SUBURBANIZATION OF INDUSTRY IN THE PORTLAND METROPOLITAN AREA

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ABSTRACT: Until recently, manufacturing in the Portland Metropolitan Area was highly concentrated in the central city, with little industrial activity in the periphery of the urban area except for primary processing of timber and agricultural resources. However, in recent years, especially within the last decade, industrial activity has spilled well beyond the limits of the City of Portland. Needed space for expansion, congestion, rising land values, and other factors have tempted an increasing number of resident plants to relocate in the suburbs. In addition, firms new to the Portland Area have rejected a central city location in favor of the suburban area. As a result of these developments, a significant proportion of manufacturing employment and establishments is presently located in the suburban area.

An important characteristic of economic growth is the increasing concentration of population, along with manufacturing and other economic activities, in cities. For many decades cities in the United States continued to attract population and economic activity which resulted in a corresponding decrease in rural population. Cities were natural places for continued growth because of the direct contact of cultural, administrative and economic institutions. However, improvements in communication and transportation began to equalize the advantages between the central city and the peripheral areas. In time a sufficient proportion of city population and manufacturing

activities were drawn off to these peripheral areas which have the advantages of vacant land, less congestion and lower land values.

This movement outward from the city has been called industrial suburbanization. Such a process results in an internal redistribution where the proportion of manufacturing or other activity located in the central city decreases and the proportion in the periphery or fringe increases. Recent studies of manufacturing for the United States show that manufacturing is heavily represented beyond the corporate limits of many central cities.[1]

This changing intra-urban pattern of manufacturing has major implications for the land use planner and others concerned with the land use of suburban areas. Industrial suburbanization is one of the critical factors in the "sprawl" of American cities. Manufacturing plants are important land users as well as major employment sources. The location of manufacturing plants has a major impact on suburban land use and on the location of other activities such as residences and service outlets.

Another important factor is the increased land needs of industry today. Single-story facilities with extensive parking lots and adjacent tracts of land held in reserve are characteristic of industrial plants locating in the suburban areas. Adequate area for expansion is one of the most important location factors for industries

moving to the suburban area.

The changing location of manufacturing activity also has a major impact on central cities. Manufacturing has traditionally represented a key economic activity of most urban centers in the country. However, as a consequence of industrial suburbanization this dominant position of manufacturing in many major cities has been declining.

Since most of the research on changing intra-urban patterns of manufacturing has been on a national level or has been concerned with case studies of the nation's largest metropolitan areas, there is need for research on the matter for smaller metropolitan areas. Frequently, it is implied in these studies that the rate of industrial suburbanization is a direct function of city size and that the process is less intense, and therefore, less significant in smaller metropolitan areas.[2] Therefore, it was of interest in this analysis to select a metropolitan area of medium size, or one with a central city population of less than 500,000 persons, for a case study on industrial suburbanization.

OBJECTIVES

The primary objective of this paper is to determine if there is a significant trend toward industrial suburbanization in a large portion of the suburban area of

Portland, Oregon, and to find out if resident plants, new firms, or both are involved in the process. The other objectives of the study include: (1) determination of the patterns of industrial suburbanization, including definition of areas showing important increases in industrial activity and (2) determination of the primary location factors which influence new plant location.

Several important steps are necessary for achievement of these objectives. These necessary steps include: (1) finding evidence of industrial suburbanization using data extracted from both the United States Census of Manufactures and a local survey of locational behavior of individual firms; (2) determining the origin and destination of industrial plants including relocated and new plants; and (3) determining through interviews and a local survey the location factors which plant officials considered most important in their location decision.

II. REVIEW OF LITERATURE

For the purposes of summary it is convenient to recognize that the literature on the changing intra-urban pattern of manufacturing may be roughly divided into two broad types of studies. First, several of the earlier studies have been based on United States Census data for the nation as a whole. Secondly, many of the studies of

suburbanization of industry have been restricted to a particular metropolitan area. Many of the studies in both of these groups have demonstrated a trend of movement away from the original manufacturing centers of the urban complex.

On a national level the pioneering study of industrial suburbanization within metropolitan areas was made by Creamer and later continued by Woodbury.[3] Together they analyzed trends in the 1899-1947 period. Evelyn Kitagawa and Donald Bogue made a more exhaustive study of suburbanization for the 1929-1947 period.[4] Zelinsky extended the analysis through 1954 and observed a rapid increase in industrial suburbanization during the period 1947 through 1954.[5]

The generality of studies based on the United States Census data for the nation as a whole places some limitations on their value. Kitagawa and Bogue admitted,

> "By observing data for the 1929-39 and 1939-47 periods, it was demonstrated that national trends are very poor indicators of what may be expected to happen in a particular S.M.A."[6]

Understood in such a conclusion is the need for more empirical studies of particular urban areas or limited groupings of areas.

Most of the studies of industrial suburbanization which are restricted to a particular metropolitan area are concerned with the nation's largest cities. The Chicago, New York, Detroit, and Philadelphia Metropolitan Areas have

received the most attention.[7] Most of the literature on these large metropolitan areas is concerned primarily with the reasons for out-migration of industries, including extensive discussions on traditional location factors. Pertinent to this study are those area analyses which employ techniques for providing evidence and patterns of suburbanization.

Two separate studies in the Chicago Metropolitan Area by Reeder and by Reinemann should be cited as among the most complete and comprehensive in providing evidence for manufacturing suburbanization in a particular metropolitan area.[8] The locational history of individual firms was used as opposed to using census data which reveals little about plant relocations. The data were analyzed in terms of net gains and losses with reference to systems of sectors and zones which divided the metropolitan area into workable geographical segments. Degrees of industrial suburbanization were indicated by the relative proportions of an activity as between a metropolitan area and its constituent parts.

The literature provides ample evidence that manufacturing suburbanization is an important process in the nation's largest metropolitan areas, but the smaller metropolitan areas have been neglected. In one of the few published studies of industrial suburbanization in a smaller

metropolitan area (central city population less than 500,000), Stuart demonstrates a significant trend toward suburbanization of manufacturing in Roanoke, Virginia.[9]

In addition to the studies which are concerned specifically with industrial suburbanization are the more common industrial land use reports published by city and regional planning commissions. An example of the latter type of study is a report completed for the Portland Metropolitan Area titled Land for Industry which was published by the Metropolitan Planning Commission in 1960.[10] This study inventories present industrial facilities (1959) and evaluates the area's capability of accommodating estimated industrial land needs for 1975. This report is a component of a metropolitan development plan and is much broader in scope than a special-purpose study of industrial suburbanization.

