THE SPATIAL PATTERN OF URBAN RESIDENTIAL BLIGHT

THE SPATIAL PATTERN OF URBAN RESIDENTIAL BLIGHT

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SCOPE AND CONTENTS:

This thesis seeks to describe and explain the spatial pattern of urban residential blight. The empirical analysis is limited to one study area; that of the Chicago metropolitan area. The data are U.S. Census data for census tracts in 1940, 1950, and 1960. Following a review of pertinent literature, an attempt is made to conceptualise the process that generates residential blight. From this conceptual framework, a number of hypotheses are developed concerning the relationship between residential blight and selected socio-economic variables. Other relationships are derived from an interpretation of maps of residential blight in the Chicago area for the different time periods. The hypotheses are tested using such multivariate procedures as principal components analysis, and regression and correlation analysis. The thesis also contains an application of the Blalock-Simon procedure for causal modelling to the Chicago data. The findings of the empirical analysis are related to present knowledge concerning urban residential blight.

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No one can complete a thesis such as this without the assistance of many people. The work was begun under the guidance of Dr. Gerard Rushton, and he has always made himself available to me since that time. For his patient understanding, his insight, his constructive criticisms, and his stimulating friendship, I will always be grateful.

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CHAPTER I

INTRODUCTION

It is the purpose of this study to attempt to describe and explain the spatial pattern of residential blight in urban areas.[1] Residential blight serves as a convenient expression for poor quality of housing. This is a limiting expression, however, since residential blight is often defined in terms of the physical attributes of the structure; for example, the condition of the structure, and the lack of facilities. Yet, the nature and importance of poor housing quality go beyond the specific physical characteristics of residential blight. While physical disrepair may be a threat to the safety of the residents, it seems intuitively reasonable that poor quality of housing might adversely affect the occupants in a number of ways.[2] Despite this, there has been little or no attempt to include a social component in the previous definitions. Rather, "slum" has been

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[1]The word pattern is used in this study in the sense of the arrangement of a phenomenon across an area.

[2]In reality, it has proven extremely difficult to identify and measure the relationships between housing quality and such things as the social and mental well-being of the inhabitants. The literature in this area is commented on in Chapter 3. Nonetheless, poor housing quality has been identified as a social problem, and all levels of government have increasingly sought to deal with this problem as a matter of policy.

used as the appropriate term in both analysis and prescriptive statements.[3]

The approach adopted in this study is to treat residential blight in its familiar context of physical characteristics. The social aspects of residential blight and the concept of a "slum" are only briefly considered.[4] An analysis of residential blight which adopts this approach thus avoids the difficult definitional problems associated with the use of the "slum" concept. Problems of data availability and collection are also much less severe.

The pattern examined in this work is one which varies across space and through time, in any given urban area. The spatial arrangement of residential blight may be considered as a surface extending throughout the urban area; such a con-

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[3]Examples of authors who make a distinction between blight and slums are:

(a) H. GANS, The Urban Villagers, (New York, The Free Press, 1962), and

(b) L. C. GERCKENS, "Urban Blight and Slums: Concepts, Causes and Patterns of Development," (unpublished master's thesis, Department of City and Regional Planning, Cornell University, 1958).

[4]The writer follows Gans, Ibid., in treating the "slum" as a concept. In fact, an analogy might be drawn between the "slum" and the region. Certain groups had come to believe in the existence of regions much as some people believe in the existence of "slums." Just as the mythology of regional geography developed, so did there develop a mythology around the slum -- the concept became reified and an image of the "slum" became reality. The myth concerning regions has been exposed and the region is now clearly seen as a mental construct; it is to be hoped that a similar process will occur with the concept of a "slum."

ceptualisation has already proven fruitful in spatial analysis.[5] To use Warntz's terminology, the surface has peaks, pits, plains and flats (in the sense that there is no residential blight in the case of the flats).[6] The overall surface is generated by the interaction of a number of factors. Data are often reported by areal unit (giving a two dimensional space). The occurrence of some amount of residential blight within a given areal unit realises a third dimension of space. A continuous smoothing of the amounts over the areal units yields the surface.

This study specifically describes the spatial and temporal variations in this surface across the urban space of the Chicago metropolitan area from 1950 to 1960, using small area data from the U.S. Censuses of Population and Housing. The reasons for the choice of data are given in Chapter 2. This choice does create certain constraints for the subsequent analysis; notably, in the definition of residential blight, and in the statement of hypotheses. The form of the hypotheses is a direct function of the variables contained in the data set. Description being a form of explanation, this description assists in the attempted explanation of the spatial pattern.

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[5] P. HAGGETT, Locational Analysis in Human Geography, (London, Edward Arnold Ltd., 1965), Chapter 6.

[6] W. WARNTZ, "A New Map of the Surface of Population Potentials for the United States, 1960," Geographical Review, vol. 54, no. 2 (April, 1964), pp. 170-184. Given the general image of blighted areas, perhaps the surface should be referred to as "the badlands."

The explanation of this arrangement is sought through the identification of some causal mechanism which generates the pattern. This is a traditional aim for geography but, as Harvey comments, the use of deductive procedures to achieve such an aim has proven "extraordinarily difficult."[7]

Thus, a process is suggested which, it is argued, generates varying amounts of residential blight across the urban space. This process is conceptualised on the basis of a synthesis of previous research and "a priori" reasoning. It essentially reflects the interaction of human decisions which are thought of as being a response (and adjustment) to a perceived urban environment. This interaction determines the amount of residential blight in any given area; it also produces change through time. The utility of the suggested process is examined by stating hypotheses which are reflections of elements of the process. These hypotheses are tested by multivariate procedures.

While the study is geographical in intent, it also finds a place in what has come to be described as quantitative ecology.[8] As such, it can be classified according to the research strategy

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[7]D. HARVEY, "Pattern, Process and the Scale Problem in Geographic Research," Transactions of the Institute of British Geographers, no. 45 (September, 1968), p. 71.

[8]M. DOGAN and S. ROKKAN (eds.), Quantitative Ecological Analysis in the Social Sciences, (Cambridge, Mass., The M.I.T. Press, 1969), pp. 3-6.

employed. Some of the difficulties associated with quantitative ecological analysis and the search for causal explanations are considered in the following chapter.

There is little point in dwelling overly long on the neglect of geographers of residential aspects of urban areas; this is the case, however.[9] In contrast, there have been numerouse studies on housing in general, and on various specific features, in such fields as economics, sociology, social psychology, planning, real estate analysis and regional science. Allowing for the aspatial nature of much of this research, one still recognizes the relevance of theories of consumption and investment, of ideas concerning urban renewal and redevelopment, of concepts such as land value and property value, of studies on the perception of the urban environment, and perhaps most important, theories of decision-making. It is emphasized here that the spatial pattern of residential blight is the product of some mechanism or a process. This consists of the aggregate of individual decisions made with respect to the consumption of housing of a certain level of quality, location of residence, investment, construction and maintenance of the housing stock, the location of renewal activities and the like.

Residential blight is also part of what has become known

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[9]This point has been forcefully made elsewhere. J. MERCER, "Some Aspects of the Spatial Pattern of Multiple Occupancy Residential Structures in Hamilton," (unpublished M.A. thesis, Department of Geography, McMaster University, 1967), Chapter 1.

More recently, however, there has been a welcome increase in research by geographers on residential structure in urban areas.

as urban spatial structure.[10] Thus, the theories of location of activities and urban growth are also relevant. The ideas and theories from these various fields of research provide the framework from which the conceptual base of this study is developed.

Residential blight, if not all forms of blight, is of considerable current interest to students of urban areas and urban problems. This study seeks to contribute to our understanding of this phenomenon by investigating the process which generates residential blight. It yields a precise description of the spatial pattern of this phenomenon in a major American metropolitan area, and thereby increases our knowledge of that city.

A further aim of the study is generality of application and conclusion (at least within an American context). The conceptual base and the suggested process are developed without reference to any one specific urban area. One consequence of this aim is the decision to use census data, which are universally available on a tract basis for a number of large U.S. cities. This decision has important implications, as will be seen subsequently.

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[10]The term urban spatial structure is frequently used in the geographic literature. However, like so many of our terms it lacks a precise meaning and is used loosely. A stimulating discussion of the term and its meaning is by Foley.
D. FOLEY, "An Approach to Metropolitan Spatial Structure", M. WEBBER (ed.), in Explorations into Urban Structure, (Philadelphia, University of Pennsylvania Press, 1964), pp. 21-55.

The study begins with a statement of the research "strategy" used. There follows in Chapter Three an overview of previous research, attempting to identify key variables in the generating process; previous research on some forms of blight is also reviewed. Chapter Four contains the conceptual basis for the study and the statement of hypotheses to be tested. The results of empirical analysis are reported in Chapters Five and Six. The final Chapter contains a review and integration of the conclusions and suggests future lines of research.

CHAPTER II

RESEARCH DESIGN

The approach to the research problem, the techniques used, the source and type of data, the study area and areal units are discussed in this chapter. Consideration is also given to some methodological problems of ecological analysis.

Data.

The research problem (as stated in the Introduction) is to describe and explain the spatial pattern of residential blight in urban areas. Although the problem is investigated only for the Chicago metropolitan area, one of the aims of the study is to obtain some generality of application and conclusion. Such generality is related to the availability and the nature of data, and to the research strategy employed.

In many countries, the national census is a major data source on the spatial aspects of urban housing quality (assuming small area data are available). Alternative sources might be municipal surveys of housing quality or a survey by research investigators. For this study, the U.S. Census is chosen as the major data source. Municipal surveys are rejected because of lack of national availability, variation in coverage and definition from place to place, and unknown degree of reliability.

Budget and time constraints precluded survey work by the investigator.

The Census provides data for a range of socio-economic and housing variables for small areas within the tracted Standard Metropolitan Statistical Areas (SMSA's). It is, thus, widely available. Also, some degree of comparability is maintained for different time periods and the errors and reliability of census data have been investigated.

The time periods for this analysis are a function of the major data source. 1940 represents the first time housing data were reported on a census tract basis, but the range of socio-economic variables reported is limited. Only housing data are used for 1940 and even these suffer from the fact that they are not directly comparable to the 1950 and 1960 data. The bulk of the analysis uses data for 1950 and 1960.[1]

There is good reason to be dissatisfied with a ten year time span. Although it would be preferable to treat time as a variable, thereby making the study dynamic, data are rarely available in a continuous time series. Since so little is known about the causal mechanisms which generate the patterns which

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[1]The specific data sources are:
U.S. Bureau of the Census, Population and Housing, Statistics for census tracts and community areas, Chicago, Illinois, 1940.
_____, U.S. Census of Population: 1950 Bulletin P-D10, Census Tract Statistics, Chicago, Illinois and adjacent area.
_____, U.S. Censuses of Population and Housing: 1960 Final Report PHC (1) -26, Census tracts, Chicago, Illinois, S.M.S.A.

are a focus of geographical research, it would be of considerable benefit to have data reported on a short time interval. Longer time lags could then be created by aggregation and spatial patterns and hypothesised generating mechanisms could be considered over a range of time intervals.[2]

Limitations of census data.

Census data, particularly on such a subjective item as housing quality, are described as unreliable and misleading.[3] Bureau of Census officials are themselves very much aware of the inherent weaknesses in their definitions and data collection procedures. Their work is continually under review with the aim of improving the definitions and reducing error to an acceptable level. Changing definitions, however, lead to problems of

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[2]It is obvious that there is a lag between the time that a decision is made and the time by which the effects of the decision can be observed. There is then a further time lag before a response is made and yet another lag before the effects of the response are observable. Without having detailed data, it is difficult to know how long these various lags are and how long it takes for the effects of decisions to be observed in the urban spatial structure.

[3]See, for example, the comments in B. WELLAR, "The Utilization of Multi-band Aerial Photography in Urban Housing Quality Studies," (unpublished report, Department of Geography, Northwestern University, 1968), and L. WEXLER, "Housing Census Inadequacies," Journal of Housing, no. 9 (1965), pp. 495-497. For a general discussion on the problem, see _____, "Measurement of Housing Quality and its Policy Implications," American Statistical Association Proceedings of the Social Statistics Section, Section 3 (1968), pp. 49-65.

comparability.[4]

A recent U.S. Census report is critical of national statistics on housing quality in 1960 as both "inaccurate" and "unreliable."[5] However, in any given city, the "random errors of measurement tend to cancel out on the tract level."[6] Thus, they conclude that tract to tract comparison of structural condition within a given city is possible and is valid. In general, this report concludes favorably on the accuracy and validity of tract data, whether they are for substandard housing (that is, housing ranked on a composite measure of structural condition and absence of plumbing facilities) or structural condition alone.

Thus, for an exploratory study such as this, the census remains the best available source for a range of housing and socio-economic data for small areal units in metropolitan areas. Clearly, however, there are severe measurement problems in gathering information on housing quality.

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[4]For example, in the present study the data on housing condition are not directly comparable between 1940 and 1950. Faced with the problem of measuring the structural condition of housing on a large scale, the concept "state of repairs" was used as an indication in 1940. Following considerable dissatisfaction, the concept "condition of structure" was used for the 1950 census and housing was classified as "dilapitated" and "not dilapidated." This concept was also used in 1960 although a three way classification was used -- "sound," "deteriorating," and "dilapidated." Taken together, however, "sound" and "deteriorating" are equivalent to the 1950 "not dilapidated." Thus, data for 1950 and 1960 are comparable but direct comparison with 1940 is not possible.

[5]U.S. Bureau of the Census, Measuring the Quality of Housing: An Appraisal of Census Statistics and Methods, (Working Paper no. 25, Washington, D.C., 1967), p. 5.

[6]Ibid.

Definition of the study area.

To define a study area for the Chicago metropolitan area, the urban area is treated as a functional unit. This functional unit is defined by the interactions between the components of what is regarded as a locally closed system. The commuting field of the central city is considered a reasonable approximation of this functional area. The relationship between this commuting field and the spatial limits of the local labor market strengthens the use of the former as an indicator of the urban area. The commuting field for Chicago has been delimited by Berry and Goheen.[7] The isopleth of 20% of the labor force commuting to the central city is taken as the outer limit of the study area (or as the definition of the urban area), thus excluding much of the rural periphery and the four larger urban centers of Aurora, Elgin, Joliet and Waukegan.[8] The 20% commuting contour is the heavy black dotted line in Fig. 1. This limit is modified to conform to the existing (1960) census tract boundaries. Using this approach gives the study area a functional

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[7] U.S. Bureau of the Census, Metropolitan Area Definition: A Reevaluation of Concept and Statistical Practice (Rev.), (Working Paper, no. 28, Washington, D.C., 1969).

[8] This was done at the suggestion of Philip Rees. Rees has recently completed a study of the factorial ecology of metropolitan Chicago and consequently felt that these areas were somewhat independent of the Chicago urban area.
P. REES, "The Factorial Ecology of Metropolitan Chicago, 1960," (unpublished M.A. dissertation, Department of Geography, University of Chicago, 1968).

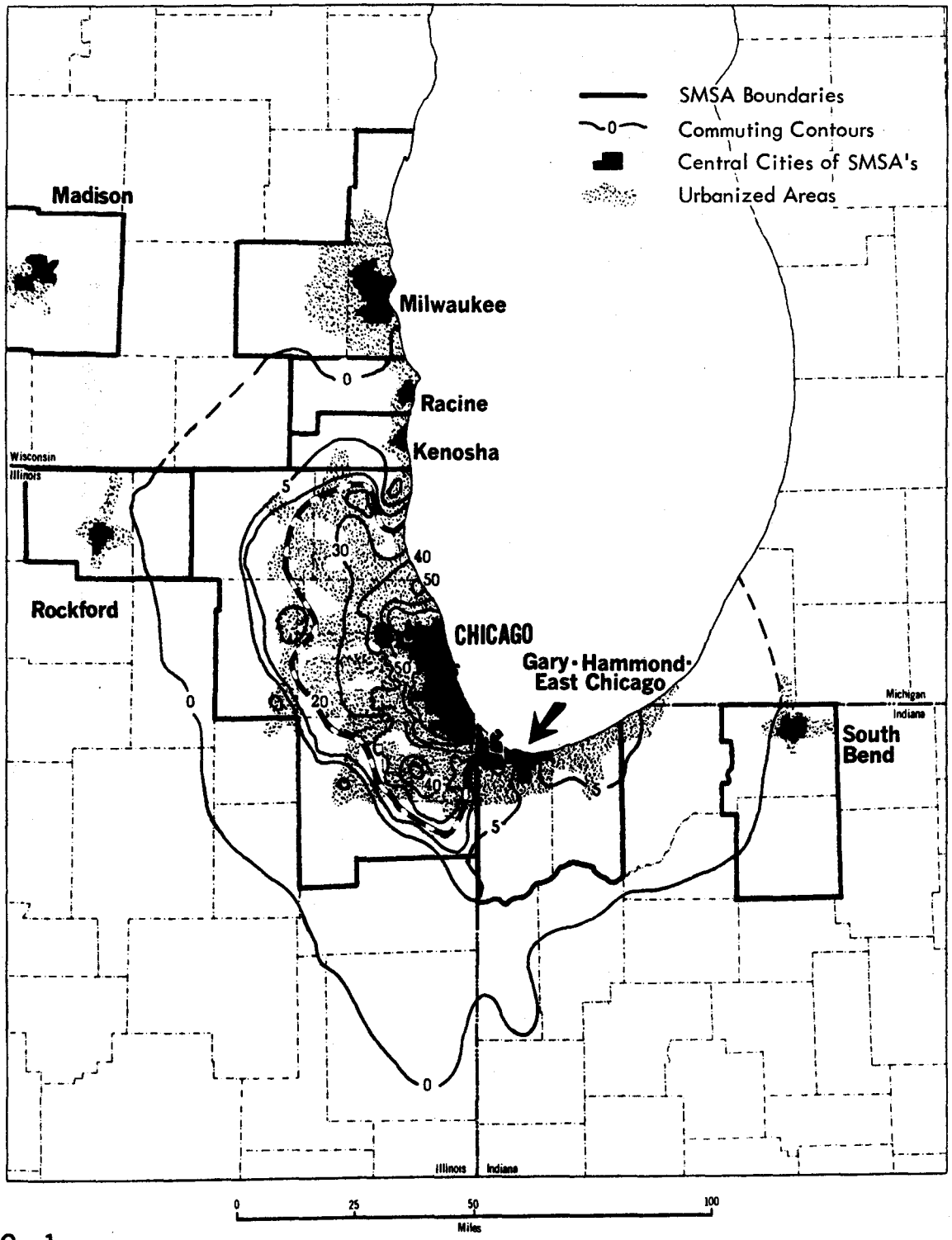

FIG. 1

CHICAGO'S COMMUTING FIELD AND URBANIZED AREA (AFTER REES)

coherence that it would not have if it was narrowly defined as the central city.[9]

Areal units for analysis.

The basic areal unit for analysis is the census tract. As noted, this unit is reliable for the variables measuring housing quality. Although it would have been possible to use the smaller enumeration districts, the data for these districts are less reliable.[10] For 1940, only the city of Chicago is tracted and there are 935 census tracts. Some suburban areas are included in the 1950 tracted area and there are approximately 1200 census tracts. With the expansion of the metropolitan area, there are approximately 1400 tracts in 1960.[11]

An important aspect of census tract data is the vari-

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[9]In his study of redevelopment in Toronto, for example, Bourne chooses to examine only the central city, largely on the grounds of data availability, although the consistency in municipal policies with respect to redevelopment is also important. It is evident that this is a limitation (as, of course, Bourne acknowledges), and it is one which must be faced if our analyses are to have meaning for the urban area as a whole. Murdie, working in the same area, uses Census data and is thus able to encompass the metropolitan area much as the present study does.
L.S. BOURNE, Private Redevelopment of the Central City, (Department of Geography, Research Paper No. 112, University of Chicago, 1967).
R. MURDIE, Factorial Ecology of Metropolitan Toronto, 1951-61, (Department of Geography, Research Paper No. 116, University of Chicago, 1969).

[10]U.S. Bureau of the Census, (Working Paper No. 25), p. 42.

[11]Any tract which had less than fifty dwelling units or fifty people is excluded from the analysis. By defining the 1960 study area in the manner described, some peripheral tracts are also excluded in both 1950 and 1960; however, some tracts which appear to be rural in character are included. The actual number of tracts used is as follows: 1940: 881, 1950: 1060, 1960: 1216.

ability or amount of homogeneity within the census tract.[12] Short of being aware of the problem, there is little else one can do once the decision to use census tracts has been made. Although this study is concerned with the condition of residential structures within the tracts, the census tract becomes the unit of analysis. The general methodological problem of using areal units of analysis is discussed at the close of this chapter.

Another problem of tract data is the comparability of tracts from one census to another after boundary changes. For the City of Chicago, comparability from 1950 to 1960 is treated in a special report.[13] This, however, proved to be of limited value -- see Appendix 5.

