. If, as some of the other results indicate, larger establishments of other concentrated industries are bidding up rents at those locations, the actual results for specific industry dummy variables are understandable.