A similarity between the Metropolitan Planning Commission's report and this analysis is the method of data collection. In both studies a mail questionnaire was drafted and circulated to selected industries in the metropolitan area.

III. PROCEDURE FOR INVESTIGATION

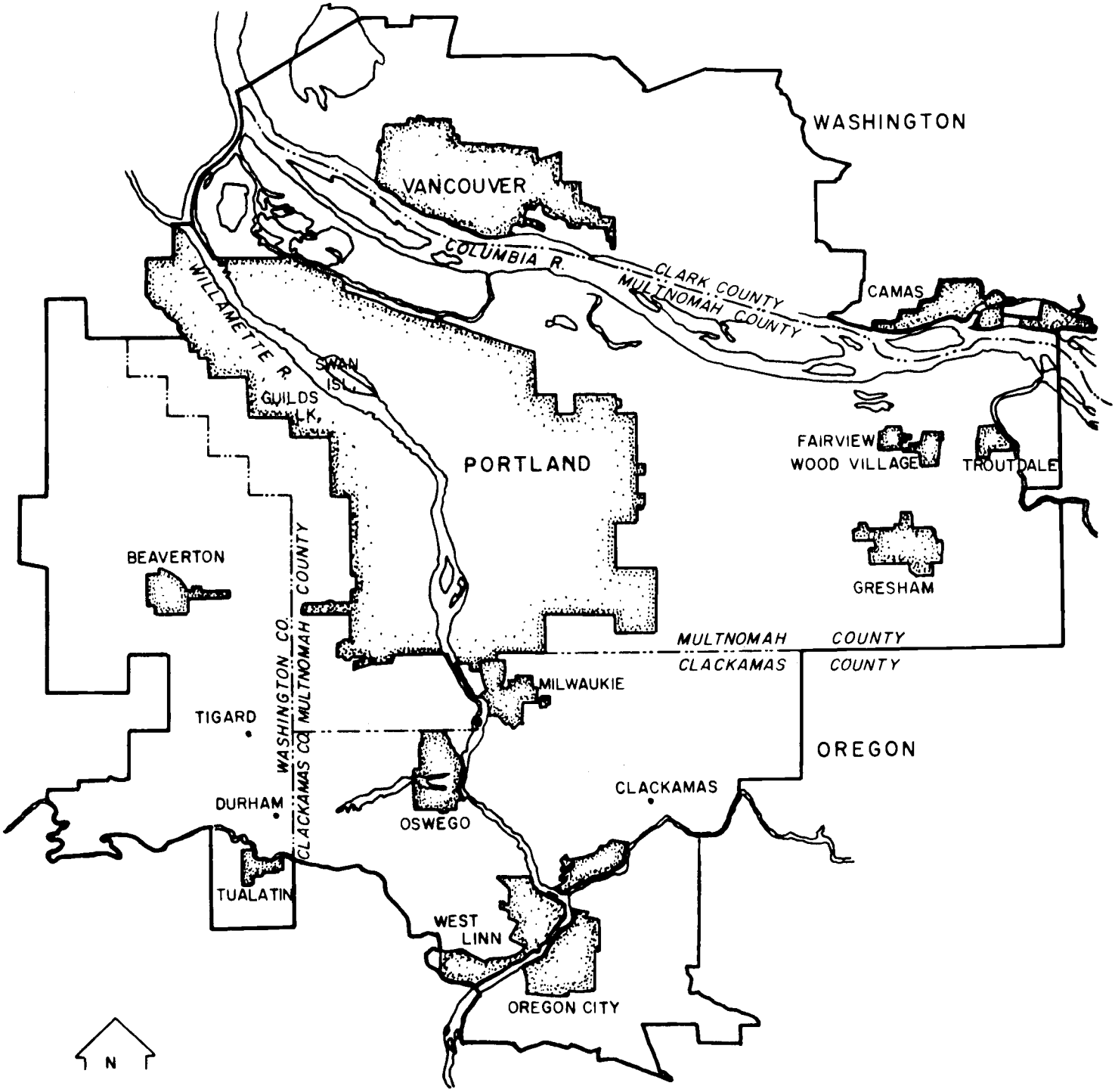
The area selected for study was the Portland, Oregon, Standard Metropolitan Statistical Area, embracing Clackamas, Multnomah, and Washington Counties in Oregon, and Clark

County in Washington. In 1968 the Portland S.M.S.A. had a population of 968,645.[11] The 1968 population of the four counties comprising the Portland S.M.S.A. is Multnomah, 555,700; Clackamas, 158,990; Washington, 137,140; and Clark, 116,815[12]. Clackamas and Washington Counties have experienced recent, rapid gains of population. Increases have been 41 percent and 49 percent, respectively, between 1960 and 1968. These two counties contain rapidly expanding suburban residential areas. The central city, which has had a stable population for several decades, had 377,800 persons in 1968.[13]

In order to determine the trends and patterns of industrial suburbanization, it was necessary to divide the Portland Standard Metropolitan Statistical Area into two zones of industrial activity, including the central city and the suburban zone. The suburban zone lies adjacent to, but outside, the City of Portland. The outer boundary of the suburban zone sets apart those suburbs that are adjacent to the City from those detached satellite towns which are surrounded by rural countryside. The outer boundary of the suburban zone is roughly the same as the boundary outlining the Urban Area of Portland (Figure 1). In order to allow for a finer distinction of the trends and patterns of industrial suburbanization, the suburban zone was divided into three sectors, including Clackamas, Multnomah and

FIGURE 1.

PORTLAND URBAN AREA



Washington Counties.[14]

The industries moving to the suburban zone were classified into four origin groups including: (1) newly organized firms; (2) industries moving into the metropolitan area; (3) new local branches; and (4) internal relocations. The first two groups will be referred to collectively as new industries, since they constitute activities entirely new to the suburban area. The last two groups refer to firms already operating in the metropolitan area which have relocated in the suburban area. This latter group will be referred to as resident or relocated plants.

METHODS OF ANALYSIS

The evidence and pattern of industrial suburbanization were determined by use of data from the United States Census of Manufactures and the execution of a local survey of industrial plants. First, using census data for the period 1939 through 1965, an analysis was made of the changes in distribution of industry by constituent parts of the Portland Standard Metropolitan Statistical Area using number of establishments and number of employees as measures. This was followed by a detailed survey of the location of industry and the movement of industrial plants in the Portland S.M.S.A.