Since geographers and other social scientists often work with areal units of analysis, there is a common concern for

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[12]There has only been limited study of this problem. For a review and empirical analysis of variability within census tracts in New Haven, see J.H. MABRY, "Census Tract Variation in Urban Research," American Sociological Review, vol. 23 (1958), pp. 193-196. A more general comment on the use of census tracts is to be found in D.L. FOLEY, "Census Tracts and Urban Research," Journal of American Statistical Association, vol. 48 (1953). The original intent in the definition of census tracts was to create a small unit which included an area fairly homogeneous in population characteristics. Consideration was also given to creating tracts with approximate uniformity in size but with due regard for natural features. Changes in tract boundaries are largely due to annexation, large changes in population and attempts to create more homogeneous units.

[13]A.F. TAUEBER (ed.), Comparability of Census Tracts, 1950-1960 Censuses of Population and Housing: Chicago, (Chicago, University of Chicago, Chicago Community Inventory, 1963).

possible changes in results as these areal units are changed. Blalock succinctly deals with this problem.[14] He notes that as the researcher alters the units of analysis, he may affect the degree to which other variables influence the relationship between two selected variables. In developing this point, Blalock draws upon Kish's typology of independent variables.[15] There are (1) the independent variables in which the researcher is particularly interested; these are usually designated X_1, X_2, X_3 and so on; (2) other independent variables which the researcher recognises as being related to the dependent variable, (Y) but, in a given analysis, these are considered as "disturbing influences" to be controlled; (3) unknown variables that are causally related to the dependent variable but are not related to the independent variables in group (1); (4) unknown variables that are related to both the type (1) independent variables and the dependent variables so that they confuse the relationship being studied. In his argument, Blalock assumes that the type (4) variables are controlled. He then demonstrates that by controlling for the variables other than X that are related to Y, the correlation co-efficient between X and Y should increase, and the regression coefficient, b_{yx}, should not change except

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[14] H.M. BLALOCK, Causal Inferences in Nonexperimental Research, (Chapel Hill, University of North Carolina Press, 1964), pp. 97-113.

[15] L. KISH, "Some Statistical Problems in Research Design," American Sociological Review, vol. 24 (1959), pp. 328-380.

for sampling errors.

There are many ways to change areal units. Most commonly, grouping procedures using various criteria are employed, thereby reducing the number of units or cases and making them larger in area. Means for the new units are used as scores.

Blalock examines four possible methods of grouping, (there are other alternatives). These are grouping units (1) randomly, (2) so as to maximise the variation in x, (3) so as to maximise the variation in y, and (4) on the basis of proximity. The fourth method is commonly employed in research designs. Under each of these grouping procedures, Blalock develops a set of expectations with regard to the behavior of the correlation coefficient between x and y -- r_{xy}, the regression coefficient -- b_{yx}, and the regression coefficient -- b_{xy}. The coefficient b_{xy} is the measure of slope when x is treated as the dependent variable and y as the independent.

The actual behavior of these coefficients is observed under the four different grouping procedures, and for larger and larger groups (or fewer and fewer observations). In general, the behavior is as expected. The correlation coefficient consistently increases as the areal units become larger, except in the case of random grouping, where, as expected, there is no change. The regression coefficient, b_{yx}, is relatively constant, except where the grouping procedure maximises the variation in y. In this case, the relationship between x and y is being disturbed by the other variables which are causally linked to y.

Blalock emphasises that in the case of proximity grouping, this procedure may approximate either a grouping by independent or dependent variables. This can only be determined empirically. Also, a random effect is at work as the size of the areal unit increases.

If the census tracts in the study area were to be grouped into larger community areas, (a proximity grouping), the expectation is that higher correlation coefficients between variables would be obtained. The behavior of the regression coefficient is dependent upon whether or not this grouping maximises variation in the dependent or independent variable (i.e. it is a function of the spatial autocorrelation in each variable). This requires the assumption, however, that variables related to X are controlled, that the models are linear, and that there are no interaction effects.

Since the purpose of this study is not to investigate the behavior of correlation coefficients and regression coefficients under changes in areal units, no analysis is carried out on higher levels of scale. By replicating Blalock's procedures the behavior of these coefficients can be reasonably assessed. This would have redirected the purpose of the study, however.

Research procedure.

The research problem has been stated, the data source and limitations discussed, and the study area defined. To attack this problem, the strategy is as follows. The first step is a review of literature in a number of fields. The purpose

of this review is to examine previous research on housing and blight so that, firstly, some understanding of the nature of residential blight may be obtained, and secondly, some of the factors that others believe are related to housing conditions may be identified. A process is also delineated, based on the premise that housing condition is a consequence of decisions made by a number of individuals. A set of researchable hypotheses is then drawn from this statement on process. These hypotheses describe the relationship of residential blight to a number of variables. A major operational constraint here is that the hypotheses must be developed within the context of the data source. Ideally, some hypotheses concerning the nature of the process could have been stated and data collected for the test of these hypotheses. Preliminary consideration of this type of hypothesis indicated that the type of data needed on the behavior of individual owner-occupiers, tenants and landlords could only be collected by detailed field work by the investigator, possibly in a small blighted area within one city. In view of this and the anticipated difficulties, the more general approach through the census data source is adopted.

In the course of this analysis, problems of operational definition and the limitations of the statistical techniques used are discussed. The first part of the empirical analysis is the mapping and description of the spatial pattern of residential blight for 1940, 1950 and 1960. Since residential blight is thought of as a surface in this study, it is appro-

priate to also use trend surface analysis to describe that surface at different time periods.

The hypotheses developed are tested by using a regression model. The regression model attempts to explain the tract to tract variation in residential blight in 1950 and 1960 in terms of a set of independent variables. These independent variables are drawn from the Censuses and are conceptually linked to the process which, it is argued, generates residential blight. The contribution of each independent variable to the explanation is observed using stepwise multiple regression. Partial correlation coefficients and beta weights are used to measure the strength and form of the relationship between an independent variable and the dependent variable. The regression residuals are also investigated. This could permit the identification of 'deviant' areas and may also suggest the development of new hypotheses.

A principal components analysis is undertaken prior to the regression analysis. This is used to decompose a set of possibly inter-related variables into a smaller number of independent dimensions or factors. These factors are then used as inputs into a regression model. The principal components analysis also reveals the nature of inter-relationships among the dependent, and among the independent variables.

The use of data for 1950 and 1960 allows some treatment of change through that period. A regression model with the

change in amount of residential blight from 1950 to 1960 as the dependent variable is used. The procedure is similar to that for the 1950 and 1960 analysis. The initial working hypothesis here is that change in the variables used in the regression analyses for 1950 and 1960 can explain the spatial variation in the change in amount of residential blight from 1950 to 1960.

There is a simple reason for using a regression approach to the research problem. So little is known about the generating process underlying the spatial pattern of residential blight that to develop a sophisticated mathematical model, such as a set of simultaneous equations, would be foolhardy. The use of a linear regression model allows preliminary examination of the hypotheses in what is an exploratory investigation.

Cross-level inference and ecological research.

Given the choice of data and the approach to the research problem as already outlined, a basic methodological difficulty is quickly encountered. The empirical analysis designed to test the hypotheses uses data for census tracts for both the dependent and independent variables. On the other hand, the process which, it is suggested, generates residential blight is conceptualised at the level of the individual decision-makers. Does the analysis at one level then permit statements to be made about process at another level?

This difficulty was initially discussed in terms of

"the fallacy of ecological correlation."[16] The researcher has been cautioned against making inferences about relationships between individuals on the basis of relationships between aggregates, as established by correlation analysis. More recently, it has been demonstrated that there are other ecological fallacies, e.g., the "contextual fallacy" where the individual relationship is erroneously assumed equal to all areas.[17] Although this sounds discouraging, to the extent that inferences across different levels of analysis are thus rarely made, it does not mean that ecological research cannot advance.

It should be noted that, in many cases, the areal units used in analysis are collectives, having properties which are sums or measures of individual attributes; the cross-level nature of the data should, therefore, be clearly recognized. Some students of ecological methodology are willing to assume that the ecological relationship is a reflection of an individual-level relationship but the necessary assumptions appear to be limiting.[18] In other situations, the researcher might

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[16]The classic statement is by Robinson.
W.S. ROBINSON, "Ecological Correlations and The Behavior of Individuals," American Sociological Review, vol. 15 (1950), pp. 351-357.

[17]H.R. ALKER, JR., "A Typology of Ecological Fallacies," in M. DOGAN and S. ROKKAN (eds.), Quantitative Ecological Analysis in the Social Sciences, (Cambridge, Mass., M.I.T. Press, 1969), pp. 69-86.

[18]See the comments in
T. VALKONEN, "Individual and Structural Effects in Ecological Research," in M. DOGAN and S. ROKKAN, op. cit., p. 67.

attempt to identify structural effects, i.e., where properties of areas affect the behavior and properties of individuals. Others suggest that the ecologist should be willing to speculate or make causal interpretations, as distinct from causal inferences. In the latter case, a variable is seen as being causally connected to another variable, if a change in the first variable precedes a change in the second one. It must be admitted that the change may be brought about through a set of intervening variables which must be explicitly included in the causal system. Thus, $X \rightarrow U \rightarrow W \rightarrow Z$, where U and W are intervening variables and $X \rightarrow U$ expresses a direct causal relationship between X and U. Blalock, however, would argue that it is possible to make causal inferences concerning the nature of causal models which are consistent with observed data, such as correlational data.[19] Here again, however, some restrictive assumptions are necessary.

Using correlation data obtained from the empirical analysis, some alternate causal models are examined concerning poor housing quality and certain selected variables. To deal with cross-level inferences would require what Dogan and Rokkan call a "micro-macro" research design, where the dependent variables are characteristics of the aggregate level and the

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[19] H. BLALOCK, op. cit., p. 62.

independent (or explanatory) variables are sought at both the aggregate level and at the level of individual decisions.[20] There seems to be general agreement on the fruitfulness of such a design. The design of this study, however, does not include data on individual decisions and the problem remains to account for the tract to tract variation in residential blight in the Chicago metropolitan area.

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[20] M. DOGAN and S. ROKKAN, "Introduction," in M. DOGAN and S. ROKKAN, op. cit., p. 8.
To illustrate this approach, they cite the case of an in-migrant seeking housing in an urban housing market, where the existing alternatives, created by a variety of past decisions, will be modified by current decisions.

CHAPTER III

REVIEW OF LITERATURE*

This chapter is a review of some previous research on housing and related topics in various fields such as geography, sociology, land economics, and planning. This review allows the identification of elements to be used in developing a conceptual basis for the generating mechanism; literature on residential and other types of blight is also considered.

An immediate problem is that much of the previous research has been concerned with the "slum," rather than with residential blight per se. Since housing quality is a component of the notion of a "slum," however, some of this literature is relevant.

Early conceptual framework.

A detailed documentation of "slum" areas and their conditions was provided by such reformers and crusading journalists as Booth, Rowntree and Riis.[1] The "slum" was recognized as being

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*This review does not include literature published after Spring, 1969.

[1]C. BOOTH, Life and Labour of the People of London, (London, McMillan and CO., 1892-1904);
B.S. ROWNTREE, Poverty: A Study of Town Life, (London, McMillan and Co.), 1901; and
J.A. RIIS, How the Other Half Lives: Studies Among the Tenements of New York, (New York, Sagamore Press, 1957). For an interesting contribution, see the famous Dickens' novel, "Oliver Twist" and the comment in T. BLOUNT, "Dickens: Slum Satire in Bleak House," Modern Language Review, vol. 60 (1965), pp. 340-351.

multi-faceted. It was simultaneously an area of poverty, an area of social disorganization and pathology, and an area of physical decay.[2] Following this framework, some researchers have maintained an interest in these various facets of the "slum" taken together. Others, with a more limited perspective, have concentrated on a particular facet. Thus, the findings of those who have concentrated on the "slum" as an area of physical decay are of most direct relevance for this study. The relevance of the findings of those concerned with other aspects is perhaps more indirect.[3]

Spatial description and explanation.

In general, research into residential blight by urban geographers and human ecologists has continued to employ the multi-faceted framework for analysis, but there has been additional consideration of the location of "slum" and blighted areas within the urban area. The classic early ecological statement is that of Burgess who developed the zonal model of urban structure, where the "slums" are found in the "zone of transition" which en-

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[2]Another facet that was identified, particularly in North America, was the "slum" as a port of entry and area of acculturation. This was a role also fulfilled by European "slum" areas which received rural in-migrants, but the impact was perhaps less than in the U.S. where the concentration of large numbers of ethnic immigrants was highly recognizable.

[3]As will be seen, however, some of the concepts employed by others, rather than their findings, are of direct relevance.

circles the downtown area.[4] Continuing research has identified "slum" areas as being low rent areas which are spatially associated with industrial areas, transportation links, the in-migration of non-white, low income groups, and poor physical site conditions.[5]

The explanations utilized by urban geographers in considering the location of "slum" areas have been derived from a synthesis of research on urban spatial structure. The factor of contiguity would seem to be important in this type of explanation--it is proximity to, or spatial association with, certain "blighting influences" that is regarded as the causative factor. Just exactly how the residential structures become blighted is

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[4] E.W. BURGESS, "The Growth of the City: An Introduction to a Research Project," in R. PARK, E.W. BURGESS, and R.D. McKENZIE, (eds.), The City, (Chicago, University of Chicago Press, 1925), pp. 47-62.

[5] Examples of the studies which have contributed to this research are:
B.J.L. BERRY and R.A. MURDIE, Socio-economic Correlates of Housing Condition, (Toronto, Metropolitan Toronto Planning Board: Urban Renewal Study, 1965);
L.L. POWNALL, "Low Value Housing in Two New Zealand Cities," Annals Assoc. Amer. Geog., vol. 50 (1960), pp. 439-460;
E. JONES, A Social Geography of Belfast, (London, Oxford University Press, 1960); and
B.T. ROBSON, "An Ecological Analysis of the Evolution of Residential Areas in Sunderland," Urban Studies, vol. 3 (1966), pp. 120-142.
Recently two geographers have examined the "transition zone" of Burgess -- D.W. GRIFFIN and R.E. PRESTON, "A Restatement of the Transition Zone Concept," Annals Assoc. Amer. Geog., vol. 56 (1966), pp. 339-350. This article, however, does not add significantly to our understanding of the processes operating in this area of the city. For other criticisms, see, L.S. BOURNE, "Comments on the Transition Zone Concept," Professional Geographer, vol. 20 (1968), pp. 313-316.

rarely spelt out in any rigorous fashion. The human ecologists, who had considerable impact on early urban geography studies, derived their explanations from ecological processes such as competition and succession between and among social groups. Assuming population growth, there is an expansion over time of the various zones into less intensively used adjacent zones; thus, the less intensive uses are displaced. This process becomes more evident toward the center of the city since there is greater demand for location at the traditional point of maximum accessibility. Therefore, central uses will most likely expand into residential areas in close proximity to the Central Business District. Consequently, it is argued, investment in these properties in the form of maintenance is delayed in the anticipation of sales to commercial users and the condition of the structures deteriorates. No evidence on this point is presented, however.

Areas of physical decay.

This facet of the "slum" has been primarily the concern of the urban planners. The marked physical perspective of the planners reflects their early training in architecture, civil engineering, and geography. Furthermore, the profession was developing at a time when the belief was current among social scientists and reformers that, if one improved the physical environment, then many of the socio-pathological problems that had been identified in that environment would disappear.

The "slum" was considered as an area of physical decay

and the notion of substandard housing came into existence in the literature, the prescriptive planning statements, and the relevant legislation. Such housing is measured by the absence of such amenities as heating, private toilets, piped hot water, and the poor condition of the structure. Since many data-collecting agencies served the planning activities, it is not surprising to find this approach reflected in the type of information collected by such agencies.[6]

The existence of these areas is often explained in terms of an urban growth process. The argument would approximate the following. The centrally located housing of an urban area is commonly the oldest housing and, thus, reflects the housing standards and styles of a bygone era. With changing tastes and styles, accentuated by new transport technologies, the upper and middle income groups have left the central city (central luxury apartment dwellers excepted) -- "the flight to the suburbs" -- and the demand for centrally located housing has declined. Consequently, the price of housing has fallen, bringing it within the range of the low income groups for purchase or renting. With falling prices, investment in property maintenance is reduced because of the low rates of return, and physical deterioration follows. The weakness of this argument

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[6]For example, the United States Census of Population and Housing reflects this physical perspective, since its measures of housing quality are of physical attributes, and social aspects are not considered. Consequently, the fact that only a certain class of data is easily available reinforces the continued existence of the perspective since these data will likely be utilized in studies of the phenomenon. This situation also applies to other data-collecting agencies.

is that it has under-estimated the in-migration of low income groups to large urban areas and the strength of their demands for low-rent housing. Thus, in many cases, maintainance behavior occurs in a 'tight' market. Again, empirical research to substantiate this argument is rare, particularly on the point of owners' maintenance decisions.[7]

The economic approach.

Useful insights are gained from the work of a small group of land economists and the urban economists. The smallness of the former group may reflect the complexity of housing market analyses. This derives from the fact that housing is not a simple good, such as apples or clothing, but has certain singular characteristics, notably its durability and immobility, which complicate the analysis. Further, the various types of homes -- single family dwelling units, duplexes, town houses, large villas or apartments -- are poor substitutes for one another and, therefore, there are numerous although not independent sub-markets. Since housing markets are also local in character rather than national, there is a lack of data, which has hindered research in this field.

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[7]One of the few researchers who has investigated maintenance expenditures (as part of the costs and revenues in housing markets) is Grebler. However, his findings are limited to New York City, a somewhat unique case in view of the long period of rent control since the Second World War.
L. GREBLER, Housing Market Behavior in a Declining Area (New York, Columbia University Press, 1952), and
_____, Experience in Urban Real Estate Investment, (New York, Columbia University Press, 1955).

Filtering process.

The filtering process has been utilized by land economists in housing analysis. This process assumes that, as the new residential construction on the urban periphery is occupied by upper and middle income groups, the housing previously occupied by these groups becomes available to lower income groups. By moving into such housing the lower income groups will improve the quality of their housing. There is evidence that this process does occur but one must also consider two important points.[8] Firstly, there is a likelihood that only a part of the lower income demand will be met in this way since, numerically, only a relatively small number of housing units will be vacated by the higher income groups. Secondly, the subsequent degree of maintenance and investment in property and services in both structures and neighbourhood must be examined. If the property is not maintained then the structures will deteriorate into a blighted conditon.

Maintenance behavior.

Those involved in housing market analyses and real estate studies have considered housing quality as a direct function of maintenance behavior. Another aspect discussed is the failure of the various market operations to remove such blighted residential structures from the housing stock. Although maintenance

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[8]For example, the Lawndale area in Chicago was occupied by largely Jewish middle income groups who moved to Skokie, a northern suburb, while their former housing was occupied by Negro families. This area is now considered as part of the West Side ghetto.

behavior is a critical factor, other factors are relevant. If, as has often been the case, the original structures are deficient in construction, then perhaps above average maintenance expenditures will be necessary to keep the property in "standard" condition. The problem of changing housing standards is a difficult one to handle analytically. As standards of living have increased through time, there have been changes in attitudes towards quality and acceptable standards. Consider, for example, toilets. It seems that external toilets were once acceptable to the majority. Later, acceptable toilets had to be inside the residential structure although sharing was "permissible," while, more recently, acceptable toilet facilities are inside the dwelling unit and private to the household. For the purposes of this study, with a ten year time span, such changes in attitudes will be assumed as being constant.

Previous discussions on maintenance behavior have been largely restricted to rental properties. It is apparently assumed that owner-occupiers have, by virtue of investing in a property, a direct interest in the maintenance of that property to preserve the value of the investment and so will prevent the property from becoming blighted. This assumption raises some further complicating problems about the control an owner-occupier can exert on his neighbours to ensure that they maintain their properties to an acceptable standard for the neighbourhood. Clearly, if adjoining properties are not maintained

this may lower the value of the maintained property in the eyes of prospective purchasers, thus diminishing the value of the investment in the maintained property. A reasonable assumption, however, would be that other owners have an equal concern for preserving their investments and so will maintain their properties. The owners will in all probability, act as a pressure group to prevent any activity seen as a threat (a blighting influence) from being located within or peripheral to the neighbourhood; such action will likely come through political and social acts.[9]

Social pressures will also be exerted on members of the local community to conform by "correct behavior" and by having a "responsible attitude" towards property values. This is a delicate area of social behavior about which relatively little is known. Over-exertion of such pressure may bring about a spiteful response such as selling to a black family in a white neighbourhood (this may also be done by a "liberal" family). This action can trigger a type of downward spiral in the price obtained for properties.[10]

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[9]See, for example, the cases described in S.J. MAKIELSKI, The Politics of Zoning, (New York, Columbia University Press, 1966), and S. WILLHELM, Urban Zoning and Land Use Theory, (New York, Free Press of Glencoe, 1962).