The major sources of data for the detailed survey were the reports of the Industries Department of the Portland

Chamber of Commerce, recent and past issues of the Directory of Oregon Manufacturers, and a mail questionnaire.[15] The mail questionnaire was sent out to fifty firms presently located in the suburban zone. This questionnaire was designed to gain the following information: (1) the locational trends of new and relocated resident plants, by asking the date the firm was established at its present site and the previous location of the plant; (2) the number of employees for each plant; (3) the types of industries, using the Standard Industrial Classification; and (4) the factors that determined new location in the suburban zone. For the latter information the plant manager or owner was asked to check each of fifteen location factors as to whether it was of primary importance, secondary importance, or not a determining factor. Eighty-five percent of the firms completed and returned the questionnaire.

The period from 1955 through 1969 was selected for the survey. From preliminary investigation it was found that there was little movement of industry to the suburban zone during the period prior to 1955. For purposes of data collection and analysis, time was broken into three five-year intervals, including 1955 through 1959, 1960 through 1964, and 1965 through 1969.

Since no records exist which list the origin of new and relocated plants, it was necessary to trace the

locational history of individual firms presently located in the suburban zone. However, it was found necessary to place some limitation on the number of manufacturing plants to be investigated. From preliminary investigation it was found that most relocated and new firms established since the beginning of the study period had ten or more employees at the time of their location in the suburban zone. It has been the larger plant in need of a larger site that has moved to the lower-cost suburban land. It was decided to include in this study all new and relocated plants with ten or more employees at the time of location in the suburban zone.

IV. ANALYSIS OF DATA

During the last two decades industrial development in the suburban zone has undergone an important change in emphasis. Before the 1950's much of the suburban zone was without industrial activity except for important primary manufacturing, including food processing and forest products manufacture. For example, a resource analysis for Washington County indicated that in 1949 ninety-two percent of the county's employment was engaged in either the lumber industry or in food processing. In 1963 these two categories were reduced to only 18.6 percent of the total manufacturing employment.[16] During this period employment in these

segments, combined, declined in relative importance but not in absolute terms. Increasing employment at new and relocated manufacturing plants in the suburban zone has been responsible for this important change.

The census data reflected in some degree the increasing relative importance of industrial activity in the suburban zone, while at the same time revealed a decline in the proportion of manufacturing employees and establishments in the City of Portland. While the central city still dominated the local job market with 60 percent of the Portland S.M.S.A.'s total employment in 1965, the proportion of manufacturing employees in the central city has declined from 75 percent in 1939.[17] Between 1939 and 1965 total employment in the suburban zone increased by 420 percent, as opposed to an increase of 133 percent in the central city, causing the suburban zone's share of the S.M.S.A. employment to increase from 20 to 35 percent.

Similar results can be obtained by using number of establishments as a measure of industrial activity. Between 1939 and 1963 the suburban zone's share of the S.M.S.A. manufacturing establishments increased from 16 to 34 percent, while the central city's share declined from 80 percent to 61 percent.

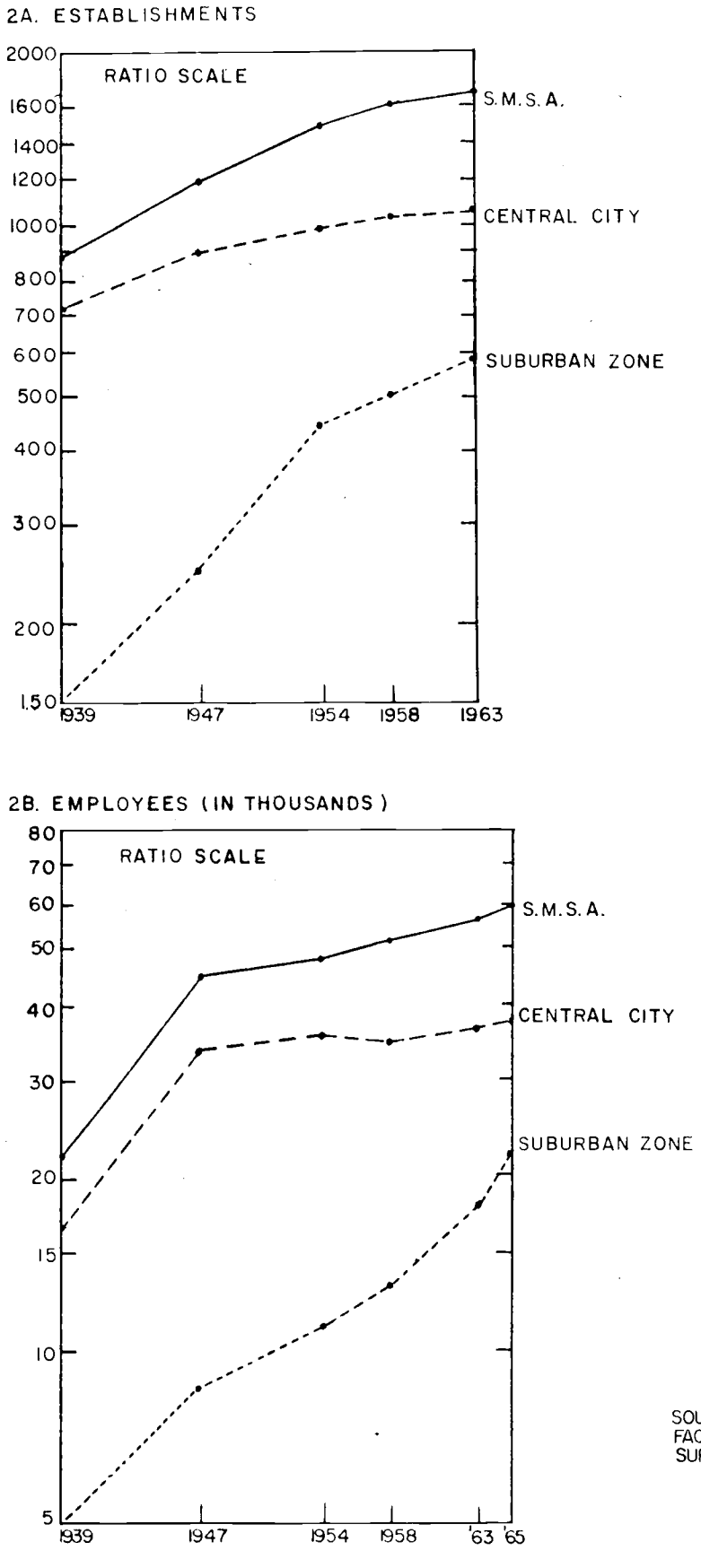
Figures 2a and 2b trace the pattern of change in the location of manufacturing in the Portland S.M.S.A. One

characteristic predominates. Although in absolute terms there has been a considerable growth in manufacturing employment and establishments in the Portland S.M.S.A., the central city has grown considerably slower than the suburban zone. Conspicuous in Figure 2b is the trend indicating that the central city has shown very little increase in the number of employees since 1954. Also conspicuous is the significant increase in employees in the suburban zone since 1958.