[10]This spiral has been noted in areas undergoing racial change when 'panic' conditions occur. The local market is overloaded with properties, often similar in type and this oversupply brings about a decline in sale prices. See the evidence in L. LAURENTI, Property Values and Race: Studies in Seven Cities (Berkeley, University of California Press, 1961), and D. McENTIRE, Residence and Race, (Final report to the Commission on Race and Housing, Berkeley, Univ. of California Press, 1960).

In the case of rental properties, the critical investment decisions are made by the landlords. Too often in the popular press the problems of the "slums" are laid at the door of the "slumlords." While it is clear that such speculative operators of renting properties do exist, recent evidence indicates that such a type is not numerically dominant among tenement landlords, although they do hold large numbers of properties.[11] The type of maintenance decision is likely to be a function of the type of landlord. This typology can range from the speculative operator seeking a quick return on his investment to the person who is financially incapable of maintaining a property for a number of reasons. Other relevant factors, which will affect these maintenance decisions, are the rent-paying abilities of the tenants and their behavior with respect to the upkeep of the property.

Properties so poorly maintained so as to be classed as blighted do persist in the housing stock. This situation will occur particularly if there is a demand for low rent housing. When one considers the inflows of rural migrants to the urban areas of United States and then further considers the impact of racially discriminant actions in the housing market, it is not surprising that a spatially concentrated demand for low rent housing has existed over the last twenty years. The high vacancy

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[11] G. STERNLIEB, The Tenement Landlord, (New Brunswick, N.J., Urban Studies Center, 1966), pp. 121-122.

rates that have recently been noted in blighted areas indicate, however, that this demand may not be exhausting the blighted residential stock. In such cases, it is likely that demolition costs preclude action by the owners who are content to await some public action on the part of the local authority, through the enforcement of housing code regulations or the implementation of urban renewal programs.

The impact of redevelopment.

In this context, one must consider the spatial pattern of demand for re-development or the re-use of areas occupied by blighted properties.[12] Action in severely blighted areas by private investors has been limited. Unless the sites can be re-developed to produce a financial return which covers demolition costs and loss of income, as well as competing with alternative investments, then there is no incentive for the owners of blighted properties to sell. Further, re-development is more likely to occur once the properties have depreciated to some extent; otherwise, this will involve higher costs for the developer. Given the existence of attractive alternative suburban locations for new residential and commercial construction and given the problems of private re-development in the blighted areas, it is not surprising to note the lack of activity.

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[12]This section draws on Chapters two and three of Bourne's study which provide an excellent review.
L.S. BOURNE, Private Redevelopment of the Central City, (Department of Geography, Research Paper No. 112, University of Chicago, 1967).

One exception to this has been residential re-development for luxury "high-rise" apartment developments. Such developments have very specific locational criteria, however, and such activity is also highly concentrated in a few favored areas within the larger central city.[13]

The public authorities have been more active in this type of inner city redevelopment through public housing construction, expressway construction and renewal activities. Operating largely with Federal funds, these local authorities secure and clear blighted property, the power of eminent domain being used when necessary. The site is then offered to private redevelopers or given over to other public agencies for subsequent re-use.

Other economic perspectives.

While the land economists emphasize investment behavior, Alonso's work provides a clear indication of the importance of income for decision-making by consumers.[14] The question of allocation of the household budget among commodities is discussed. It is obvious that this allocation reflects the preferences of the household but the amount allocated to satisfy

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[13] Ibid.
J. MERCER, Spatial Pattern of Multiple Occupancy Housing in Hamilton, (unpublished M.A. thesis, Department of Geography, McMaster University, 1967), Chapters II and VI.

[14] W. ALONSO, Location and Land Use: Toward a General Theory of Land Rent, (Cambridge, Mass., Harvard University Press, 1965).

these preferences may very well be constrained by available income. Alonso also explains the location of low income groups on highly priced land in proximity to the center of the city (holding growth of the city constant) but he unfortunately does not deal with the quality of housing obtained by this group.

This explanation is based on the low income group's propensity to consume smaller amounts of land, given their limited resources. Muth uses a similar argument, although the approach is through the more traditional demand and supply analysis of the economists.[15] He asserts that most arguments (such as the one summarized above to explain central areas of physical decay) are "defective" since they ignore the basic cause of poor housing quality -- the poverty or low income of the occupants. In Muth's opinion, most arguments have failed to explain three empirical facts. These are (1) that "slum" housing would seem to be expensive in relation to its quality, (2) that urban renewal projects often lose money, reflecting high acquisition costs for land and structures, and low resale receipts and (3) that housing quality has improved over the period 1950-1960.

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[15] R. MUTH, The Spatial Pattern of Residential Land Use in Urban Areas, (unpublished manuscript, Chicago, 1964). Since this part of the study was completed, Muth's work has been published.
R. MUTH, Cities and Housing: The Spatial Pattern of Urban Residential Land Use, (Chicago, University of Chicago Press, 1969).

The alternative argument offered by Muth notes that personal income (in real dollars) has been rising over this period and this would suggest increases in housing demand, leading to increased consumption of housing.[16] Although the quality of housing consumed by all groups has improved, the low income groups, other things being equal, consume poorer quality housing and less space per person (it is not clear whether Muth is referring to less floor space within the structure or to smaller lot sizes). The housing stock is then adapted to the economic circumstances of the low income households by conversions and deferral of repairs, thus leading to low rent housing which meets this group's demands.[17]

Review of the economic approach.

It is apparent from the fore-going that a whole range of decisions are made by a variety of actors in different contexts with respect to the location of housing and its quality. The decisions range from those made by households to own or rent, what to allocate for housing in terms of the available household budget and where to locate, to those made by landlords

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[16] A downward shift in consumers' preferences for housing is suggested by the lack of trend in per capita real value of the standing stock of housing and by the perceptible decline in the average real value per dwelling unit, since one would expect a discernible rise in the per capita use of housing capital with the recent rise in per capita real income.
L. WINNICK, "Housing: Has there been a Downward Shift in Consumer Preferences," Quarterly Journal of Economics, vol. 69 (1955), pp. 85-98.

[17] In spite of this adaptation, however, the empirical fact (1) as noted by Muth still obtains.

concerning rental and maintenance policies. Others are made by local authorities or private groups concerning the location of redevelopment activities or new residential construction.

Thus, the relevant theories for an understanding of residential blight would appear to be primarily economic -- investment theory and consumption theory. It can be argued that economic theories have traditionally lacked a systematic treatment of social variables.[18] A likely rebuttal to this would be that such variables are implicit in the development of preferences, which are then revealed in market behavior.

The sociological perspective.

The major contribution of sociological research for the student of residential blight is in the identification of a subculture which apparently has attitudes towards housing, employment, and education, for example, which differ from those of society as a whole.

This work, however, rarely deals with residential blight specifically. There has been much investigation of whether or not "slum" areas are organized or disorganized with respect to social behavior. From this line of research, a typology of

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[18] G. KATONA, Psychological Analysis of Economic Behavior, (New York, McGraw-Hill Book Co., Inc., 1951), preface, p. v.

"slum" areas has been developed.[19]

Gans' study of the West End in Boston merits some additional comment since it is he who argues most persuasively that the "slum" is a concept and that it is an evaluative one, rather than analytic. In providing an operational definition for a "slum," the two important criteria for Gans are physical condition and social image. In an area of housing of poor physical condition (variously defined), if the overt and visible behavior of the residents is considered undesirable by the majority of society, then that area, in all probability, will be regarded as a "slum." Gans argues that in the planning reports and the various statements of housing standards, there is a confusion of the culturally different with the anti-social and the pathological, and a reflection of middle class housing standards. These physical standards make no distinction between low rent and "slum" housing. A structure or an area may be defined as a "slum" Gans suggests, if it is proven harmful physically, socially, or emotionally to its residents. Low rent housing may be deficient and inconvenient but it is not necessarily harmful. This approach, however, raises other problems of definition and establishment of proof. Nonetheless, this

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[19] See for example,
W.F. WHYTE, "Social Organization in the Slums," American Sociological Review, vol. 8 (1943), pp. 34-39; and
J.R. SEELEY, "The Slum: Its Nature, Use and Users," Journal American Institute of Planners, vol. 25 (1959), pp. 7-14; and
H. GANS, The Urban Villagers, (New York, The Free Press, 1962).

socio-psychological perspective deserves emphasis since so little is known about these relationships.

Forms of blight.

Although the term blight is a familiar one, there has only been limited systematic analysis of the various types of blight. Among the kinds of blight that have been examined are commerical blight, industrial blight, recreational blight, botanical blight, and a range of diseases that, essentially, blight the human organism.[20]

Residential blight is one of these classes of blight. It has been argued that blight in general is synonymous with dysfunctionalism,[21] which in turn implies that some system is in a state of dis-equilibrium. In the case of residential blight this would be the housing market. The available evidence, however, indicates that residential blight has long existed in urban areas.

If in fact this type of blight is the product of some form of dis-equilibrating system, then the implication is that

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[20]Examples of this research are:
B.J.L. BERRY, Commercial Structure and Commercial Blight, (Department of Geography Research Paper, no. 85, University of Chicago, 1963);
L. GERTLER, "Causes and Costs of Urban Blight in Canada," Community Planning Review, vol. 1 (1951), pp. 1-4;
J.G.C. POTVIN, "Commercial and Industrial Blight," Community Planning Review, vol. 9 (1959), pp. 26-33;
G. BREGER, "The Concept and Causes of Urban Blight," Land Economics, vol. 53 (1967), pp. 369-376.
One might also consider the extensive literature on air and water pollution, Dutch elm disease, and on epidemics.

[21]BERRY, op. cit., p. 179.

the housing market is never in equilibrium. While it may be true that many markets are never in equilibrium but only move continuously toward some equilibrium, the existence of residential blight is taken as an indication of malfunctioning in the market operations. It is argued here, however, that residential blight is not a consequence of disequilibrium, but that it reflects the expected allocation procedures of the housing market.[22] This suggests that the quality and amount of housing consumed by a household is a function of that share of its resources which the household is willing to allocate to housing. This would depend on (a) the amount of available resources, (b) other goods demanded and (c) the household's preference rankings. Thus, the housing market would not necessarily be in disequilibrium.

Berry approached a study of commercial blight from this dysfunctional standpoint and was able to identify four classes of blight. These are (a) economic blight, (b) physical blight, (c) functional blight, and (d) frictional blight. This scheme was developed since no one definition could encompass the various facets of commercial blight. If residential blight is considered in this convenient framework, it is clearly seen as a physical condition brought about by maintenance decisions (or lack of).

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[22]It might be noted that the housing market cannot allocate in a strict sense, since it is non-human in character. The loose use of terminology here has led to the reification of the market concept.

Frictional blight.

Frictional blight refers to the situation where an adverse environment 'causes' deterioration of the structure. More accurately, the owners (either occupiers or landlords) do not maintain the property, and it is this action which brings about deterioration. One has to consider why an adverse environment can cause this response. It is difficult to separate out the reasons for lack of investment; in one case, it might result from the owners' anticipation of neighbourhood prospects, while, in another case, high profits can be achieved with low inputs and high returns under particular demand conditions. One would need to know what prompted a particular decision by the investor (i.e., the owner) in a given situation.

The situation is further complicated by perception problems with respect to the urban environment. It would seem likely that most people would not want to live close to a glue factory. But at what distance is the glue factory no longer thought of as undesirable? On the other hand, some households may wish to locate close to a mass transit route, but a location immediately next to the facility would likely be undesirable because of noise, dirt, safety and the like. Again, at what distance is location vis-a-vis the transit route seen as acceptable? It could be assumed that, if structures close to unacceptable activities are less desirable, then their rents (or values) would be lower than those demanded for adjacent properties which are not located immediately next to such

activities.[23] Other things being equal, these lower rent (or value) properties would be occupied by families who were seeking accommodation in accordance with their budget decisions.

Without detailed investigation of the case histories of investment decisions in specific properties, which are regarded as being affected by "blighting influences," it is difficult to assess the contribution of these influences. Since deterioration of a structure is the end-product of the environmental situation described as "frictional," frictional blight can be equated with physical blight.

Functional blight.

Functional blight can also be equated with physical blight. The aging process and technological obsolescence are likely to occur together, especially in the long run. As obsolescence occurs, for example, in very large mansion-type structures, deterioration may occur concurrent with subdivision of the structure into a number of units or with a change to another use (perhaps producing a "frictional environment for adjacent properties"). Changes in tastes and preferences for styles and housing arrangements will be reflected in consumers' demands and, thus, functional blight is also equated with economic blight.

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[23]Just how far the impact of a so-called "blighting influence" extends spatially is rarely clear since the operation of such influences has not been investigated in detail.

Physical and economic blight.

It is argued here that the deterioration which is physical blight is essentially not so much a product of aging as a product of decisions with respect to the allocation of resources.[24] These decisions are largely economic in the strict sense, although many social and psychological factors enter into the formation of the decisions. Deterioration due to aging can be deferred if property owners are willing to allocate sufficient resources to offset aging effects (this assumes that the owner derives continued satisfaction from the property; in the case of a landlord, a satisfactory rate of return is assumed). In other circumstances, old property can be restored and modernized, reflecting the desires of the owners for this type of housing, or landlords' decisions concerning the profitability of such an investment decision.

As suggested earlier, owner-occupiers will attempt to maintain their property to protect their investment (and their derived social status). In certain circumstances, the allocation of a certain amount of resources to housing may place a strain

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[24] H. WOLFE, "Models for Condition Aging of Residential Structures," Journal, American Institute of Planners, vol. 33 (1967), pp. 192-196.
Wolfe develops a simple model to describe the movement of residential structures through a number of housing condition class as a function of time since the building of the structure. His data also show a positive relationship between age of structure and deterioration. This is to be expected given normal or sub-normal maintenance expenditures.

on the household budget. Whether the decision is made to cut back on expenditures in other areas of household expenses, or to defer some maintenance costs, will largely depend on the household's ranking of housing compared to other goods; another factor might be neighborhood pressures -- where these social pressures are high, maintenance will not likely be deferred.

Other relevant factors here would appear to be whether or not the household intends to move and how the household regards the condition of the neighbourhood and its immediate prospects. If a household intends to move, then outlays for maintenance may be deferred. If a reasonable return on the outlay prior to the actual move could be anticipated, however, the payment is not likely to be deferred. A neighbourhood may be seen as deteriorating because of external diseconomies from other uses (or even other residential properties), or as a result of pressure from minority groups, especially non-whites. These situations may bring about a deferral of investment since the owner anticipates a lower re-sale price with decreasing neighbourhood desirability; this situation can also bring about a residential move.

Landlords maintain their property in a competitive situation, where a well-maintained apartment or house is demanded by the tenant who has a range of choice. This degree of maintenance will also protect the value of the owner's investment. A situation may exist, however, where high rates of return on an investment can be achieved by minimizing maintenance costs.

This will occur where the demand is high, the supply limited and the consumer has a restricted range of choice. Property owners will be motivated to charge as much rent as possible for the rent-bearing units and they can defer maintenance without risking increased vacancies.[25] Under this type of market situation, some subdividing of structures might be expected and conversion from non-residential to residential use may also occur. Overcrowding of units is also a possible development. Since rents are high (relative to the household budget), the addition of relatives or friends to assist in rent-paying is not uncommon; this can lead to excessive strain on the structure's facilities. If these conditions are found in an area of mixed tenure, the landlord's decisions may produce a neighbourhood impression which will bring about an owner-occupier response similar to that already described.

Again, the demand conditions may be weak. The least attractive rental properties will then fall vacant and are liable to deteriorate even further, due to lack of occupancy, neglect and vandalism. This may lead to a change in use, (if allowed under the zoning regulations) but this new use may generate some external diseconomy, thereby worsening the neighbourhood situation (the reverse is also possible in that improvement can occur, although this seems more likely with a large-scale redevelopment rather than small, piecemeal changes).

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[25]While the evidence on this point is limited, it does suggest that high rates of return can be achieved -- see footnote 6, Chapter IV.

The conclusion is that residential blight can be seen in terms of a physical condition or state which is brought about by the investment decisions of owners, be they occupiers or landlords, in response to a perceived market situation.[26]

Using this schema, there has been no discussion of what Gans has called "the social image." The important relationship here is between the condition of the structure and the physical, social, and emotional condition of the occupants. Very little evidence exists on this relationship. One review concludes that there is substantial, though scattered, evidence that the type of housing occupied influences health, behavior, and attitudes, particularly if the housing is "desperately inadequate."[27] Another study attempts to measure the impact of differences in housing quality on a test and control group over a three year period in Baltimore, Maryland.[28] The findings are that substandard housing does have an adverse influence, but this is true only for some age groups and only for some health and morbidity measures. In spite of the increasing concern for the quality of the environment, social scientists remain unable to specify the relationships between the physical envir-

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[26]That the information the owners may have is incomplete, or is based on misconceptions or misinformation, is clearly important for the outcome, but this is beyond the scope of this study.

[27]A. SCHORR, Slums and Social Insecurity, (Social Security Administration Research Report, no. 1, Washington, D.C., U.S. Government Printing Office, 1963). "Desperately inadequate" is defined as being dilapidated or lacking a major facility. This is very similar to the concept of substandard housing, based on Census data.

[28]D.M. WILNER, et. al., The Housing Environment and Family Life, (Baltimore, John Hopkins Press, 1962).

onment and the social condition of individuals or groups occupying that environment. More specifically, the relationships between housing quality and man's behavior and physical and mental health are not well known.[29] The need for interdisciplinary research in this area seems obvious.

Summary.

This chapter reviews the literature on some forms of blight and also literature dealing with a variety of factors which can be used in an explanatory model. The important decision making areas of investment and maintenance behavior are discussed. Residential blight is identified as a condition brought about by owners making maintenance decisions in the light of market conditions as they see them. It should be noted, however, that there is little literature which deals with the spatial pattern of residential blight per se.

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[29] E.G. MOORE, et. al., Comments on the Definition and Measurement of Housing Quality, (Department of Geography, Research Report no. 46, Northwestern University, 1968).

CHAPTER IV

CONCEPTUAL FRAMEWORK AND HYPOTHESES

This chapter contains the conceptualisation of a process which, it is suggested, generates residential blight in urban areas. In undertaking this task, certain factors, identified in the preceding chapter, are linked together to create the conceptual framework. This framework is not rigorously specified (in the sense that a mathematical model is stated), but it allows the development of certain hypotheses. The hypotheses, as stated, are constrained by the context of the data with which they are tested.

The review of the literature suggests that the amount of low quality housing, and its location is a consequence of a set of decisions made by suppliers, consumers and those who "hold the ring" -- the public authorities. These decisions are of two types: there are spatial choices from available alternatives, and there are decisions on the allocation of limited resources within an expenditure schedule. Although social scientists, particularly economists, often assume that such decisions are made with complete knowledge, it is perfectly clear that this is not the case; rather, all decisions are likely made in an imperfectly understood situation. Three areas of

decision-making can be identified as parts of this process.

Firstly, there are decisions made by the household with regard to the consumption of housing -- how much residential space will be consumed and how much is the household willing to pay (i.e., allocate) for this residential bundle. Secondly, the investment and maintenance decisions of owner-occupiers and landlords affect the quality of the housing stock supplied. Thirdly, public decisions act as a constraint on these sets of decisions by setting limits on what is permissible. Zoning regulation in urban areas is an example. Public decisions as of themselves have also been important in public housing and urban renewal. Of course, the way in which the environment is perceived at the time of decision-making affects all of the above decisions. The location of existing "slum" areas and the anticipated movement of non-whites are examples of environmental information which could affect decisions.

Household decisions.

Following Alonso,[1] the budget equation which contains all choices open to a household has the general form:

Income = land costs + commuting costs + all other expenditures (including savings)

This leads to a budget equation:

$$y = P(t)q + k(t) = P_z z \qquad (1)$$

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[1] W. ALONSO, Location and Land Use: Toward a General Theory of Land Rent, (Cambridge, Mass., Harvard University Press, 1965).

where
- y: income
- $P(t)$: price of land at distance t from the center of the city
- q: quantity of land
- $k(t)$: commuting costs to distance t
- t: distance from the center of the city
- P_z: price of the composite good (all other expenditures) and
- z: quantity of the composite good.

Alonso uses land expenditures as a component of the budget equation. This can be replaced by a housing cost component. The purchase of a single family dwelling unit involves two things -- a structure and the lot on which the structure stands. The cost of housing, C_o, is made up of cost of structure, C_{so}, plus lot cost, C_{lo}. This latter term, however, is determined by the size of the lot and the price of land at some location, say at t miles from the center of the city.

$$C_{lo} = P(t)q \qquad (2)$$

where $P(t)$ is the price of land at distance t from the city center and q is the size of lot or quantity. Thus, cost of housing for owner-occupiers is

$$C_o = C_{so} + [P(t)q]_o \qquad (3)$$

The other common type of tenure is renting an apartment unit. Although lot size is rarely a critical element in one's decision to rent a particular apartment (in contrast to a single family dwelling unit purchase), the cost of the lot must be met by the owner of the property (this will likely be the individual landlord, except in the case of a condominium). In those parts of the urban area where apartment buildings are commonly found,

lot costs are likely to be high.[2] Part of the rent demanded will be used to defray this lot cost.[3] Since there are a number of apartments on the same lot, lot cost is a proportion of the rent demanded for each apartment, and equality of distribution is reasonably assumed. The lot cost per apartment can be used as a component in the budget equation.