Further evidence of the increasing relative importance of industrial activity in the suburban zone can be provided by employing the shift ratio.[18] In applying this technique the over-all rate of growth of the S.M.S.A.'s industrial employment or number of establishments is calculated for an intercensal period. Then for each constituent part of the S.M.S.A., including the central city and the sectors of the suburban zone, the ratio is computed by dividing the actual employment (or number of establishments) in the latter census year by the expected employment, which is the employment that would have resulted had each constituent part's employment grown at the same rate as the S.M.S.A.'s total industrial employment. A shift ratio greater than one represents a relative gain of employment in the sector while a ratio less than one indicates a relative decline.

Tables 1a and 1b show the results for the 1954-1963 period using number of employees and number of establishments,

FIGURE 2. DISTRIBUTION OF MANUFACTURING ESTABLISHMENTS AND EMPLOYEES IN PORTLAND METROPOLITAN AREA, 1939-1965



SOURCE: U.S. CENSUS OF MANUFACTURES, FOR 1965, ANNUAL SURVEY OF MANUFACTURES

TABLE 1a -- SHIFT RATIO, USING NUMBER OF EMPLOYEES

Sector	Intercensal Period (Actual) 1954	1963	Expected[a] 1963	1963 Actual / 1963 Expected
S.M.S.A.	48,297	56,552	56,552	1.00
City of Portland	35,285	35,646	44,636	0.79
East (Mult.Co.)	4,449	5,826	5,627	1.03
South (Clack. Co.)	4,570	5,375	5,781	0.93
West (Wash. Co.)	2,690	7,618	3,402	2.24

[a]Computed by using 27% as rate of growth for S.M.S.A.

TABLE 1b -- SHIFT RATIO, USING NUMBER OF ESTABLISHMENTS

Sector	Intercensal Period (Actual) 1954	1963	Expected[a] 1963	1963 Actual / 1963 Expected
S.M.S.A.	1,519	1,718	1,718	1.00
City of Portland	997	1,052	1,127	0.93
East (Mult.Co.)	165	190	187	1.02
South (Clack. Co.)	185	225	209	1.08
West (Wash. Co.)	120	185	136	1.36

[a]Computed by using 13% as rate of growth for S.M.S.A.

respectively. A relative decline of employment and establishments for the central city is indicated. With one exception all of the suburban sectors registered a relative gain, indicating generally a relative shift of industrial employment and establishments into these areas. It would appear that Washington County was the most active in attracting industrial activity, as measured by number of employees and number of establishments.

LOCAL SURVEY OF INDUSTRIAL FIRMS

Although the census data provides some evidence for industrial suburbanization, it gives no indication of the nature and pattern of the suburbanizing process. Industrial suburbanization may be caused by removal of industries already in existence within the corporate limits of Portland, or by an influx of new industries, or a combination of both. Such information can be determined by an examination of the locational history of individual firms.

Relocated Plants. It can be seen in Table 2 that since 1955 the suburban zone has gained 71 plants, employing 9,460 persons in 1968, from the central city. This total includes only five new local branches with 1,200 employees in 1968. Table 2 indicates that relocation of resident plants represents the largest proportion of the total amount of establishments that located in the suburban zone between

TABLE 2 -- ESTABLISHMENTS THAT LOCATED IN THE SUBURBAN ZONE BY FIVE-YEAR INTERVALS, 1955-1969

Period	NEW INDUSTRIES			RELOCATED PLANTS			
	Newly Organized	In-migration	Total	Local Branches	Complete Relocation	Total	Total
1955-59	7	6	13	1	14	15	28
1960-64	14	8	22	1	26	27	49
1965-69	8	7	15	3	26	29	44
Total	29	21	50	5	66	71	121

Source: Author

1955 and 1969. Sixty percent of all establishments constructed in the suburban zone during this time period were relocated firms, while 40 percent were new industries to the area. It is clear that a significant proportion of the industrial growth in the suburban zone is at the expense of the central city. There was no return of industries to the central city from the suburban zone during the fifteen-year study period.

There are three general methods firms employ in transferring their activity from the central city to the suburban zone. In many of the larger metropolitan areas relocation may take the form of physical separation of parts of a firm, including the factory, offices, and the warehouse. However, in the Portland Metropolitan Area relocation in nearly all of the cases consists of movement of the entire productive

capacity of the firm.

In the 1955-1969 period only five firms opened a branch factory in the suburban zone. These five firms are relatively large with each employing over 200 workers at the parent and branch plants in 1968. Relatively speaking, however, Portland is a city of small industries which are usually not large enough to operate both a parent factory and branch facilities in the suburbs. Table 3a indicates that over 40 percent of the industries that relocated had less than 40 employees at the time of removal from the central city. In the majority of cases when a Portland firm decides to expand its facilities, it moves its entire productive capacity rather than establishing a branch factory.

The pattern of movement of the 71 plants which are known to have moved from the central city to the suburban zone is illustrated in Figure 3. The map indicates the destinations to which Portland firms have moved and affords a basis for showing direction and pattern of industrial relocation. It is evident that all sectors received resident plants from the city between 1955 and 1969, but it can be seen that dominant locational trends exist, particularly toward the south and southwest. The West Sector (Washington County) attracted more relocated establishments than any other sector. This is all the more significant when placed against the fact that about 42 percent of the vacant land

TABLE 3 -- MOVEMENT FROM PORTLAND TO THE SUBURBAN ZONE, 1955-69

3a. EMPLOYEE SIZE GROUPS[a]	Percentage of Establishments
10- 39 Employees	40%
40- 69	20
70- 99	11
100-129	9
130-159	11
160-189	2
190 or more	7

3b. TYPE OF INDUSTRY SIC	Percentage Distribution of Establishments
34 Fabricated Metal Products	17%
35 Machinery, Except Electrical	16
37 Transportation Equipment	14
36 Electrical Machinery, Equipment & Supplies	10
20 Food and Kindred Products	6
Other	38