Therefore, the cost of housing for renters is

$$C_r = C_{sr} + \frac{[P(t)a]_r}{a} \qquad (4)$$

where C_{sr} is not the cost of the structure, but is that part of the rent (or C_r) which reflects the size and/or quality of the unit obtained and 'a' is the number of apartments in a structure.[4] The cost of housing for purchasers or renters, C,

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[2]See the review of the land value and associated land use models in L.S. BOURNE, Private Redevelopment of the Central City, (Department of Geography, Research Paper No. 112, University of Chicago, 1967), Chapter 2.
Casual observation suggests that size of lot for apartment structures does not seem to increase markedly as one moves from the city center, if size of structure is held constant. If land costs do decrease with increasing distance from the city center, then the development costs should be lower for suburban apartment structures. This in turn might raise potential profits, although one would also expect lower rents in suburban locations. Bourne's evidence supports this point. Simple correlation between Distance from CBD and Apartment Lot Area for the City of Toronto = 0.061.

[3]How this component of the total rent could be specified is not clear. It might be expected that it is related to the previous rent schedules, awareness of site costs, and the size of the operating unit. It is likely that large companies are more aware of the factors involved than the small landlords, who are sometimes individuals with no corporate resources to assist in obtaining such information.

[4]The amount of size and/or quality consumed is a function of the household preference structures. In some cases, space may be sacrificed to obtain better quality and vice versa.

can replace the P(t)q term in the original budget equation.

$$y = C + k(t) + P_z z \tag{5}$$

Various intermediate positions such as owning an apartment unit or renting a house or a duplex can be handled under this approach.

Another essential feature of Alonso's model is the dominance of distance from the center of the city in the model's spatial dimension, this being expressed in t. More realistically, t can be replaced with d, where d is distance from the place of employment to residence.[5] Thus, the budget equation containing all choices open for the household is

$$y = C + k(d) + P_z z \tag{6}$$

Then, from (6)

$$C = y - k(d) - P_z z \tag{7}$$

Housing cost is, therefore, a function of income, commuting costs and all other expenditures. Since housing cost has two components, equation (7) can be re-written as

$$C_s + C_l = y - k(d) - P_z z \tag{8}$$

Then, from (7)

$$C_s = y - k(d) - P_z z - C_l \tag{9}$$

This equation can be summarized thus. The amount and quality of housing consumed by the household is bought by the disposable

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[5]It might be noted, however, that a considerable literature indicates that accessibility to place of work is less important in terms of the residential location decision than Alonso would have us perhaps believe.

household income, after deductions have been made for commuting costs, site costs, and all other expenditures (including savings). From this framework, the following hypothesis is offered

(1) The higher the household income, the less likelihood of the household occupying blighted or low quality housing (other things being equal).

This is a simple and straightforward hypothesis. It seems reasonable that as more income is made available to a household, not only is it likely to expand its range of consumption but it will also improve the quality of the goods it already consumes.[6]

The following hypothesis can also be developed: for any fixed given household income, y, the higher the site costs, C_l, the less internal space and/or quality the household consumes, C_s. This assumes the same level of expenditures for commuting costs, k(d), and all other goods, $P_z z$. A more general hypothesis is that if the cost for <u>any</u> factor on the right hand side of equation 9 rises, then the household will reduce the proportion of its budget allocated toward housing costs or C_s.

There are two difficulties with this hypothesis. One is obtaining data to test the hypothesis. Secondly, and more im-

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[6]There is, however, a marginal utility of housing quality. There is some level of expenditure for housing beyond which the utility derived from each additional unit of expenditure becomes less and less. Any additional income would then be diverted to other areas of consumption.

portantly, it is difficult to conceive that households would always behave in this manner (although some might). If the cost of any right hand side factor rises, then the compensation (within the budget constraint of a fixed y) may well be on another right hand side factor; say, all other goods in the above example which postulates an increase in site costs. The substitution relationships here are a function of the household preference structures and the demands of the household. Substitutions within the framework of equation 9 are more easily made when income is high. If income falls, then at some point substituting any other factor for housing becomes increasingly difficult. There is a minimum of shelter that can be regarded as necessary by most people. Winnick and Blank comment on this difficulty of substitution.

> "While other goods and services may be substitutes for the quantity and quality of a family's housing, only rarely can this important item be entirely displaced from the family budget."[7]

They also discuss the problem of substitution <u>within</u> housing markets, noting that a large number of clusters of substitutes can be developed using a variety of characteristics, such as location, tenure, type of structure, etc. Thus, a house in another part of the urban area may not be a feasible substit-

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[7] D.M. BLANK and L. WINNICK, "Structure of the Housing Market," <u>Quarterly Journal of Economics</u>, vol. 67 (1953), p. 183.

ute for the presently occupied unit. Also, a five room apartment may be preferred as a substitute for a five room single family dwelling unit, as compared to a six room house of the same type. Furthermore, as noted in footnote 4, in reducing housing costs, some tradeoff between amount of housing and quality is also possible. This form of hypothesis is, therefore, not tested here, although it points to an important research problem.

Investment and maintenance decisions.

A major distinction is made between the decisions of owner-occupiers and landlords. This distinction is based on the fact that the two groups have different goals and will, therefore, behave differently. The owner-occupiers seek to maintain the value of their property and thereby protect their investment. Landlords seek to maximize the return on their investment. Further distinctions can be made. Owner-occupiers can be classified by level of income into three groups - high, middle, and low-income. Landlords can be classified by the type of rental market served, e.g., luxury or non-luxury.

Where landlords operate in high-rent properties, the high quality of the structure and the amount and quality of fringe services are often a major differentiator among properties which are largely similar in range of rents and general locational attractiveness. Quality is maintained to attract tenants, reduce vacancies, and sustain profits. For this type

of property, the developers' costs (including site, construction, and maintenance costs) are high, and thus, rents are at a correspondingly high level.

In the low rent housing market, a different situation prevails. Here, as has been noted in recent work, the decisions on maintenance vary largely with the type of landlord.[8] The low-rent properties which are maintained in best condition are those in which the landlord also lives. The worst areas confirm the notion that these are increasingly owned by large scale, white, "slum" landlords. Their response to a weakening market structure has been to reduce maintenance expenditures rather than rents. Another important group in the worst areas are small scale landlords who have extended themselves financially to secure the property and have no other resources, or recourse to extra capital, with which to sustain maintenance expenditures.

There is considerable difficulty in obtaining reliable evidence on profitability in low-rent markets. However, it seems fair to say that for some owners, "slums" are not profitable but that they are "saddled" with the property since no other entrepreneur will take over these structures.[9] Such owners can only look forward to a public "slum-clearance" scheme so that the burden might be removed. In contrast, other owners

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[8] G. STERNLIEB, The Tenement Landlord, (New Brunswick, N.J., Urban Studies Center, 1966), Chapter 6.

[9] Ibid., p. 152.

are achieving substantial rates of return.[10] This situation occurs particularly where there is a spatially concentrated, heavy demand for low-rent housing. Typically, maintenance costs are reduced and very low absolute rents are charged. In some cases, subdivision occurs to increase the number of rent-bearing units. In such circumstances, the landlords can anticipate low vacancy rates, particularly in the non-white areas where residential choice is not only constrained by available resources, but also by discriminatory practices. The situation is further worsened by families doubling up or adding relatives to help meet the rents which, although low, represent a substantial proportion of the budget.[11] This naturally leads to overcrowding and the structure's facilities are often overtaxed. Whether or not this situation leads to deterioration of the dwelling unit will depend on maintenance and renovation decisions made by the landlords and owner-occupiers.

Owner-occupier decisions.

In general, the single family dwelling units tend to be

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[10] A.D. SPORN, "Empirical Studies in the Economics of Slum Ownership," Land Economics, vol. 36 (1960), pp. 333-340. A. NAKAGAWA, "The Profitability of Slums," Synthesis, (1957), p. 45. Metropolitan Housing and Planning Council of Chicago, The Road Back - The Slums, (Chicago, 1954).

[11] Care must be taken in the interpretation of the level of rent charged. The most commonly reported figure is the average monthly contract rent, which may or may not include furnishings or utilities. Thus, in one case reported from Boston, the average contract rent was $25 per month, but the average charge for various utilities was $15 per month; thus, the total outlay was $40 per month. See NAKAGAWA, op. cit.

better maintained, since they are largely owner-occupied. A distinction into three categories is made for purposes of discussion. Single family homes may be classified thus -- low-income, middle-income, and high-income.[12] Deterioration and possible subdividing of single family dwelling units is most likely to occur in black or other non-white areas, largely in response to institutional constraints, which bring about overcrowding. Although such areas are low- and middle-income in character and are predominantly non-white, the previous occupants will probably have been middle-income whites. This reflects the resistance levels of the three income areas to non-white intrusion; this resistance appears to exist in any part of the U.S. urban areas but it is intensified by home ownership. The non-white group generally lacks the wealth to penetrate the upper income areas while the groups in the lower-income areas resist by force.[13] The areas most amenable to non-white (or black) penetration are those areas of white, middle-income people. This group will likely have sufficient residual, or flexibility, of income so that they can move to avoid being close to the non-whites. These moves seem to take two forms. This group either moves to the "white" suburbs, especially the

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[12]The exact specification of limits is not a problem here.

[13]Since the low income white groups have the smallest residual after housing costs and commuting costs have been met, their ability to move under pressure is, therefore, less and this group has least flexibility in such circumstances.

more familistic households, or moves ahead of the "wave" of non-whites, even though the early 'intruders' are often the middle-income element of the minority group.[14] Thus, one would expect little evidence of residential blight in single family dwelling units in upper-income areas or middle-income areas not under pressure from the non-white groups. One might find higher levels of residential blight in the low-income, white areas but this group has traditionally been very conscious of its relatively new home-owning status and great efforts are made to keep up the properties even though resources may be strained and cut-backs on other goods made. Residential blight seems more likely, therefore, to occur in low-income, non-white areas, and where middle-income white areas are under pressure from racial invasion.

A key factor which underlies much of this discussion is the existence of different levels of demand from certain groups in the urban population. The behavior of the landlords and owner-occupiers is largely a response to this demand. This demand is in turn related to population growth within the urban area, or some section of the urban area. Population growth has two main components, natural increase or the net of births over

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[14]The movement of a community on the South Side of Chicago under the pressure of non-whites, as this was perceived by the residents, has been recently studied, and this type of movement was observed.
H. MOLOTCH, "Racial Change in a Stable Community," American Journal of Sociology, vol. 75 (1969), pp. 226-238.

deaths, and growth from in-migration. It has been suggested that the profitability of blighted property is independent of a 'ghetto' situation.[15] While a ghetto situation can lead to increased levels of profitability, the available evidence suggests that substantial rates of return can also be achieved in a non-ghetto situation. What such areas have in common is a low-income group, a group which suffers from adverse employment circumstances, and which cannot achieve any rapid movement out of the low income sector. This group maintains itself by natural increase, or by the in-migration of other low-income groups, or by a combination of both. The demands of this group are largely met by the private housing sector in the United States, since the amount of public housing in any one urban area or within parts of the urban area is rarely sufficient to meet the demand; also, the 'image' of public housing is not an attractive one in the eyes of those that the public housing is designed to serve.[16]

Thus, as long as low-income groups, ethnic, non-white or poor-white, continue to migrate in large numbers to cities then

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[15] By a "ghetto" situation is meant the constraint of a minority group through discriminatory practices, rather than through the free choice of social cohesion on the part of the group.

[16] C. HARTMANN, "The Limitations of Public Housing," Journal, American Institute of Planners, vol. 29-30 (1963), pp. 283-296.

one might reasonably expect residential blight to persist, especially in the "reception" areas. It would not follow, however, that if this stream of migrants were to cease, that residential blight would also disappear. The high birth rates of this group within the urban area also maintain the low-income, disadvantaged sector which is beset with many cyclical social and economic problems.

Certain forces are operating in American society to sustain the non-white ghettoes. Non-whites, and particularly blacks, do not have the range of housing choice open to most white groups. In the latter case, ability to pay is generally taken as the major determinant of choice. Thus, the non-white population's demand for housing is severely constrained to certain locations in urban areas.[17] This creates a local market situation which encourages landlords to defer expenditures on property, in the knowledge that vacancies are unlikely to occur. Deterioration is a common result of such behavior over some time period. The non-white population thus labours under a double burden of lack of resources and discriminatory practices.

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[17]Helper has investigated the racial practices of real estate brokers in Chicago. She finds that in 1955-56, and in 1964-65, restrictive racial practices are still operative in Chicago. Evidence of similar behavior in other U.S. cities is also presented. This group's behavior is a major contributor to housing discrimination against racial minority groups. R. HELPER, Racial Policies and Practices of Real Estate Brokers, (Minneapolis, University of Minnesota, 1969), pp. 277-301.

Certain hypotheses can be developed from this discussion of investment and maintenance decisions. It has previosly been hypothesised that income and quality of housing have a direct relationship. It is also clear that income levels have an important bearing on these investment and maintenance decisions. Thus, to consider the relationships between some of the variables discussed in this section and housing quality, income should be held constant. The indications are that quality of housing and type of tenure are related. It is hypothesized that:

(2) the higher the degree of owner-occupancy in an area, the higher will be the quality of housing in that area (assuming income is constant). Since renting and owner-occupancy are mutually exclusive types of tenure, some inferences can be drawn from the test of this hypothesis concerning the relationship between housing quality and level of renting.

Again, to consider the relationship between housing quality and the presence of minority groups, both income and type of tenure should be held constant. To test the notion that discrimination in housing has led to the "piling up" of low-income, minority groups and a deterioration in housing quality, it is hypothesized that:

(3) the higher the percentage of non-whites in an area, the lower the quality of housing in that area (assuming income and type of tenure are constant). It is also hypothesized that:

(4) the higher the percentage of foreign born or non-native Americans in an area, the lower the quality of housing in that area (assuming income and type of tenure are held constant).[18]

The expectations are that in areas of owner-occupancy, residential blight will be highest in the low-income areas, and particularly if there is a concentration of non-whites. In general, levels of residential blight are always expected to be higher in rental areas, although the level will decrease markedly where income levels rise. The concentration of non-white groups will increase the probabilities of blight occurring at all classes of income, as will the amount of immigrant population, since they too have experienced discrimination in terms of housing choice.

Following from previous arguments, some additional hypotheses are also developed concerning the occurrence of a spatially concentrated demand as a result of the in-migration of, and the natural increase in, low-income groups into urban areas. It is hypothesized that:

(5) the higher the percentage of recent migrants in an area, the lower the level of housing quality, and

(6) the higher the rates of natural increase in an area, the lower the level of housing quality.

These hypotheses are only expected to hold in low income areas.

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[18]By non-native is meant born to a couple, one of whom was foreign born.

Public decisions.

All of the private decisions made by the groups discussed above are made within a legal framework, which is established in the courts and the various legislatures. The most important statements concerning what is permitted and what is acceptable are found in the zoning and housing codes. Unfortunately, there has been only limited systematic study of the introduction, administration, and enforcement, and impact of these ordinances and codes in urban areas.[19] There does seem to be a general impression, however, that there is variation in the degree of enforcement and amount of permissiveness in different parts of the city. The implication is that in the blighted areas of cities the housing codes are not always enforced, and there is greater flexibility of behavior than is allowed in middle and high quality areas, thus permitting the continued existence of substandard housing.

One difficulty with vigorous code enforcement is that it has brought about the displacement of tenant families who could not pay the rent for rehabilitated properties or it has caused home owners to move because of increasing housing expenditures.[20] This in turn increases pressure on low rent or

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[19] S. GREER, Urban Renewal and American Cities, (New York, Bobbs Merrill Co., Inc., 1965), p. 27.

[20] GREER, Ibid., p. 46.
M. MILLSPAUGH and G. BRECKENFELD, The Human Side of Urban Renewal, (Baltimore, Fight-Blight, Inc., 1958).
This study reports on a number of rehabilitation projects in U.S. cities.

low cost housing in other parts of the city. This can lead to the blighting of these properties through the concentrated demand/lack of maintenance mechanism described earlier in this chapter.

It is extremely difficult to obtain information on the area to area variation in the enforcement and impact of these regulations. Therefore, no hypotheses are offered with respect to these factors.

Public authorities also make decisions which affect the spatial pattern of residential blight in a more direct manner. This is most obvious in the areas of urban renewal and public works programmes, such as expressways. Although these activities may have as an end-product luxury rental housing, public housing, or non-residential uses, it is evident that the site clearance activity will reduce the amount of blighted housing. This statement is, in part, dependent on the size of the unit of area that one considers. There is a well-documented assertion in the literature that urban renewal activities have generally displaced the residents of a project area and a considerable number have moved into other blighted property.[21] In some areas, as with displacement in the code

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[21] See GANS, op. cit., pp. 321-328, for a critique of relocation procedures in the West End of Boston in which he suggests that many residents have moved into old, low-rent neighbourhoods, where they may get caught up in the same renewal process.
See also GREER, op. cit., for local officials' reactions to relocation problems such as slum shifting and displacement leading to a continued demand for a reduced supply of low cost housing, which increases pressure on deteriorating neighbourhoods.

enforcement example, the pressures brought about in this manner can generate blight in property in those areas receiving the displaced.[22] Thus, given a large unit of area, the blighting may occur in the same area as the urban renewal project is located, and so the overall level of residential blight may not change appreciably; given a small unit of area, then a decrease in the amount of residential blight seems likely.

An hypothesis can be offered on the relationship between housing quality and the "spillover" effects from urban renewal activities. It is hypothesized that:

(7) the closer an area is to urban renewal or clearance activities, the greater the residential blight is likely to be in that area.

One problem with this hypothesis is that for the situation to develop as described, there must be a lag effect operating in the area which receives the displaced households. Some time must elapse before the impact of the incoming poor families is translated into deteriorating housing. Just how much time and what other variables may be operative is not usually known.

With respect to the amount of change of poor housing from 1950 to 1960, a hypothesis can be stated. Since it is

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[22]It has been suggested that in Chicago, the renewal at the Lake Meadows - Prairie Shores site displaced low-income Negroes who in turn increased pressure on the Hyde Park - Kenwood area around the University of Chicago. No documentation on this point has been found, however.

postulated that certain variables are related to residential blight, it is expected that changes in these variables through time will produce change in residential blight at some later time (again, the length of the lag is not known). Thus, it is hypothesized that:

(8) change in residential blight is related to changes in the selected independent variables from 1950 to 1960. Change in those individual variables which are most strongly related to residential blight will have the greatest effect.

The environment.

The decisions made both by individuals to purchase or rent a particular residential unit in an area, and by landlords and owner-occupiers to maintain their property, are not made in isolation but involve the property in its spatial context in the urban environment.

A relationship implied in the literature is that blighted areas occur in close proximity to the central area of a city. This argument was advanced by the early students of internal urban spatial structure at a time when the central areas of large cities were expanding horizontally (See Chapter 3). Since that time, central expansion has often been vertical in character and so the demand for adjacent property has not materialized to the extent anticipated. Recently, however, the demand for sites in such areas has increased with the construction

of luxury "high-rise" apartment buildings, particularly where there was no previous well-developed apartment concentration to shape the developing pattern. Even here, the new development tends to be on the more "fashionable" side of the central area rather than in the area of poorest property -- there is too much risk attached to the latter location.[23]

The substantially different argument put forward by those explaining the blighted areas in terms of a growth process (See Chapter 3) would also lead one to expect a decline in residential blight as one moves away from the C.B.D. The areas containing property which is not being demanded, are the centrally located areas of older housing. While it has been suggested that the factors which produce residential blight are not those of declining demand and the 'flight to the suburbs,'[24] one would still expect the low-income groups to have concentrated in this inner area for such reasons as job opportunities in and

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[23]BOURNE, op. cit., pp. 85-86.

[24]It has been argued in this study that an important factor in the persistence of residential blight has been the maintenance of a spatially concentrated demand for low cost housing. This seems to be relevant to the time period of the study which is primarily 1950 to 1960, and describes the conditions in the urban areas at this time. More recent evidence from the early and middle 1960's indicates that there is a declining demand with a weakening market and increasing vacancy rates in blighted areas. See again STERNLIEB, op. cit., Chapter 1.

around the central area, relatively low-rent housing (which may be substandard), and the kin and ethnic relationships which could provide emotional and financial support. Once the pattern has been established it has become somewhat fossilised, particularly for non-whites, although growth has occurred outwards from these initial areas which may still attract in-migrants.

With the spread of employment opportunities and the absolute spatial growth of the low-income sector, one might expect more residential blight in the other parts of the central city and older suburbs, under the mechanisms discussed. Also with renewal activities occurring in the inner parts of the central city, there might be an expected decline in the previous levels in this part of the city. It is hypothesized that:
(9) as distance from the center of the city increases, the amount of residential blight will decrease, and
(10) through time, this gradient will decrease in slope.