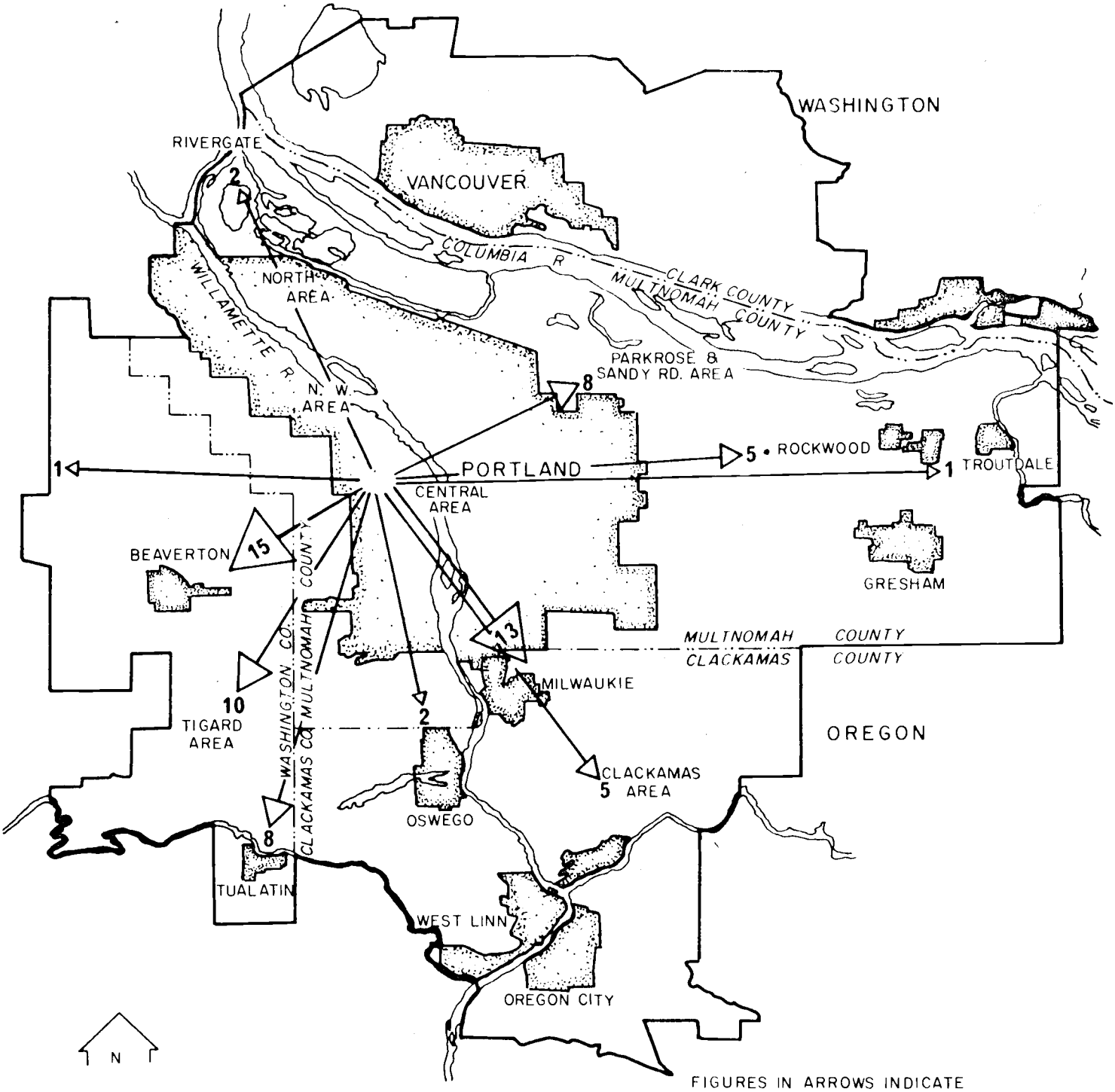
3c. TYPE OF INDUSTRY	Percentage Distribution of Employees in Each Group[b]
37 Transportation Equipment	25%
23 Apparel and Other Finished Products	19
35 Machinery, Except Electrical	14
33 Primary Metal Industries	8
38 Professional, Scientific and Controlling Instruments	8
34 Fabricated Metal Products	6
Other	20

[a]Number of employees at time of removal from Portland.

[b]Percentage of employees in the year 1969.

Source: Author.

FIGURE 3. MOVEMENT OF INDUSTRIES FROM PORTLAND TO SUBURBAN ZONE, 1955 - 1969



SOURCE: ~~AUTHOR~~ what is source of base map?

available for industrial development in the suburban zone in 1960 was in Washington County.[19] Fifty percent of the establishments that relocated to the suburban zone during the study period settled in the West Sector; 29 percent in the South Sector; and 21 percent in the East Sector (Table 4). It was the West and South Sectors which attracted most of the new establishments, also.

The location pattern of industries was one of concentration in or adjacent to suburban incorporated and unincorporated areas in place of ribbon-like development. The general pattern of relocation has been to suburban areas predominantly toward the west, southwest, and south of the

TABLE 4 -- DESTINATION OF SUBURBANIZED ESTABLISHMENTS AND MANUFACTURING EMPLOYMENT BY SECTOR, 1955-1969

Sector	Establishments			Manufacturing Employees[1]		
	New	Relocated	Total	New	Relocated	Total
East (Mult. Co.)	20%	21%	20%	28%	35%	33%
South (Clack.Co.)	38	29	33	29	39	37
West (Wash. Co.)	42	50	47	43	26	30

[1]Percentage of employees in the year 1969.

Source: Author.

central city. Within the last five-year period of study several suburbs to the west and southwest of the central city, including Beaverton, Tigard, Durham, and Tualatin, have been very active in receiving relocated industries.

It is of further interest to analyze the relocation of industries out of Portland to the suburban zone in terms of the original location of the plants. The important industrial areas within Portland that need to be identified include the Northwest Industrial Area, the Central Area including the lower east and west sides, and North Portland (Figure 3). The Northwest Industrial Area, including Swan Island, had the greatest loss of industrial establishments through relocation to the suburban zone. About 65 percent of all relocated movements originated within this area of the city. It should be noted that this industrial district is by far the largest in the city and contains more establishments than any other industrial concentration. This area consists of approximately 2,500 acres. About 20 percent of the establishments moving out of the city came from the Central Area. Increasing growth of a firm and the corresponding need to expand on sites too congested for expansion are major reasons for relocation out of these industrial areas.

Most of the relocated industries were not large in terms of number of employees. Table 3a indicates that 70

percent of the plants that moved during the fifteen-year period employed less than 100 employees at the time of removal from the central city. Only seven percent had over 200 employees at the time of relocation.

Table 3b separates the relocated industries according to major Standard Industrial Classification (S.I.C.) industry groups. Three industry groups, including transportation equipment, machinery, and fabricated metal products accounted for 47 percent of the relocated establishments. The dominant S.I.C. industry groups, in terms of number of employees, were determined by ranking these groups according to the number of employees in each one. In this ranking transportation equipment, and machinery again dominate along with the addition of apparel and other finished products. The industry groups that ranked high in terms of number of employees and establishments are, with the exception of the apparel and finished products group, characterized by relatively complex processes requiring skilled labor.

New Plants. The suburban zone has gained 50 new plants since 1955, employing 3,740 persons in 1968. This is less than the amount of relocated plants, or about 40 percent of all industries that located in the suburban zone since 1955. Table 2 indicates that 58 percent of the new plants represent newly organized industries and 42 percent are a result of in-migration from outside the Portland

Metropolitan Area.

The data in Table 2 indicates the significance of new industries to the total suburbanization process. In each time period since 1955 fewer new establishments have located in the suburban zone than the number that relocated from Portland to this zone. Since 1955 relocation of manufacturing plants has been the major factor resulting in the suburbanization of industry in the Portland Metropolitan Area. However, there was an important increase in the establishment of new plants from the last half of the 1950's to the first half of the 1960's. During this period there were a number of newly organized firms that attempted to capture part of the growing market for fabricated metal products, electrical machinery, and non-electrical machinery.

The significance of new industries to the individual sectors is indicated in Table 4. The three sectors of the suburban zone shared unequally in the establishment of new industries during the fifteen-year period. Eighty percent of the new establishments located in the South and West Sectors. The West Sector (Washington County) attracted 42 percent of the new establishments; the South Sector (Clackamas County) attracted 38 percent; and the East Sector (Multnomah County outside the central city) drew only 20 percent. The West Sector also ranked first in terms of number of plants that relocated from within the

central city. As pointed out previously, it was this sector which had over 40 percent of the vacant land available for industrial development in the suburban zone.

SUMMARY OF RELOCATIONS AND NEW PLANT LOCATIONS

The industrial pattern of the Portland S.M.S.A. underwent some important changes in the period covered by this analysis as a result of locational shifts of new and resident plants to the suburban zone. As Table 2 indicates, the suburban zone gained 121 establishments and 13,200 manufacturing employees since 1955 through relocation and establishment of new plants.[20] On the whole, suburban industrial growth is attributable more to movement of resident plants out of the central city than the ability to attract new plants. Sixty percent of the manufacturing establishments constructed in the suburban zone during the study period are relocated firms, while 40 percent are new industries to the area. Relocated plants account for 72 percent of the manufacturing employment, while new plants are responsible for 28 percent of the employment in 1969.

The movement of new and resident plants has been strongly oriented toward the west, southwest, and south of the central city. Especially noticeable has been the gain of the West Sector (Washington County). Washington County received approximately 42 percent of the new and 50 percent of the resident plants that located in the suburban

zone since 1955 (Table 4). It appears that several developing industrial districts in this sector, including the areas in and adjacent to Beaverton, Tualatin, and Tigard, will continue to expand rapidly in the future.

V. THE REASONS FOR SUBURBANIZATION

There are important reasons why the suburbs in the West Sector are presently experiencing rapid industrial development. These areas have the advantage of favorable topography, access, and labor supply. Industrial sites are excellent and still plentiful; an Interstate Highway, a new expressway, and a Southern Pacific Rail Line focus on the area; and population is rising more rapidly than in any other sector, providing reasonable assurance of an adequate labor supply. Several industrialists made special note in a recent mail survey that availability of a good labor supply was a primary factor for locating in the West Sector. In addition, there has been active promotion of industrial sites by railroad companies and land developers.

It is important to consider in more detail the factors that influence the movement of industrial plants to suburban sites. For purposes of urban and regional planning it is especially important that these factors be identified. In the literature on industrial suburbanization both the attractions of suburban locations and the

disadvantages of central city locations have been identified.

FREQUENTLY CITED REASONS

Raymond Vernon refers to both the inadequacy of facilities at central city locations and the advantages of suburban sites in his summary statement of the primary factors inducing industrial suburbanization. For the former he includes obsolescence of existing plants, the need to convert to more laterally expansive plant layouts and the consequent need for large vacant sites, and the difficulty or high cost of enlarging old sites through the purchase and clearance of adjacent occupied land. Less expensive and more abundant vacant sites and the growing availability of rental space for the use of small plants are included as the primary advantages of suburban areas.[21]

Obsolescence is reached when expanding firms in the older city locations come up against a ceiling, beyond which they can continue to grow only with difficulty. This ceiling on industrial expansion in the older areas is made up of a number of different elements. The most important one is the inadequacy of existing factory units, particularly in terms of available space for production, storage, and administration. Modern industry, which tends to operate more efficiently in one-story structures occupying large areas, has been attracted by the lower costs of land in the suburbs and the space available there for large factories.

Inadequacy of facilities can come about slowly as space utilization increases to facilitate expanding production and employment. It can come more suddenly with the development of new techniques and processes which require more or a different arrangement of space. At some level of inadequacy management is faced with three alternatives: (1) expand the facilities on the existing site; (2) purchase adjacent land if available and not too costly; or (3) relocate where less expensive vacant land is available, which in many cases is outside the central city. Other considerations favoring the decision to relocate include congestion, lack of parking space, restrictions such as zoning, older or blighted neighborhoods, and limitations on expansion because of the shape and size of city blocks.

A factor frequently cited as inducing industrial suburbanization is the increasing use of the motor truck. Pred relates industrial suburbanization primarily to changes in transportation and distribution technology.[22] Truck transportation has reduced the pull of rail and water terminals in the central cities.

Reeder and Reinemann viewed industrial suburbanization as an evolutionary process in Chicago, resulting from congestion as well as the need for more site space.[23] Congestion in industrial areas makes them less satisfactory locations for industrial firms which depend on regular

movement of materials and goods.

REASONS FOUND IN AREA QUESTIONNAIRE

Officials of 43 new and relocated firms responded to a questionnaire that included a question on the relevance of factors influencing the move to the present site. Fifteen location factors were listed and the plant officials were asked to indicate whether each was a primary factor, a secondary factor, or not a determining factor (Table 5). Of the 15 factors, availability of adequate land for expansion was by far the most significant. Eighty-five percent of the relocated firms and 65 percent of the new firms indicated this factor as of primary importance. For the relocated firms additional space for expansion was necessary and/or the factory arrangement needed to be reorganized. From field observations and comments from management, it is evident that the suburban zone's advantage of available space for an efficient factory arrangement is an important factor. In addition, facilities such as parking lots can be provided for the workers, and the surrounding part of the site can be used for storage.