An important element in the environment facing such groups as households (either as consumers or suppliers), landlords, and public agencies is the existing pattern of residential blight. Areas of blight will likely affect the manner in which decision-makers consider the future prospects of neighbourhoods. Blighted areas thus create external diseconomies for adjacent properties and act as "blighting influences." This factor of contiguity has been noted by others as being important (Chapter 3, p. 2). It is hypothesized that:
(11) the closer an area is to existing areas of residential

blight, the higher will be the amount of residential blight in that area.

Summary.

This chapter discusses three areas of decision-making, household decisions, investment and maintenance decisions and public decisions. These are conceived of as elements of a process which generates residential blight. From this framework a number of hypotheses are drawn. These are stated in a manner that allows their testing, using the chosen data source of the Censuses. In so doing, the difficulty of cross-level conceptualisation and subsequent testing, discussed in Chapter Two, becomes more apparent.

CHAPTER V

THE PATTERN OF RESIDENTIAL BLIGHT

In this chapter, the spatial pattern of residential blight in the study area is described. The emphasis is on the interpretation of a number of maps showing this pattern for different time periods.[1] The major difficulty here is that the pattern described is being lifted, as it were, out of context -- it is part of a wider urban spatial structure. Yet, to describe this spatial structure and its complex changes through the time period considered would be an enormous task; even an examination of selected variables (assuming them to be suitable surrogates) would be time consuming and possibly of limited value.

Fortunately, however, the study area has been a social research laboratory for others and previous work on such topics as black in-migration, housing patterns, the demography of the black population, and the human ecology of the area, serves as a convenient backdrop for the description of residential blight.[2]

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[1] All the maps used in this chapter were computer produced using SYMAP Version V (except for the trend surface maps-see footnote 22). This saves cartographic labour to a degree, but does raise problems of presentation and hence, of interpretation. Before continuing this chapter, the reader should consult Appendix 2).

[2] The various studies utilised are referenced in the course of this chapter.

Given the data sources of the 1940, 1950 and 1960 Censuses, measures on three aspects of poor housing quality are available (it should be remembered that residential blight serves as an expression of poor housing quality). Measures are available on structural condition, absence of plumbing facilities, and degree of overcrowding. For 1950 and 1960, measures of structural condition and lack of plumbing facilities are combined in the data sets but overcrowding is reported as a separate measure. One method for combining these measures using factor analysis, is discussed in a subsequent chapter.

1940.

Although the measures of the physical condition of housing in 1940 are not comparable with those of later censuses, a brief description gives an overview of the conditions prior to World War II. Fig. 2 shows the distribution of housing needing major repair.[3] There are a number of areas with more than 15% of the housing stock thus classified. Much of the stock throughout the city, however, is in good to excellent condition.

Two "fingers" of poor housing can be observed adjacent

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[3]A dwelling unit needed major repairs when "parts of the unit such as floors, roof, walls or foundations required repairs or replacement, the continued neglect of which would impair the soundness of the structure and create a hazard to its safety as a place of residence."
U.S. Bureau of Census, Population and Housing, Statistics for census tracts and community areas, Chicago, Illinois 1940, Introduction, p. 3.

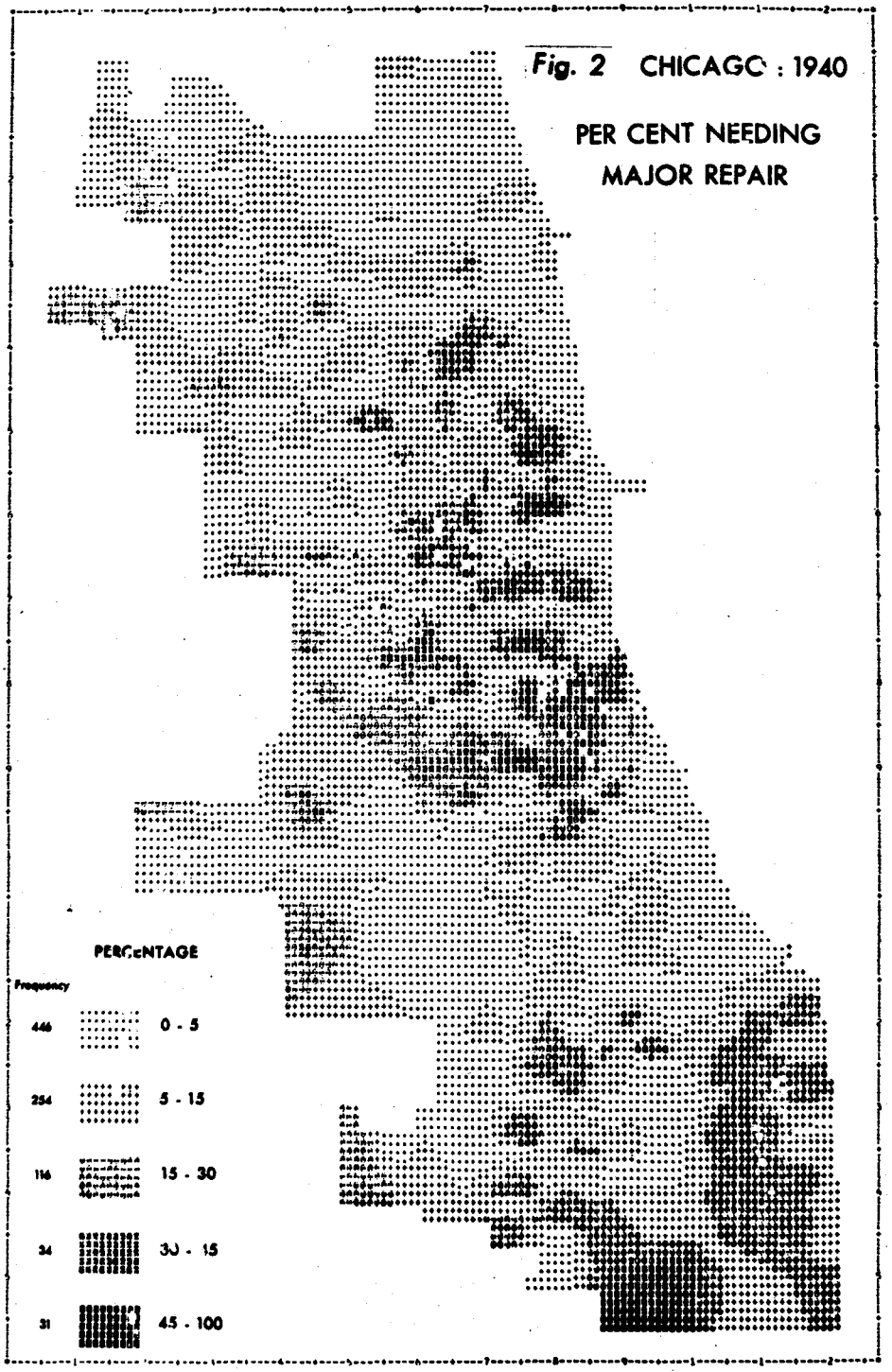
Fig. 2 CHICAGO : 1940
PER CENT NEEDING MAJOR REPAIR
PERCENTAGE
Frequency
446 0 - 5
254 5 - 15
116 15 - 30
34 30 - 45
31 45 - 100

to both branches of the Chicago River. This pattern is repeated alongside the Calumet River in the extreme south-east of the city. Both areas are major industrial areas in the city, with steel mills and associated industries in the South Chicago district, and a wide range of industries linked to river traffic on the Chicago River.[4] The spatial association with industrial activity is repeated in the New City district which is the site of the Union Stockyards.

Another important spatial association is with areas of black population. The black residential areas have long been districts of poor residential quality.[5] Thus, the wedge-like South Side ghetto, centered along South State St., and the West Side black areas along Madison and Roosevelt Rd. are identifiable in terms of poor housing conditions.

A third component of the 1940 pattern is the poor quality housing on the periphery of the city, especially in the south-west. There is a substantial amount of vacant land in these peripheral areas at this time and these districts are not fully developed. It is possible that the poor housing here is of the "rural-shack" type.[6]

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[4] D.M. SOLZMAN, Waterway Industrial Sites: A Chicago Case Study, (Department of Geography, Research Paper No. 107, University of Chicago, 1966).

[5] A.H. SPEAR, Black Chicago, The Making of a Negro Ghetto, 1890-1920, (Chicago, University of Chicago Press, 1967), pp. 24-27; 147-150.

[6] Areas of this type of housing are not uncommon around the periphery of large urban areas. See, for example, B.J.L. BERRY and R. MURDIE, Socio-economic Correlates of Housing Condition, (unpublished report, Department of Urban Renewal, City of Toronto, 1965?).

A dwelling unit with structural deficiencies can be a serious problem for its occupants but this situation is exacerbated if the plumbing system is inadequate. The distribution of such housing is shown in Fig. 3.[7] This pattern is much less extensive than that already discussed. The concentrations along the branches of the Chicago River are again evident, as are the associations with the Stockyards' neighbourhood and the black residential areas -- there appears to be a discontinuous arc around the C.B.D. or Loop, reminiscent of Burgess' "zone in transition." Apart from Riverdale, the peripheral areas are less marked. Throughout most of the urban area, however, less than 5% of the housing stock is in this category.

Overcrowding in dwelling units is much more widespread than poor structural and sanitary conditions as is shown in Fig. 4.[8] In general, the areas suffering from overcrowding correspond to the areas of physical deterioration. There are, however, some interesting deviations. Along the north branch of the Chicago River, substantial overcrowding is less than might be expected (given the poor housing conditions). Three

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[7]Inadequate plumbing is a rather vague term and appears to cover deficiencies in water supply, and/or toilet facilities, and/or bathroom and shower facilities.

[8]Overcrowding is defined as having a ratio of more than one person per room. The use of this measure may be criticised as having only limited connection to concepts of privacy and personal living space. It is, however, the standard census measure and is employed, therefore, despite its acknowledged crudity.

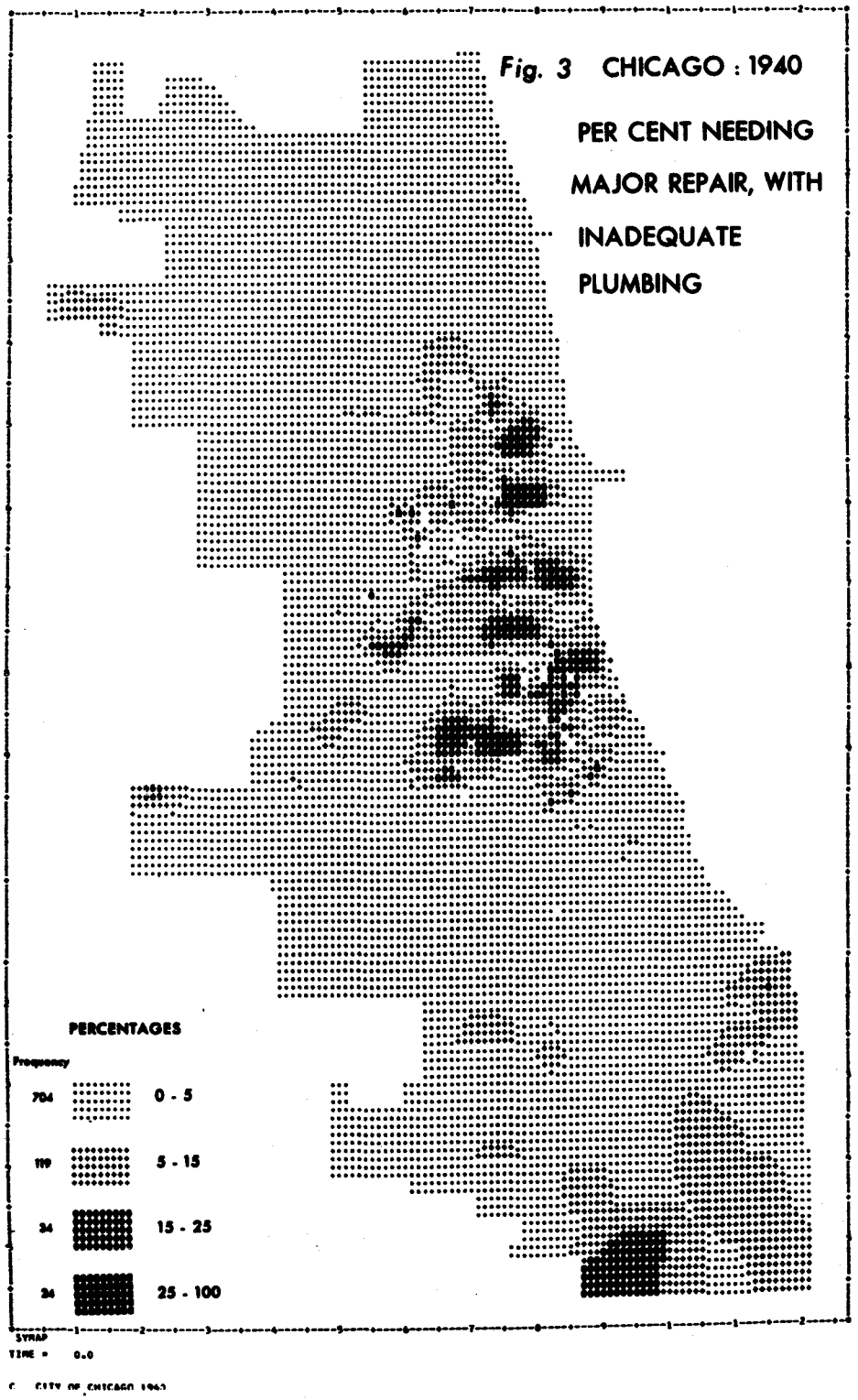
Fig. 3 CHICAGO : 1940
PER CENT NEEDING
MAJOR REPAIR, WITH
INADEQUATE
PLUMBING
PERCENTAGES
Frequency
704 0 - 5
119 5 - 15
34 15 - 25
24 25 - 100
SYMAP
TIME = 0.0
© CITY OF CHICAGO 1943

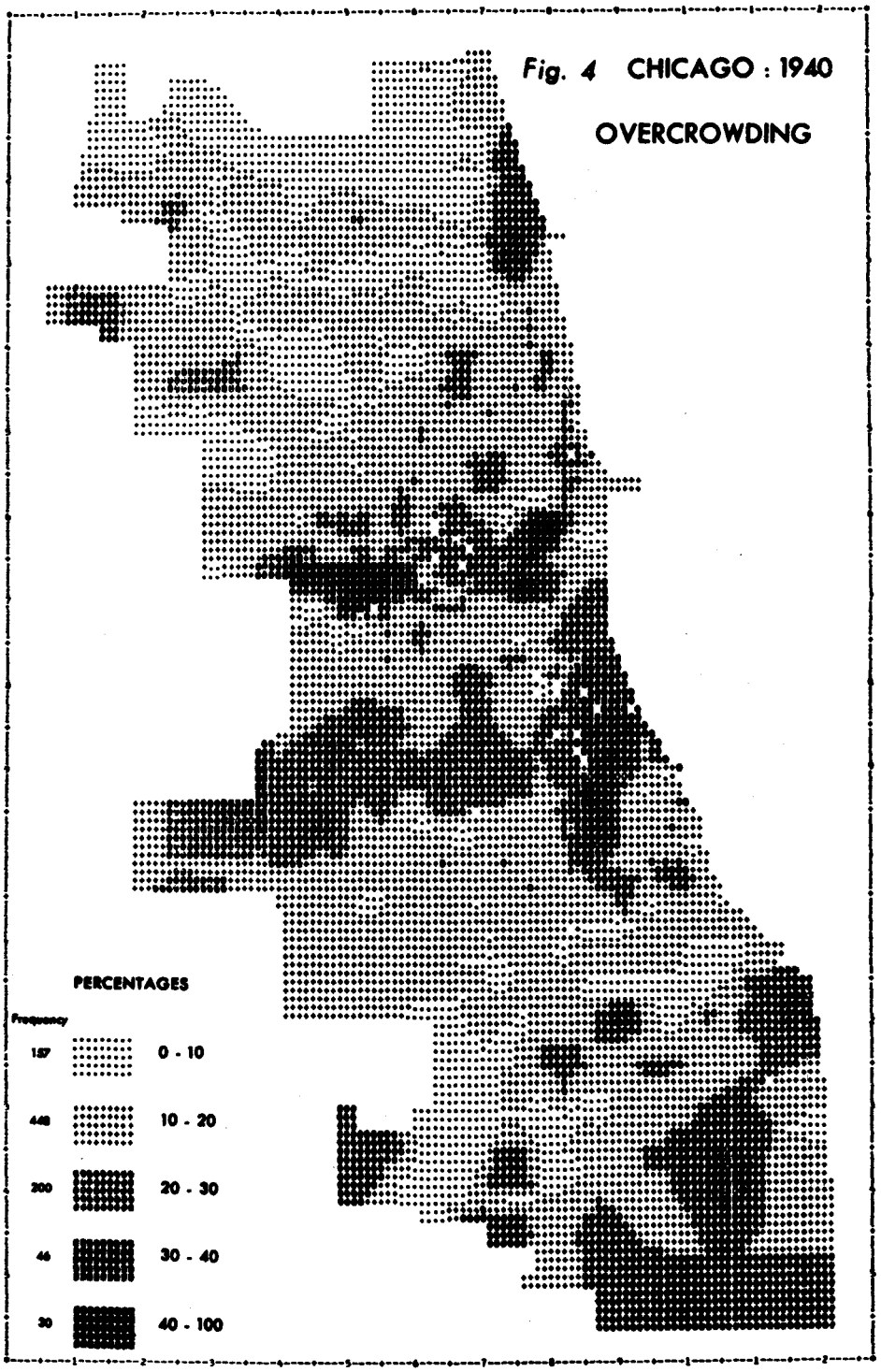
Fig. 4 CHICAGO : 1940
OVERCROWDING
PERCENTAGES
Frequency
157
0 - 10
448
10 - 20
200
20 - 30
46
30 - 40
30
40 - 100

other areas are delineated -- Uptown, North Lawndale and the community areas west of the Stockyards. The Uptown area at this time is almost all white, and low to middle class in terms of status. North Lawndale is occupied by the Jewish population and thus, the overcrowded, but not necessarily physically blighted, Jewish ghetto is identified. Rees' study classifies the community areas to the west of the Stockyards as low to middle class and predominantly immigrant and Catholic.[9] In this area of small single family dwelling units, the large households of the immigrants are likely the underlying cause of the overcrowding.

The wedge like character of the South Side ghetto is much more apparent. The pattern of overcrowding extends farther south than that of poor structural condition and is "pushing into" Woodlawn, thus creating the "island" of Hyde-Park-Kenwood, even at this early date.

1950.

Although the 1950 and 1940 patterns are not directly comparable in terms of physical attributes, some general similarities in pattern and spatial associations are discernible. The 1950 pattern of dilapidated housing in the central city,

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[9] P. REES, "The Factorial Ecology of Metropolitan Chicago, 1960," (unpublished M.A. disseration, Department of Geography, University of Chicago, 1968), Figs. 10 and 13. Although his data are for 1960, there is no reason to believe that this is not the case for 1940.

shown in Fig. 5, is like a hand, with the palm based on the central core at the lake shore and a number of "fingers" radiating outwards.[10] There are also a few outliers.

As in 1940, "fingers" are evident along both branches of the Chicago River. Another "finger" is on the West Side along the Madison axis. On the South Side, one "finger" reaches the Stockyards area while the other extends along South State and Cottage Grove. Along each "finger," there is a general decline in dilapidation with increasing distance from the central core of the Loop.

The outliers are mostly in the southern part of the city and are associated with the industrial areas around Lake Calumet and South Chicago, and the black residential area in Morgan Park.[11] The northern outlier is in the Uptown area,

---

[10] The 1950 data do not allow any separation of physical and sanitary conditions. A dwelling unit is defined as dilapidated when "it is run-down, neglected, or is of inadequate original construction, so that it does not provide adequate shelter or protection against the elements or it endangers the safety of the occupants."
The category, no private bath or dilapidated, includes, however, units which are not dilapidated but which do lack a private flush toilet or private bathing facilities. The category, no running water or dilapidated, is a subcategory of this variable.
U.S. Bureau of Census, U.S. Census of Population: 1950, Bulletin P-D10, Census tract statistics, Chicago, Illinois, and adjacent area, Introduction, p. 3.

[11] O.D. DUNCAN and B. DUNCAN, The Negro Population of Chicago, (Chicago, University of Chicago Press, 1957), Figs. 8, 23, and 34.