The second most important location factor was the cost of land. Nearly all of the relocated firms and all of the new firms cited this factor as either of primary or secondary importance. The desired large vacant parcels of

TABLE 5 -- LOCATION FACTORS

	LOCATION FACTOR	DEGREE OF IMPORTANCE — RELOCATED FIRMS: Primary Importance	RELOCATED FIRMS: Secondary Importance	RELOCATED FIRMS: Not a Determining Factor	NEW FIRMS: Primary Importance	NEW FIRMS: Secondary Importance	NEW FIRMS: Not a Determining Factor
1	Availability of Adequate Land for Expansion	85%	11%	4%	65%	28%	7%
2	Cost of Land or Rent	46	38	16	42	58	0
3	Rail Access	31	27	42	36	28	36
4	Near to Freeway	32	23	45	36	19	45
5	Near to Expressway	24	28	48	17	50	33
6	Availability of Local Services (Sewer, etc.)	27	27	46	0	36	64
7	Personal Factors	15	45	40	30	20	50
8	Differences in Taxes Within 3 County Area	15	22	63	9	36	55
9	Proximity to Markets	16	8	76	26	37	37
10	Proximity to Other Mfg. or Services	12	17	71	0	50	50
11	Avail. of Energy or Fuel Sources	13	13	74	10	45	45
12	Avail. of Pure Water	13	13	74	0	30	70
13	Labor Supply	8	40	52	55	36	9
14	Prox. to Raw Materials or Processed Materials	8	25	67	19	45	36
15	Promotion of Industrial Sites by Railroads, etc.	8	15	77	9	27	64

land are apparently more plentiful in the suburban areas and are also less expensive. A recent comparison of land prices in industrial tracts in the Portland Metropolitan Area indicates a significant difference between those industrial tracts inside the central city and those in the suburban areas. The 1969 per acre price of industrial land in several industrial tracts inside the central city are: 1. Guilds Lake, $50,000-70,000; 2. Swan Island, $40,000; 3. Columbia Boulevard (Sites fronting on N. Columbia Blvd.), $40,000; and 4. Swift Boulevard, $24,000. The study shows that the per acre price of suburban industrial land for the same year is noticeably lower. Examples of land costs for suburban industrial tracts include: 1. Clackamas (Clackamas County), $10,000; 2. Omark (Clackamas County), $22,500; 3. Rockwood (Multnomah County), $20,000; 4. Beaverton (Washington County), $20,000-25,000; and 5. Tualatin - Tigard (Washington County), $7,000-8,000.[24]

Firms looking for a new site can be expected to place some importance on access to railroads and freeways. Table 5 indicates that new and relocated firms in Portland's suburban area placed about equal importance on rail and freeway access. Only about one-third of the new and of the relocated firms considered these of primary importance. However, good rail service is obtainable in the suburban zone and industries tend to develop along rail sidings.

One of the location factors most frequently cited by new firms as of primary importance was labor supply (Table 5). The rapidly expanding suburban centers such as Beaverton and Milwaukie have become important sources of labor. The highly skilled personnel and the specialized technicians seem to gravitate to these suburbs. Several officials of new electronic firms made special note on the questionnaire regarding the importance of availability of skilled labor in the suburban zone.

It is interesting to note that only eight percent of the relocated firms cited labor supply as of primary importance. Apparently, the relocated firms retain most of their employees and thus, labor is not a critical factor in relocation.

In the industrial suburbanization process in the Portland Metropolitan Area, the market influence is largely absent or very weak. However, Table 5 indicates that this factor was more important to new firms than to relocated firms. Part of the reason is that some of the new firms in the suburban zone were established in an attempt to fulfill the needs of a growing local market. For example, there has been an increase in the number of industries offering manufactural goods. In particular, there has been a rise in new firms specializing in electrical equipment and modern machinery for the forest products industry. Other

new firms providing products and services to industrialists include: industrial chemicals, custom-made machine parts, and packaging materials.

In addition, the growing local market encouraged firms established elsewhere in the United States to set up branch plants in Portland's suburban zone. In similarity to the above-mentioned types of new industries, many of the new branch plants manufacture electrical equipment and machinery for the lumber and plywood industry.

Other traditional location factors, including availability of energy and proximity to raw materials, are of primary importance to less than twenty percent of the firms responding to the mail questionnaire. In addition, it appears that intra-area variations in local taxes were not an important consideration for plants locating in the suburban zone.

It is of interest to compare the differences in importance of the previously mentioned location factors between the Portland Metropolitan Area and larger metropolitan aress. It was pointed out that the cost of land was an important location factor in the Portland Metropolitan Area. However, a review of studies of industrial suburbanization in larger metropolitan areas indicates that in these areas land costs are even a more important consideration. In larger metropolitan areas land costs and the magnitude of

city-suburb cost differentials are much greater. Higher cost differentials have probably caused suburbanization to occur more rapidly in larger metropolitan areas.

The availability of adequate land for expansion is one of the most important location factors in most metropolitan areas. However, because of the greater distance of vacant suburban sites from the central city in larger metropolitan areas, industrial plants are sometimes less tempted to relocate than plants in smaller metropolitan areas. Unlike the situation in many larger metropolitan areas, the less distant suburban sites in smaller metropolitan areas, such as Portland, allows a plant to relocate from a central city location and still enjoy the advantages of being close to the central city.

The local market in the large metropolitan area, because it is larger and because time-space frictions are greater, is an important factor. According to Stuart the local market in the large metropolitan area has a centralizing influence while such an influence in smaller areas is much weaker.[25]

Labor supply is another location factor that is apparently a less important consideration in smaller metropolitan areas because of a higher degree of labor mobility. The manufacturer who wishes to relocate within the Portland Metropolitan Area and keep his labor force can

do so with more location freedom than the manufacturer in the larger metropolitan area. Because of the apparent higher degree of labor mobility in the Portland SMSA manufacturers seem to place minor importance on labor supply when relocating to the suburban zone.

VI. CONCLUSION

Industrial suburbanization is an important factor in the restructuring of land use patterns. The outward growth of industry has important implications relating to urban form and economics. The establishment of new plants in a suburban area may stimulate the development of other land uses. Residences, commercial and service establishments, and other industrial firms may be constructed, thus resulting possibly in a shift from agricultural to non-agricultural uses of an area. Also, new industrial areas in the suburban zone may mean a large increase in the general fund of a city or county. However, for the central city industrial suburbanization can be detrimental because of a reduction in job sources and loss of tax-base.