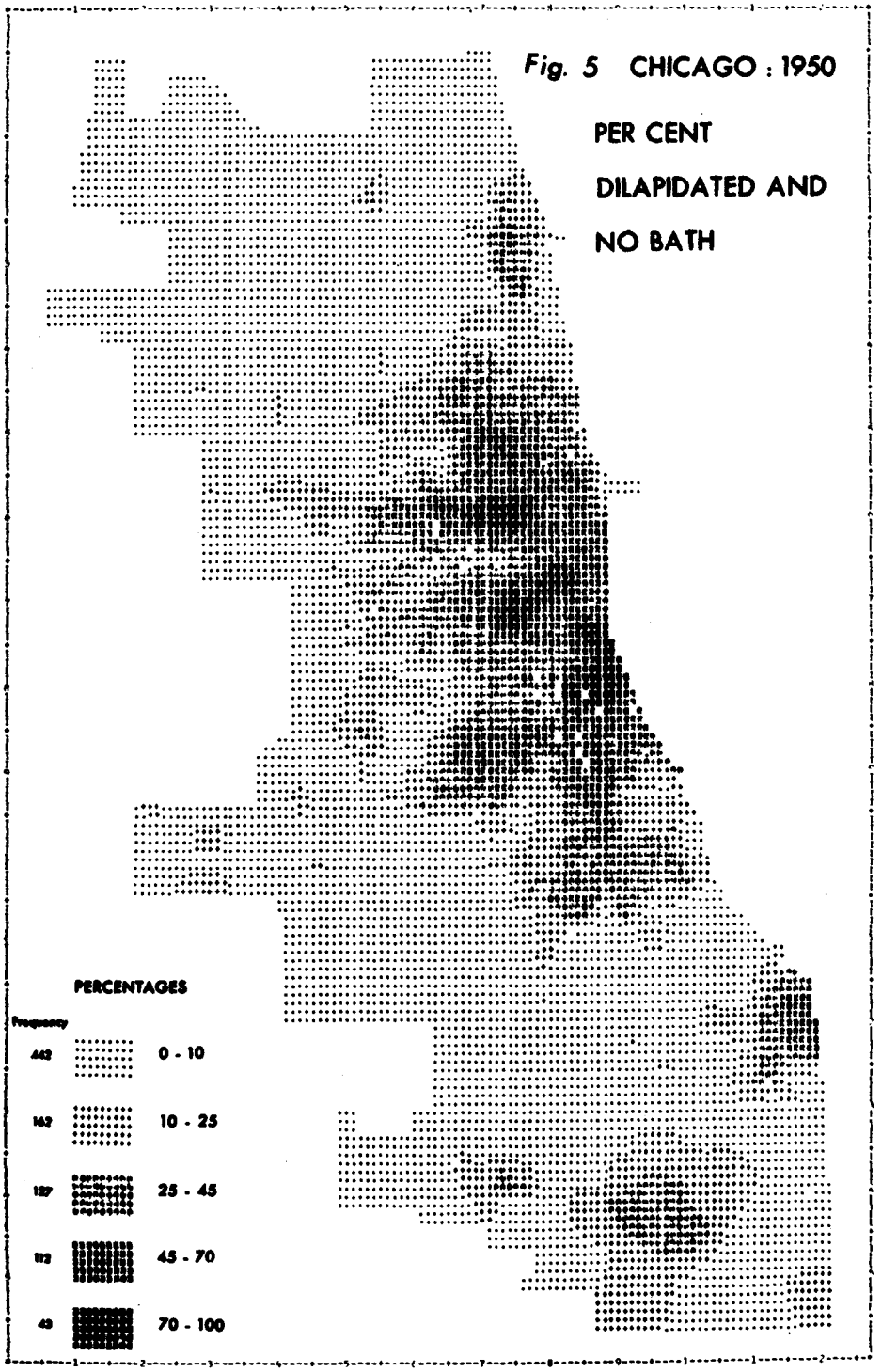
Fig. 5 CHICAGO : 1950
PER CENT
DILAPIDATED AND
NO BATH
PERCENTAGES
Frequency
442
0 - 10
162
10 - 25
127
25 - 45
112
45 - 70
43
70 - 100

which, it will be remembered, exhibited overcrowding in 1940 but little evidence of physical deterioration. This relationship is also apparent in the Woodlawn and Washington Park districts on the South Side.

With the suburban residential development of the 1940-50 period, the poor quality housing associated with the urban periphery is now found at a considerable distance from the lake, beyond, and in the interstitial areas between, the axes of suburban development -- see Fig. 6.

There is much less spatial variation in the suburban pattern with only a few areas showing any evidence of housing deficiencies. In general, the southern suburbs show higher percentages; this is consistent with Rees' findings that in 1960 the southern suburbs were generally of lower socio-economic status than suburbs to the north and west of Chicago. In this southern set of suburbs, both Harvey and Calumet City show evidence of blight. Elsewhere, pockets of poor housing are found in the older inner suburbs of Cicero and Evanston, and in the north of the study area around Fort Sheridan and Highwood.

Examination of the more restrictive (and more severely deficient) subcategory, as shown in Fig. 7, reveals that many areas described in the previous case are likely only deficient in some plumbing facilities. Therefore, the relationship suggested between overcrowding in 1940 and physical dilapidation in 1950 is very tentative. Although the distribution of units

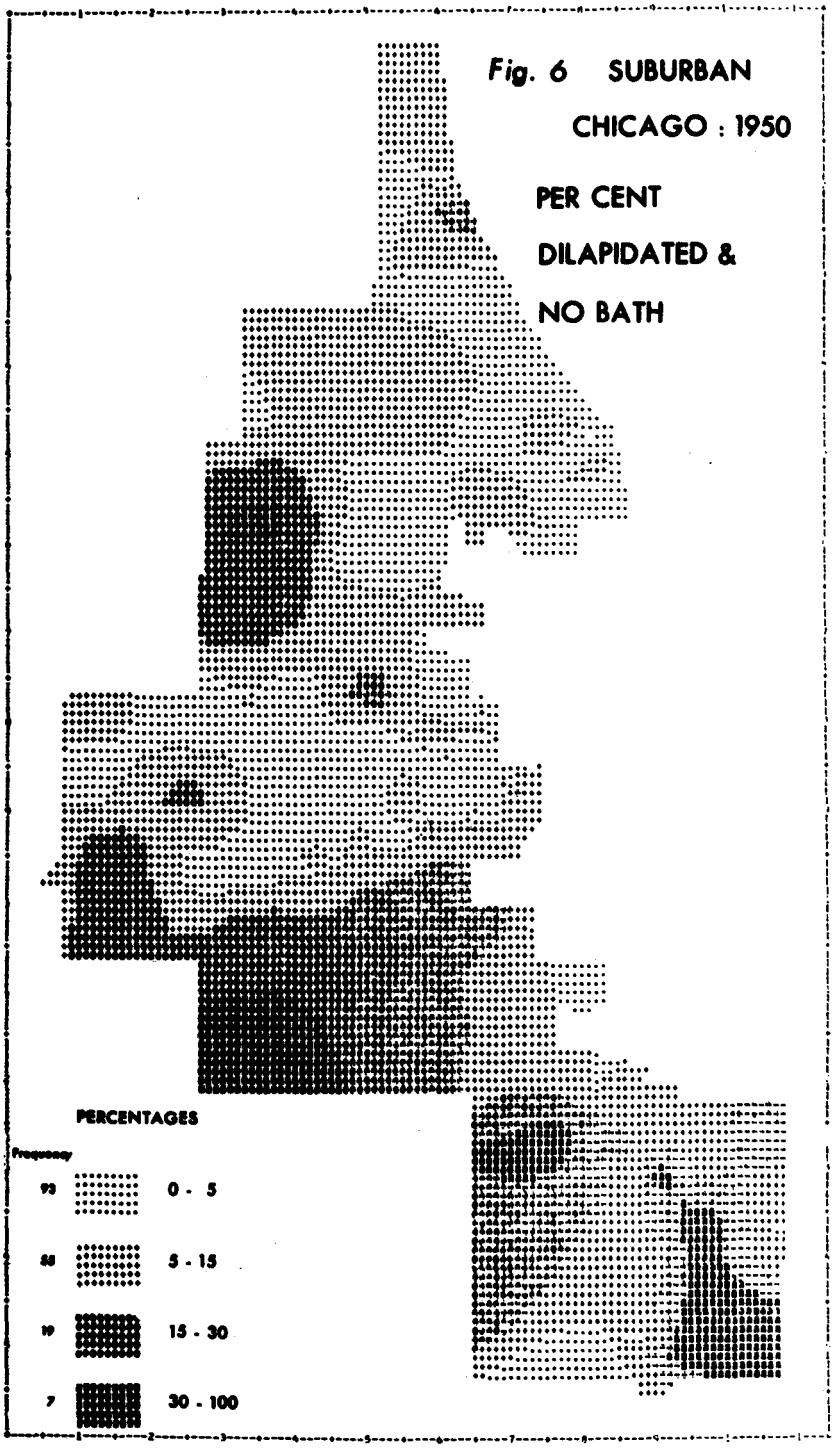
Fig. 6 SUBURBAN
CHICAGO : 1950
PER CENT
DILAPIDATED &
NO BATH
PERCENTAGES
Frequency
93
0 - 5
88
5 - 15
19
15 - 30
7
30 - 100

which are dilapidated and lack running water is much more localised, the overall pattern is not dissimilar, with the arc around the central core and some "fingers" extending from this base. Just as the central arc is less extensive, the same is true for the outliers although the same areas are identifiable. The gradient like characteristic of the "fingers" is less apparent. In some cases, there are percentages of poor housing which are as high at the "finger-tips" as those in tracts adjacent to the Loop. The suburban pattern for this variable is a paler image of Fig. 6 and is not shown.

Again, as in 1940, areas with overcrowded dwelling units are more common than those with physical deterioration and plumbing deficiencies -- see Fig. 8. Also, this pattern is directly comparable to that of 1940. Two interesting trends emerge from this comparison. Firstly, the pattern is less extensive than in 1940 and is more highly concentrated, e.g., on the South Side, along Madison and Roosevelt on the Near West Side and on the Near North Side. Secondly, more tracts (about 30) fall into the most severe category (30% and more); thus, overcrowding is more severe in fewer areas.

The major areas of decline in overcrowding are in the Immigrant-Catholic districts west of the Stockyards (perhaps this can be attributed to the increased economic security of these households and the movement away from the home of the children); also the Jewish area of North Lawndale is much less overcrowded than in 1940. This area was just beginning to experience the

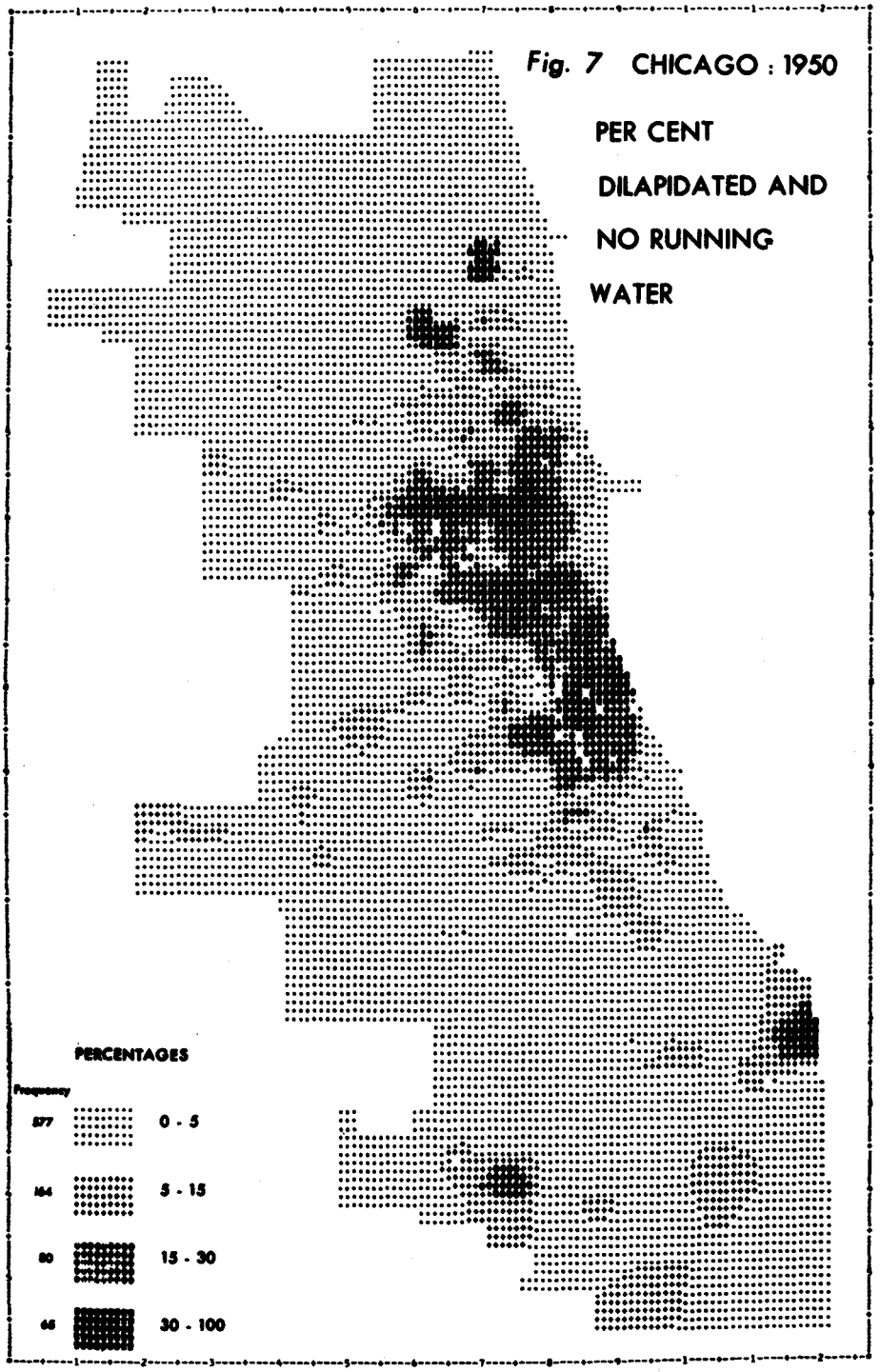
Fig. 7 CHICAGO : 1950
PER CENT
DILAPIDATED AND
NO RUNNING
WATER
PERCENTAGES
Frequency
877
0 - 5
164
5 - 15
80
15 - 30
46
30 - 100

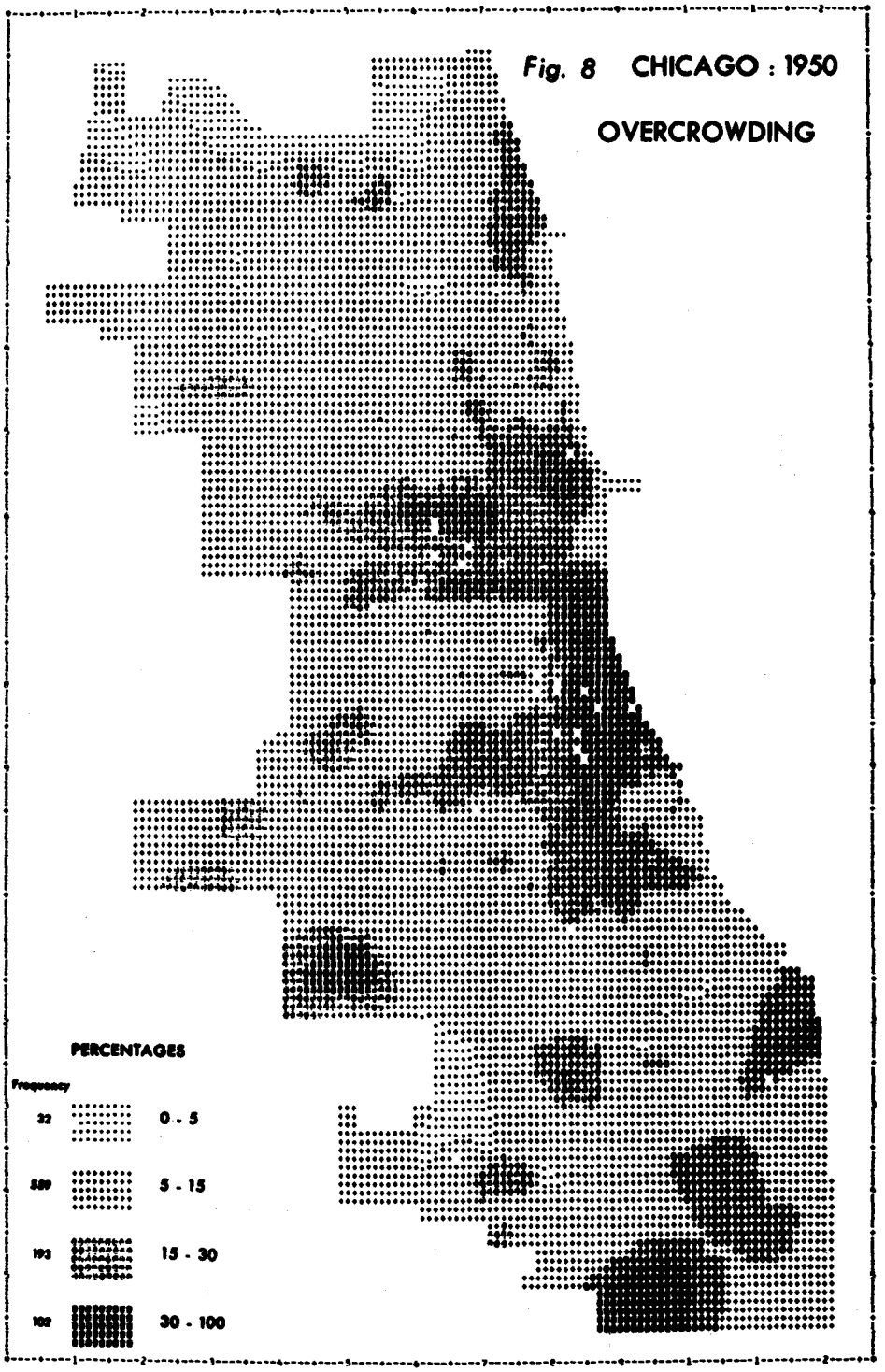
Fig. 8 CHICAGO : 1950
OVERCROWDING
PERCENTAGES
Frequency
22
0 - 5
589
5 - 15
193
15 - 30
102
30 - 100

process of "invasion" by blacks at this time and Jewish people were leaving for suburban and other residential areas.

The areas where overcrowding is now more concentrated are areas which were experiencing considerable black in-migration at this time.[12] Thus, this evidence supports the notion that doubling-up and lodging are common at periods of rapid in-migration, particularly where housing opportunities are limited.[13] Overcrowding is still characteristic of the poor quality residential areas adjacent to the industrial plants around Lake Calumet and the Calumet River in South Chicago. The area of increase in the Ashburn district does not appear to be related to any obvious factor.

The suburban pattern of overcrowding (Fig. 9) is largely similar to that for physical condition, with the rural element and a few pockets in the inner suburbs, particularly in Harvey, Calumet City, Summit (south west of Cicero), and what was to become the Harwood Heights - Norridge municipalities.

1960.

The 1960 housing condition categories are more specific than those of 1950, allowing physical condition to be separated from sanitary conditions; comparability between the 1950 and 1960

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[12] Ibid., Figs. 7 and 8.

[13] SPEAR, op. cit., pp. 149-150 also discusses this with respect to an earlier time period, and notes that overcrowding is not a serious problem in 1900-1920 but in the 1920-1940 era, overcrowding is prevalent in black residential areas.

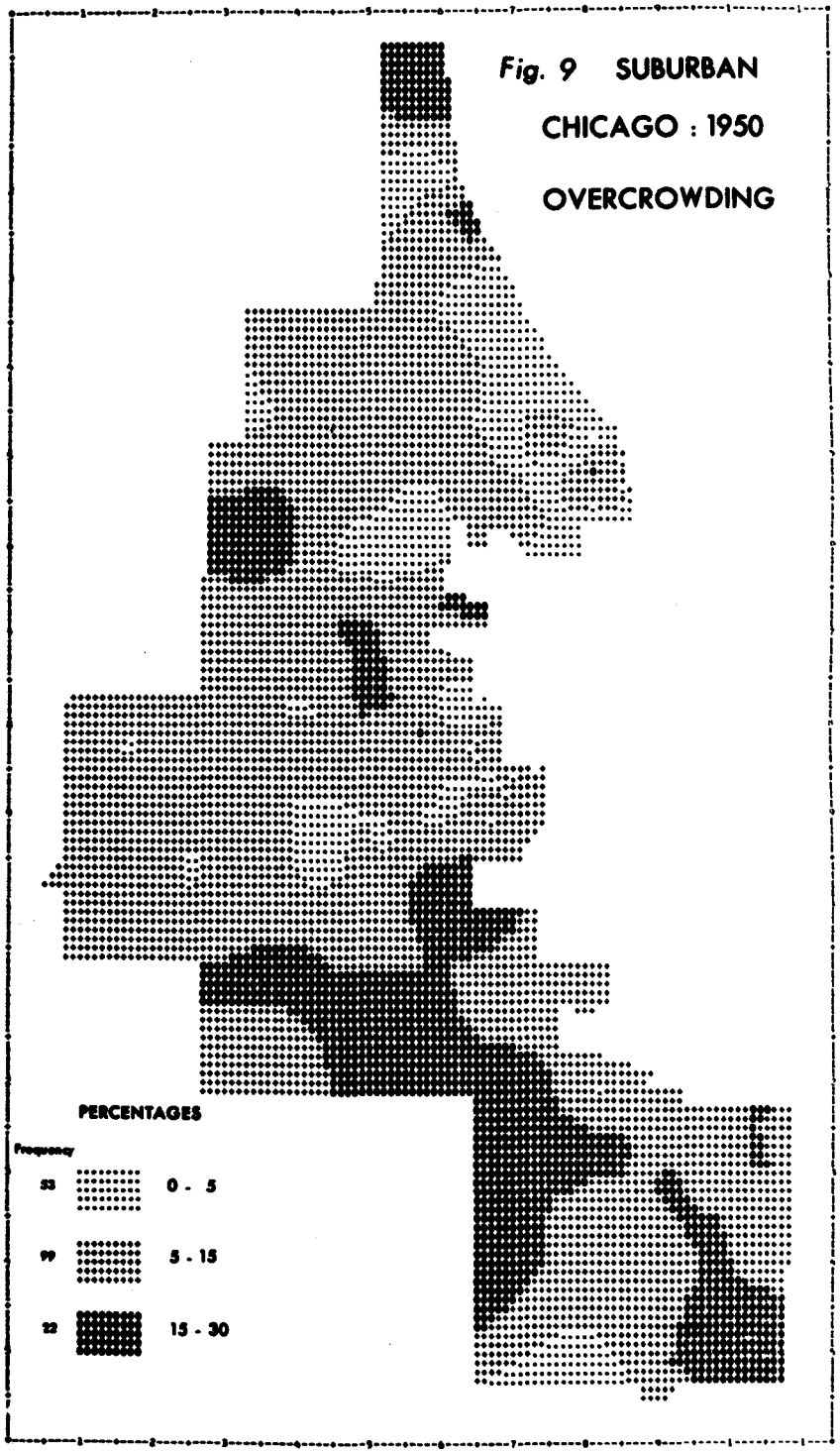
Fig. 9 SUBURBAN
CHICAGO : 1950
OVERCROWDING
PERCENTAGES
Frequency
53 0 - 5
99 5 - 15
22 15 - 30

censuses, however, is feasible. The pattern of deteriorating housing in the city is shown in Fig. 10.[14] The areas thus identified are what some writers have termed the "gray areas"--areas where housing is deteriorating in condition and where dilapidation will occur if preventive action is not taken. Such areas are often the locale of local government conservation and rehabilitation programs and/or Federally sponsored Community Renewal and Model Cities Programs. In Chicago, many areas possess this kind of housing -- districts such as Woodlawn, Englewood, North Lawndale, Austin, Humboldt Park, and Lincoln Square and Uptown all contain some tracts with over a third of their housing stock so classified.

The areas around the Loop show a substantial concentration of deteriorating housing, in the Near North Side, throughout the whole of the West Side and in the widening wedge of the South Side, broken only by the Hyde Park - Kenwood neighbourhood and in areas along the Lakefront where redevelopment has occurred.

The "rural-shack" type of housing, which was a major component of the 1950 suburban pattern, is less clear in 1960,

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[14]Deteriorating housing "needs more repair than would be provided in the course of regular maintenance....it has one or more defects of an intermediate nature that must be corrected if the unit is to continue to provide safe and adequate shelter." U.S. Censuses of Population and Housing: 1960 Final Report PHC (1) -26, Census tracts, Chicago, Illinois, S.M.S.A., Introduction, p. 6.
Dilapidated is defined as in the 1950 Census.

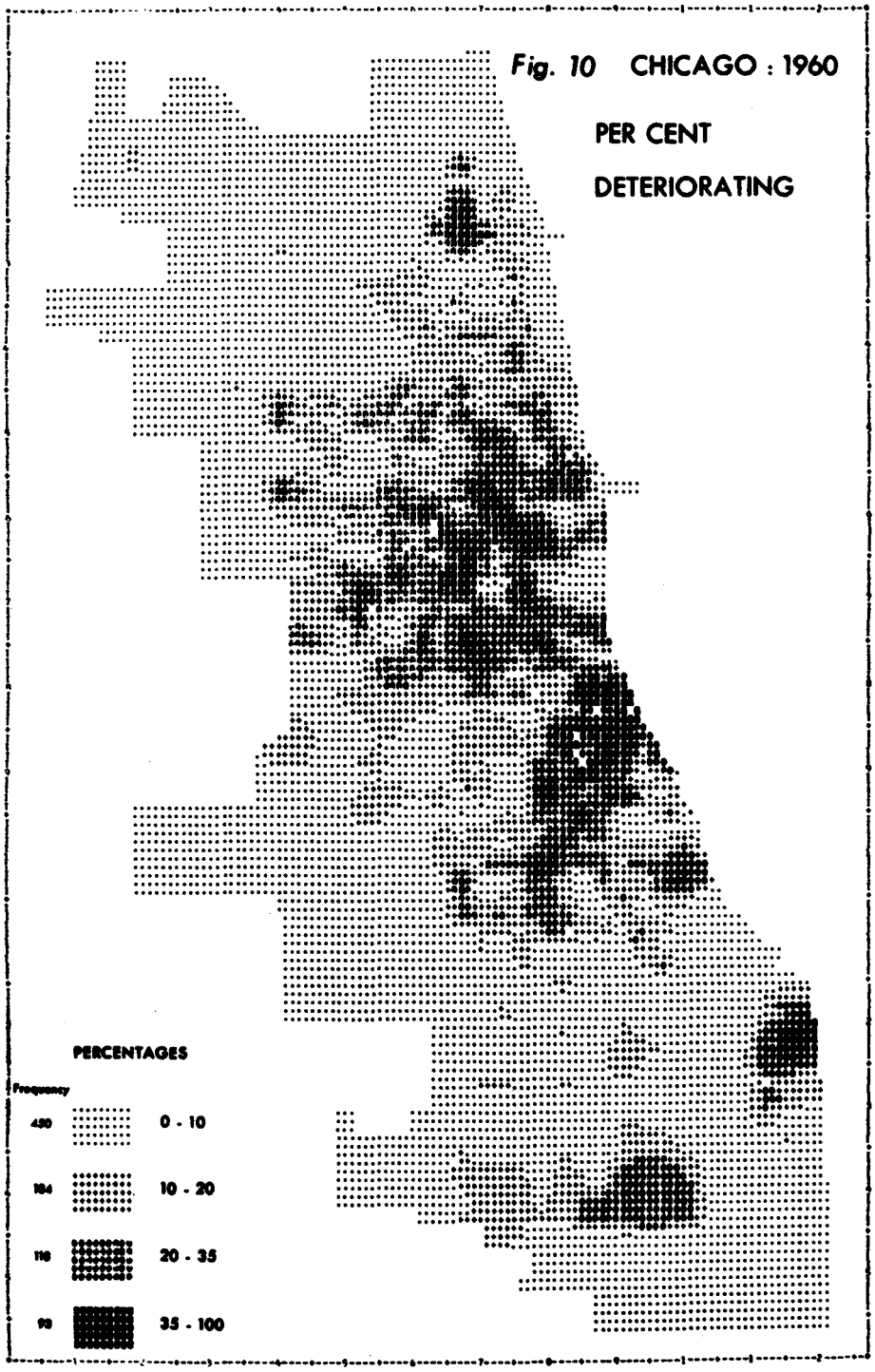
Fig. 10 CHICAGO : 1960
PER CENT
DETERIORATING
PERCENTAGES
Frequency
450
0 - 10
184
10 - 20
118
20 - 35
99
35 - 100

but it is still evident in the extreme south and north-west of the study area -- see Fig. 11. A few areas (representing 8 tracts) have over 20% of their housing stock classed as deteriorating. These are to be found in Cicero, Maywood and Elmhurst in the western suburbs, and in Robbins and the Chicago Heights - East Chicago Heights area in the southern suburbs.

When deteriorating housing and deficient plumbing conditions are combined (Fig. 12), a more clustered pattern is evident -- it is as if the pattern in Fig. 10 had been shrunk. The concentration is more clearly in the areas immediately north, west and south of the Loop with some less strongly defined outliers in Uptown and in the southern districts. The suburban pattern is very similar to, though even more uniform than, that in Fig. 11; thus it is not presented here.

Dilapidated housing, i.e., in the poorest physical condition, is not extensive -- only about 3% of the tracts have more than 25% of their dwelling units in this category (Fig. 13). The largest cluster is immediately south of the Loop, along Roosevelt Road and in scattered locations in the Near North Side, the Near West Side and the South Side black ghetto.

To compare the 1950 housing condition pattern with that of 1960, a composite variable is required. Fig. 14 shows the spatial pattern of this variable for the city.[15] The arc like

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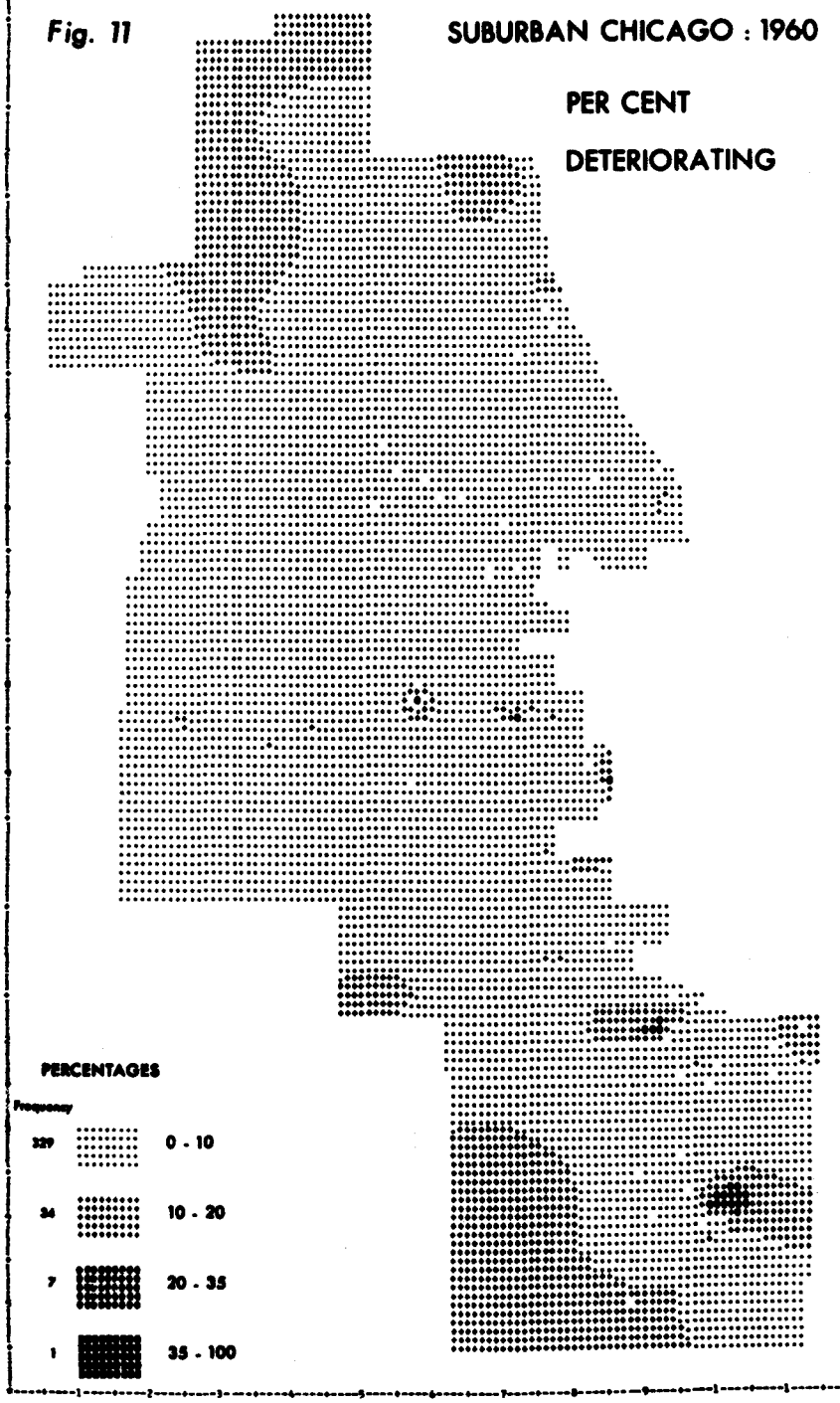
[15]The category described here as blighted is the sum of units which are (a) dilapidated, (b) deteriorating and lacking in plumbing facilities, and (c) sound but lacking in plumbing facilities. This category is then similar to the 1950 classification, dilapidated and no private bath.

Fig. 11

SUBURBAN CHICAGO : 1960

PER CENT

DETERIORATING



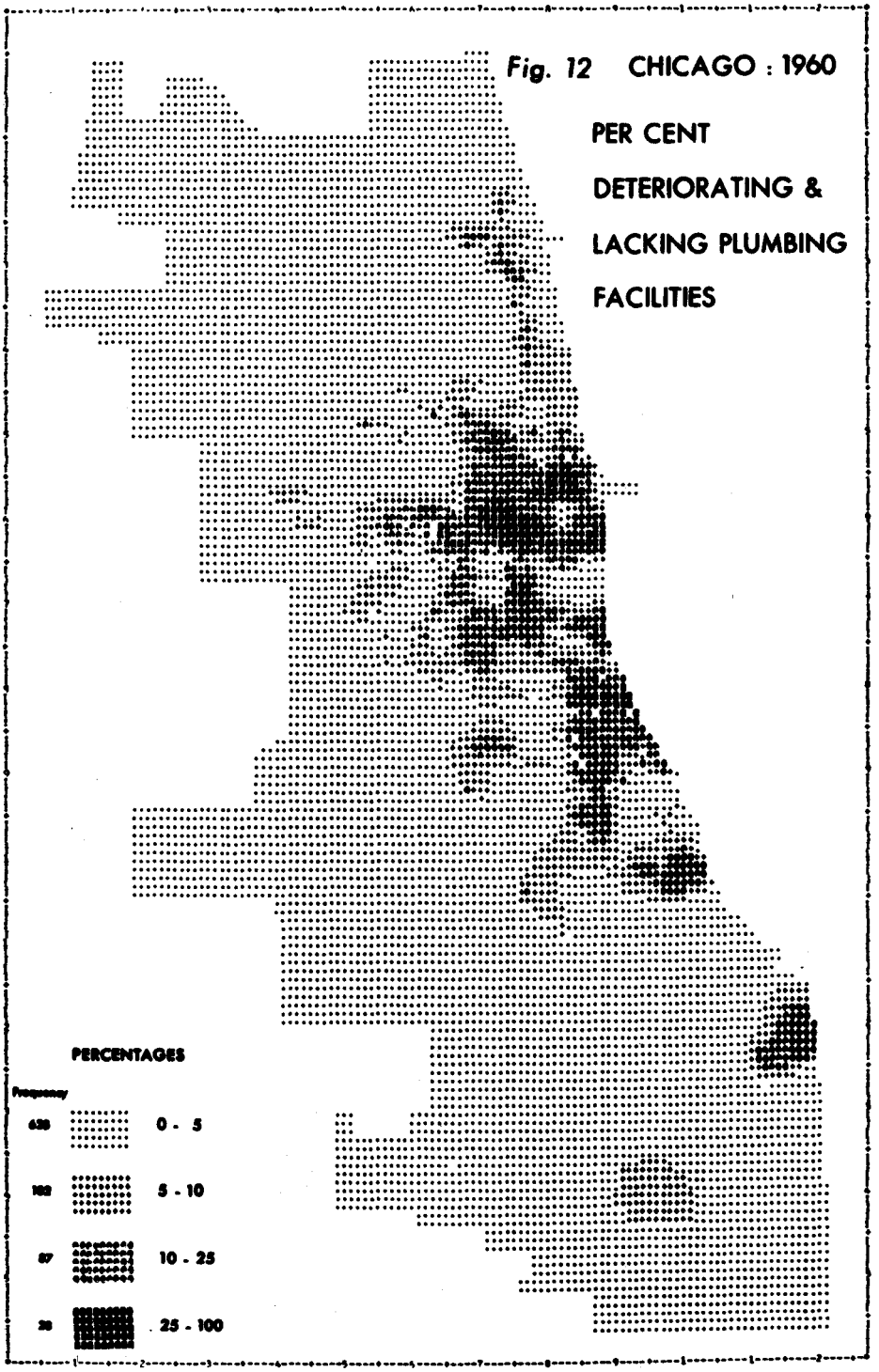


Fig. 12 CHICAGO : 1960
PER CENT
DETERIORATING &
LACKING PLUMBING
FACILITIES
PERCENTAGES
Frequency
0 - 5
5 - 10
10 - 25
25 - 100

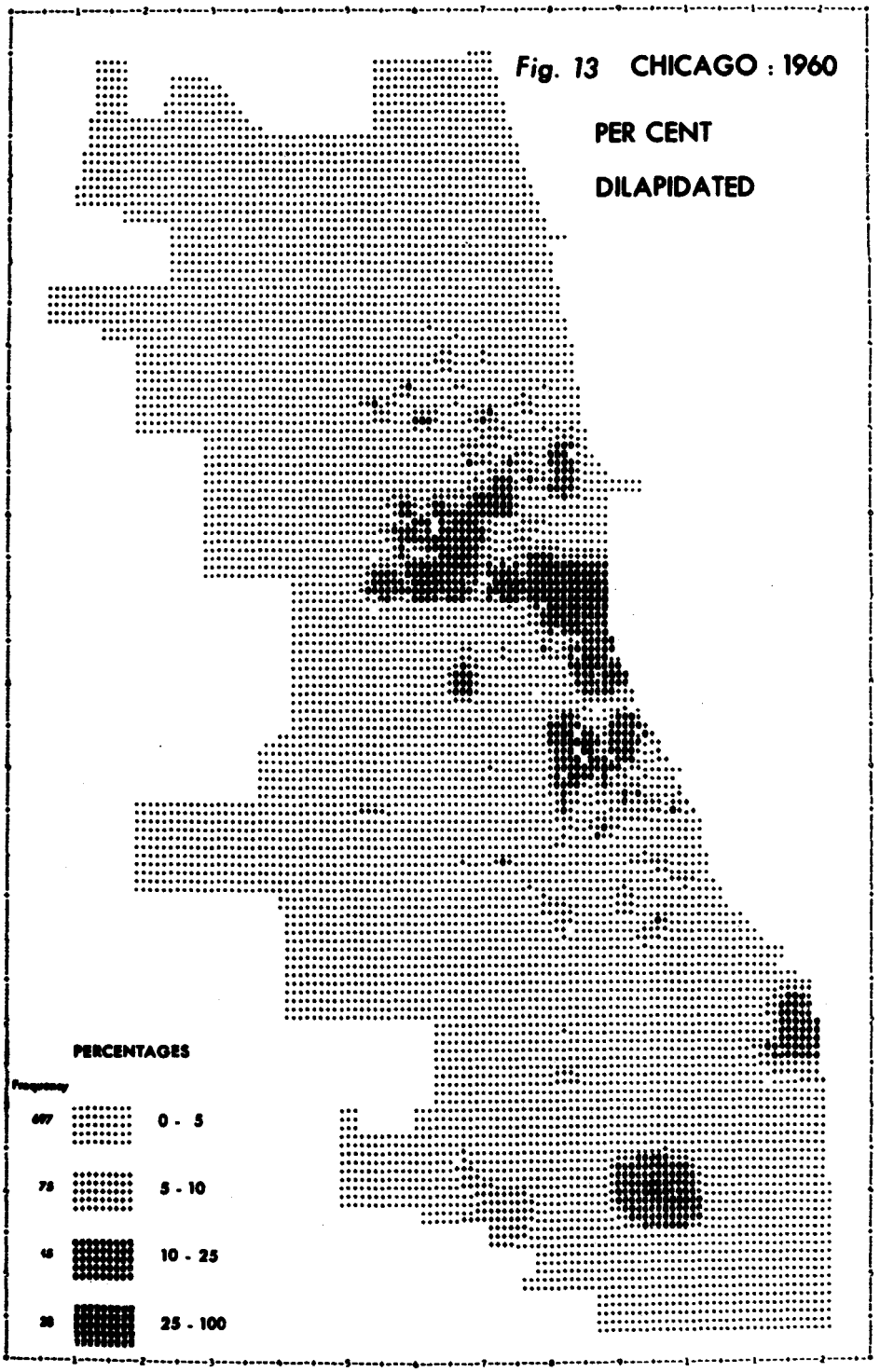


Fig. 13 CHICAGO : 1960
PER CENT
DILAPIDATED
PERCENTAGES
Frequency
697
0 - 5
78
5 - 10
46
10 - 25
28
25 - 100