For the City of Portland, industrial suburbanization has not, as yet, been significantly detrimental because there has not been a mass exodus of industry out of the central city. However, this study does present substantial evidence that there is a significant trend toward industrial

suburbanization in Portland's suburban zone. The census data indicate a larger increase of manufacturing employment and number of establishments in the suburban zone than in the central city. A local survey of trends in industrial location reveals that the suburban zone gained 121 establishments and 13,200 manufacturing employees during the fifteen-year period covered by this study. This paper has indicated that the industrial pattern of the Portland S.M.S.A. underwent important changes during the study period as a result of: (1) the establishments that entered the suburban area as new plants, and (2) the relocation of resident plants. One of the most significant changes was the development of important industrial areas in the suburban zone, primarily to the south and west of the central city.

It can be expected that there will be a continuing process of industrial suburbanization in the Portland Metropolitan Area for certain types of firms. These include machinery manufacturers, electronics firms, fabricated metals producers, and transportation equipment manufacturers. For these manufacturers the need for more land has been a critical factor affecting industrial location.

Another characteristic of these firms is their relative footlooseness. Footloose industries have considerable choice in the selection of sites. Proximity to markets and resources are less decisive location factors for

footloose industries. Generally this means both inputs and outputs are of high value relative to weight, and transfer costs constitute a relatively small share of total costs.

Likewise, there are types of establishments which will likely remain in the central city. Some firms which require dock facilities can be expected to remain in the central city where these fscilities are developed. Those firms which service a metropolitan area and as a result must locate within the city to avoid moving their products long distances would be expected to remain in the central city, also. Firms such as bottlers, bakeries and machine shops are examples of the latter type of firm.

Therefore, although there is evidence of a recent and significant trend of industrial suburbanization in the Portland Metropolitan Area, there is not a mass exodus of industry out of the central city. Manufacturing in the Portland S.M.S.A. remains concentrated in the City of Portland despite the significant number of new and resident plants that have recently located in the suburban area. However, it can be expected that there will be a continued trend of industrial suburbanization involving those types of firms not closely tied with a central city location which are primarily seeking additional space for expansion.

FOOTNOTES

1. Some of the more significant contributions are by James Kenyon, "Manufacturing and Sprawl," in Jean Gottman and Robert A. Harper (Eds.), Metropolis on the Move (New York: John Wiley, 1967), pp. 102-121; Evelyn Kitagawa and Donald J. Bogue, Suburbanization of Manufacturing Activity Within Standard Metropolitan Areas (Oxford, Ohio: Miami University, Scripps Foundation for Research in Population Problems, 1955); Raymond Vernon, The Changing Economic Function of the Central City (New York: Committee for Economic Development, 1959); and Wilbur Zelinsky, "Has American Industry Been Decentralizing? The Evidence for the 1939-54 Period," Economic Geography, Vol. 38 (1962), pp. 251-69.

2. Zelinsky, op. cit., p. 256.

3. Daniel B. Creamer, Is Industry Decentralizing? (Philadelphia: University of Pennsylvania Press, 1935).

   Coleman Woodbury and Frank Cliff, "Industrial Location and Urban Redevelopment," in Coleman Woodbury (Ed.), The Future of Cities and Urban Development (Chicago: The University of Chicago Press, 1953), pp. 205-88.

   Other contributions on the topic of changing industrial patterns during the 1930's, 1940's and 1950's were made by Victor R. Fuchs, "Changes in the Location of U.S. Manufacturing Since 1929," Journal of Regional Science, Vol. 1 (1959), pp. 1-17; and Harvey S. Perloff, et al. Regions, Resources, and Economic Growth (Lincoln Nebraska: University of Nebraska, 1960).

4. Evelyn Kitagawa and Donald J. Bogue, op. cit.

5. Zelinsky, op. cit.

6. Evelyn Kitagawa and Donald J. Bogue, op. cit., p. 120.

7. The following references exemplify these studies: Edgar M. Hoover and Raymond Vernon, Anatomy of a Metropolis (New York: Doubleday and Co., 1962); Chicago, Illinois, Department of City Planning, Research Division, Industrial Movements and Expansion 1947-1957, City of Chicago and Chicago Metropolitan Area (Chicago, Illinois, 1961); University of Pennsylvania, Institute for Urban Studies, Industrial Land and Facilities for Philadelphia (Philadelphia, Pennsylvania, 1956).

8. Leo G. Reeder, "The Central Areas of Chicago - A Re-examination of the Process of Decentralization," Land Economics, Vol. 28 (1952), pp. 369-73.

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   Martin W. Reinemann, "The Pattern and Distribution of Manufacturing in the Chicago Area," Economic Geography, Vol. 36 (1960), pp. 139-44.

9. Alfred W. Stuart, "The Suburbanization of Manufacturing in Small Metropolitan Areas: A Case Study of Roanoke, Virginia," The Southeastern Geographer, Vol.8 (1968), pp. 23-38.

10. Metropolitan Planning Commission, Land for Industry (Portland, Oregon, July, 1960).

11. Portland State University, Center for Population Research and Census, Population Estimates of Counties and Incorporated Cities of Oregon (Portland, Oregon, July 1, 1968).

12. Center for Population Research and Census, op. cit.

13. Center for Population Research and Census, op. cit.

14. Clark County, Washington was not included in the study.

15. Portland Chamber of Commerce, Industries Department, Portland-Metro (SMSA), Manufacturing Industries Employing 50 or More Persons (Portland, Oregon, 1969).

    Portland Chamber of Commerce, Industries Department, "Major Developments, Industrial and Commercial in Portland-Metro Area" (Quarterly Reports).

    State of Oregon, Department of Commerce, Economic Development Division, Directory of Oregon Manufacturers (1968, 1966, 1961, 1959, and 1956).

16. Oregon State University, Cooperative Extension Service, Resource Development Section, Resource Analysis, Washington County (Corvallis, Oregon, 1964), p. 49.

17. Data for number of employees was available for 1965 in U.S. Bureau of the Census, Annual Survey of Manufactures, Vol. 1, p. 390.

18. Walter Isard, Methods of Regional Analysis (Cambridge: The M.I.T. Press, 1960), p. 259.

19. Metropolitan Planning Commission, op. cit., pp. H-7 and H-8.

20. Number of employees in 1969.

21. Vernon, op. cit., pp. 53-59.

22. Allan R. Pred, "The Intrametropolitan Location of American Manufacturing," Annals, Association of American Geographers, Vol. 54 (1964), pp. 113-127.

23. Reeder, op. cit.

    Reinemann, op. cit.

24. The Port of Portland, et al. Swan Island Industrial Park, Access - 1969 (Portland: Technical Services Department, The Port of Portland, 1970), pp. 18-19.

25. Stuart, op. cit., p. 32.