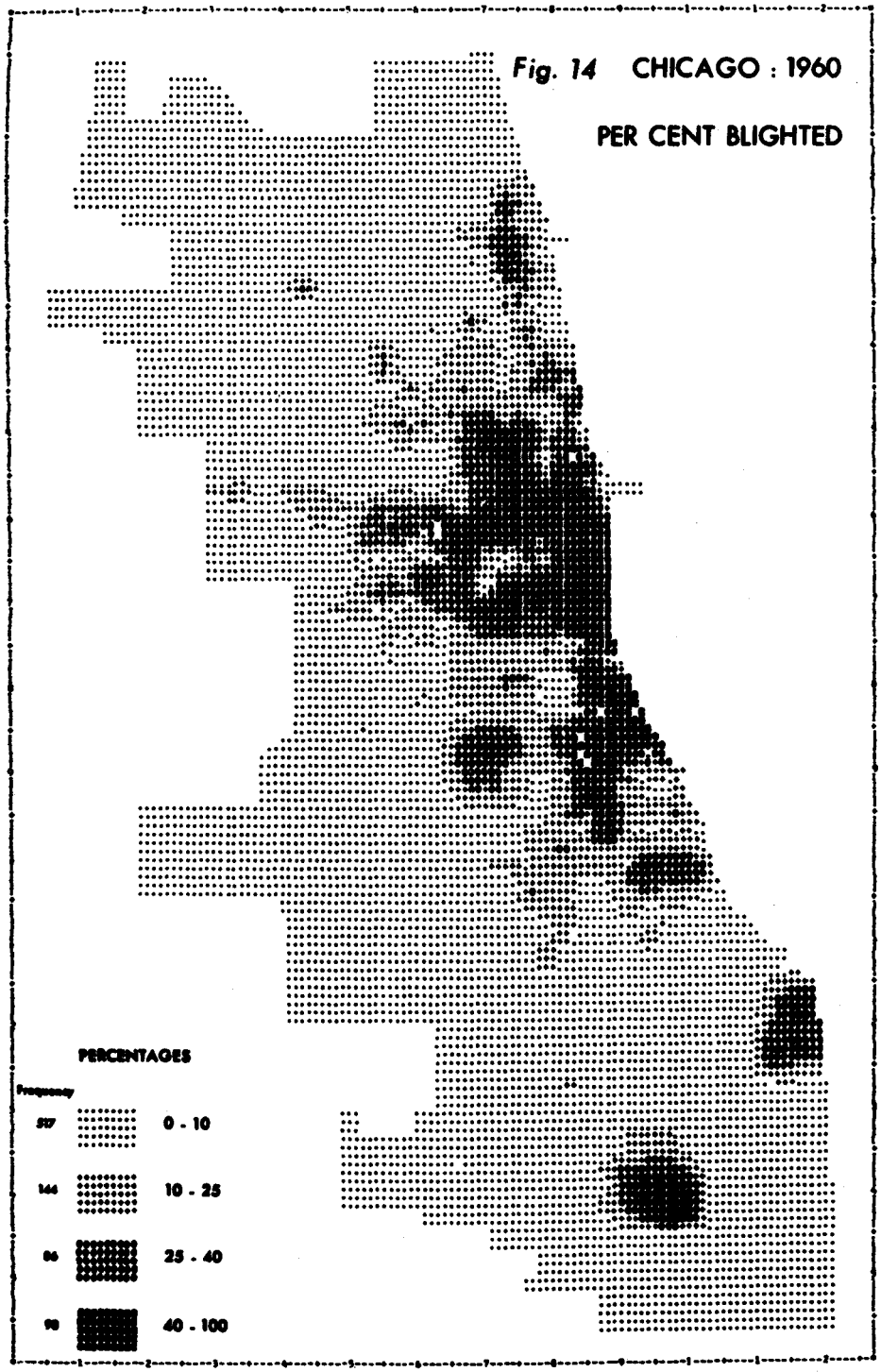


Fig. 14 CHICAGO : 1960
PER CENT BLIGHTED
PERCENTAGES
Frequency
517
0 - 10
144
10 - 25
86
25 - 40
98
40 - 100

area centred on the Loop, stretches from the Uptown district in the north, as far west as Kedzie along Madison and Roosevelt and to Woodlawn and Englewood in the South. The "fingers" described in the 1950 pattern are less identifiable, mainly because of coalescence in the interstitial areas. However, the pattern in its general outline is similar and the details need not be repeated. The suburban area shows very little spatial variation although the southern suburbs are slightly more differentiated than other sectors, showing some concentration in Robbins and East Chicago Heights -- see Fig. 15. An interesting point is that the Harwood Heights - Norridge area that was overcrowded in 1950 is identifiable in this pattern as being somewhat blighted.

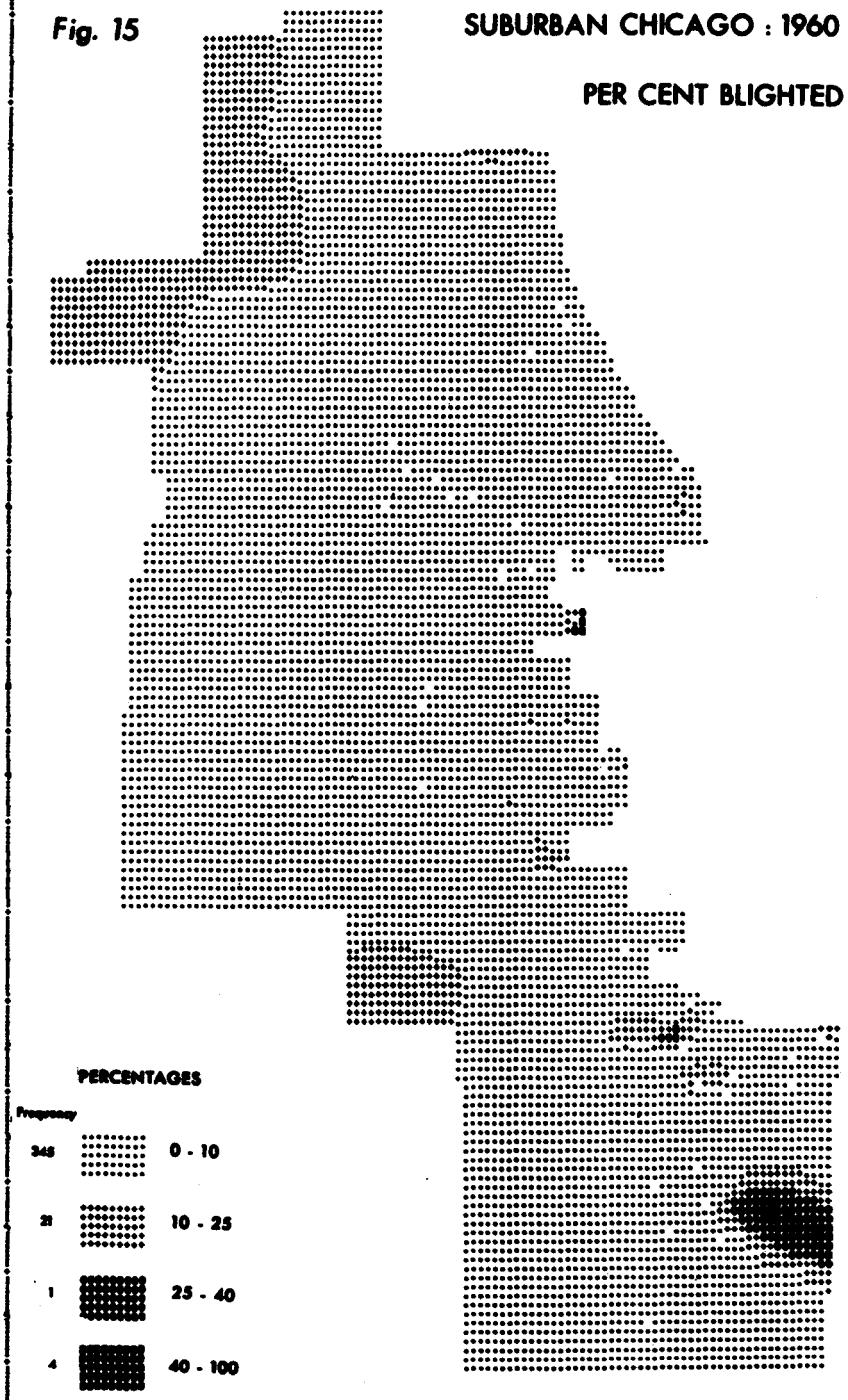
There are almost the same number of tracts having over 25% of their dwelling units overcrowded in 1960 as in 1950, (Figs. 16 and 8) but there are some important spatial differences. In both the northern and southern parts of the city overcrowding has declined, particularly in Uptown, the Near North Side and Ashburn. However, the most overcrowded conditions are more widespread on the West Side and the South Side; this is particularly true at the leading edge of these black residential areas, in Woodlawn, Englewood and North Lawndale. In contrast, there seems to be somewhat of a decline in overcrowding around the Loop area.

In the suburban area, overcrowding is somewhat more common than poor physical condition, but there are still very

Fig. 15

SUBURBAN CHICAGO : 1960

PER CENT BLIGHTED



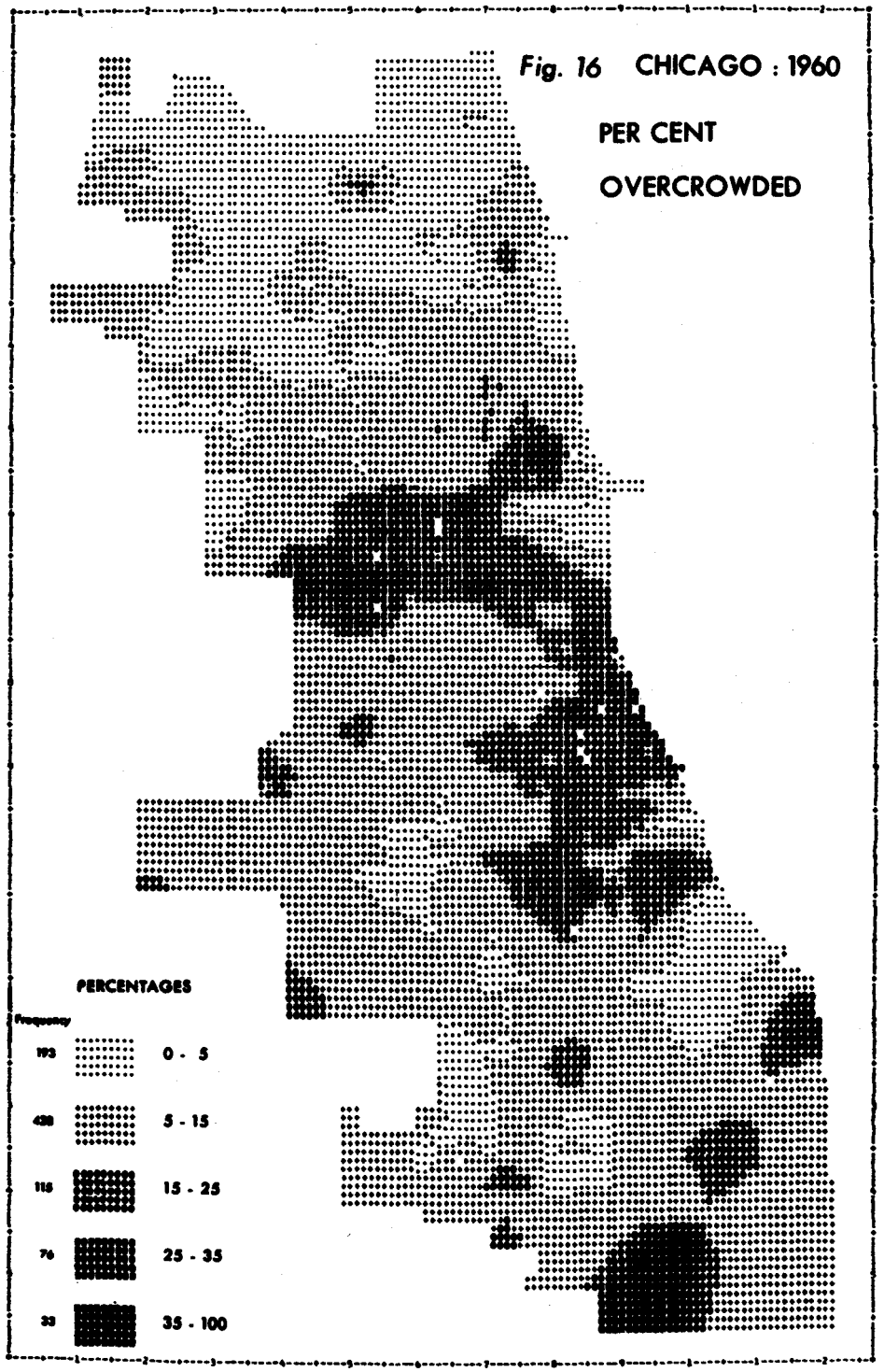


Fig. 16 CHICAGO : 1960
PER CENT
OVERCROWDED
PERCENTAGES
Frequency
193
0 - 5
438
5 - 15
116
15 - 25
76
25 - 35
33
35 - 100

few tracts which are severely overcrowded. There is a general similarity to the 1950 pattern although the rural component is considerably less (Fig. 17). The areas showing some overcrowding include Robbins, East Chicago Heights, and the Harwood Heights - Norridge area (all areas with the highest amounts of blighted housing in the suburbs); also included are pockets in central Evanston and Maywood, Crestwood, and the suburbs around Bedford Park (along the line of the South Chicago River and the Stevenson Expressway).

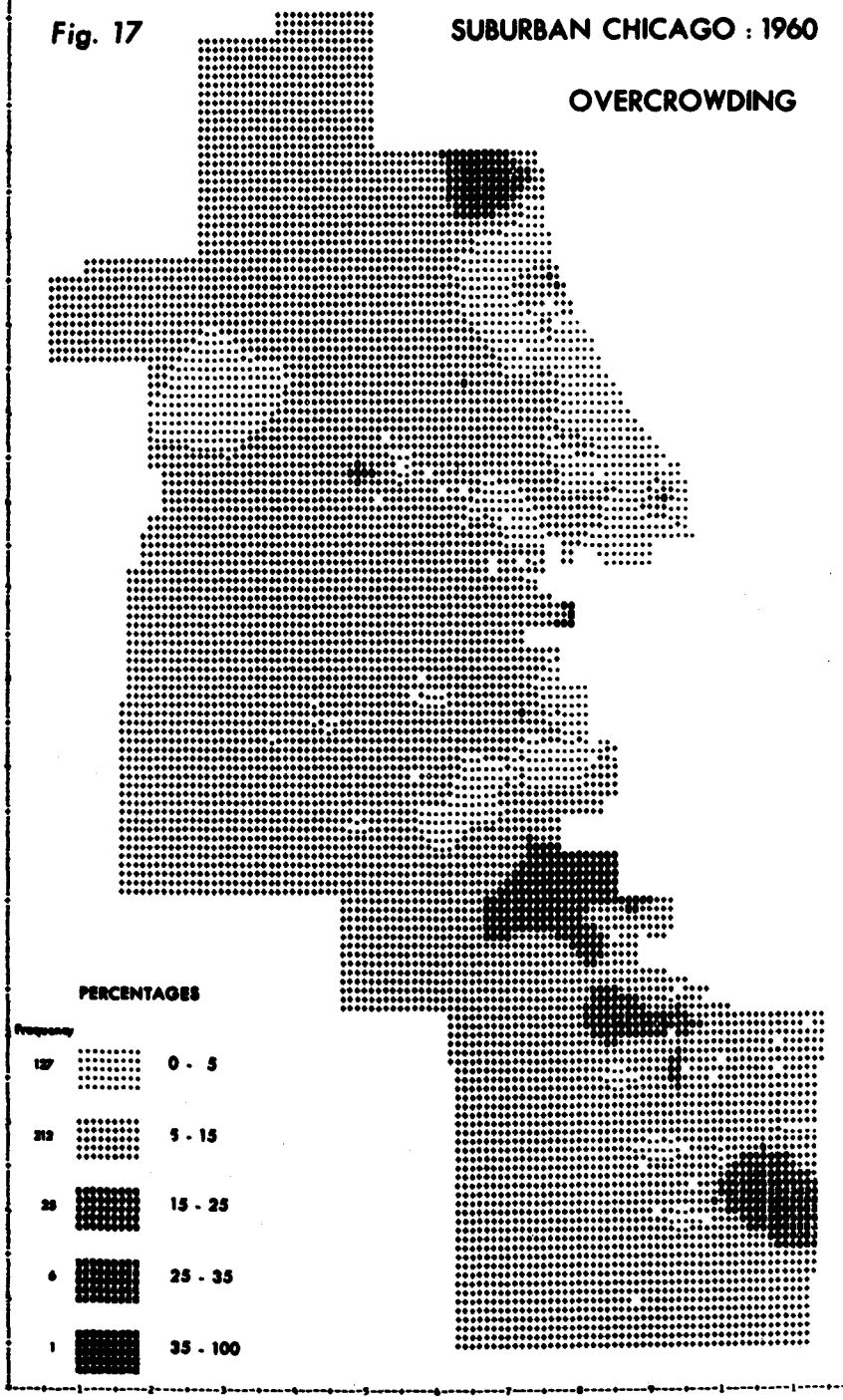
Many of the spatial associations identified in 1940 and 1950 still persist in 1960. This is especially true when the pattern of blighted housing is considered (Fig. 14), rather than dilapidated or deteriorating housing (Figs. 13, 10). The spatial association with the industrial areas is still evident, although this relationship has weakened through time. Another component of the pattern that has weakened is the "rural-shack" type of housing associated with the urban periphery (compare Figs. 6 and 15). However, certain suburbs can be characterised as showing evidence of deterioration and overcrowding. It is not surprising to find that these suburbs are generally of low socio-economic status, sometimes black, and more frequently found in the southern sector of suburbs.

Table 1 shows four sets of factor scores for certain suburbs that have been identified as containing overcrowded and deteriorated housing. The municipalities with the lowest socio-economic status are Robbins and East Chicago Heights,

Fig. 17

SUBURBAN CHICAGO : 1960

OVERCROWDING



both of which are mostly black in population (scores of -1.78 and -2.61 on the first factor and -1.76 and -1.02 on the third factor). Two suburbs appear anomalous -- Evanston and Elmhurst. The overall scores for each municipality disguise the fact that there are low socio-economic status "pockets" within the municipal boundary. This is also true of Maywood. Within Evanston and Maywood, there is a strong, positive association between black occupancy and poor housing quality -- these are the suburban "mini-ghettos."

A strong association is consistently found between areas of black residence and poor housing quality, as measured by physical condition and overcrowding. This is not surprising in view of the evidence from many U.S. cities that black residential areas are generally in poorer condition than other areas of the city.[16] In certain parts of the central city, this relationship is well established by 1940, e.g., in Douglas and Armour Square on the South Side, along Roosevelt Rd. in the Near West Side, and it is beginning to emerge around Madison between Western and Ashland.

As the black population increased in the Near North Side and along Madison by 1950, so do these areas increasingly become characterised by poor housing and overcrowding. This process is continued in 1960 in such areas as Woodlawn, Englewood, and North Lawndale. There seems to be a lag effect present. These

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[16] D. McENTIRE, Residence and Race, (Berkeley, University of California Press, 1960), Chapter 9, Housing Qaulity, Quantity and Cost, pp. 148-156.

TABLE 1

Factor Scores - 1960[a]

Municipality	Socio-Economic Status	State in Life Cycle	Race and Resources	Immigrant and Catholic
Evanston	1.27	-1.45	0.75	-1.06
Highwood	-0.76	-0.64	-0.11	0.33
Harwood Hts.	-0.25	0.28	-0.22	0.92
Norridge	0.07	0.99	-0.08	1.26
Maywood	-0.10	-0.93	0.51	-0.57
Elmhurst	1.17	-0.00	0.67	-0.35
Summit-s	-0.88	-0.25	-0.38	0.73
Justice-s	-0.85	1.11	0.13	0.03
Robbins-s	-1.78	0.41	-1.76	-2.21
Harvey-s	-0.57	-0.39	0.78	-0.69
Calumet City-s	-0.40	0.16	0.35	0.53
Chicago Hts.-s	-0.13	0.13	-0.58	0.41
E. Chicago Hts.-s	-2.61	0.80	-1.02	-2.19

[a]These factor scores are from Rees, op. cit., (Appendix 3).

s-located in the southern sector of suburbs.

areas, which are experiencing black in-movement (or invasion to use the ecological term), show considerable overcrowding in 1960, but blighted housing is still not widespread (although it is more prevalent in Woodlawn than in the other two examples). Subsequent evidence shows that physical deterioration did increase in later years.[17] This type of relationship has already been

[17]For a description of residential conditions in Lawndale in 1966, see D.A. SATTER, "West Side Story," New Republic, vol. 155, (July 2, 1966), pp. 15-19.
By 1967, redevelopment projects were under way in Woodlawn and Englewood, while both areas and Lawndale were designated as Conservation Areas, hopefully to prevent further deterioration of the residential environment.
_____, Community Improvement Program: Proposals for Program Expansion, (Department of Urban Renewal, City of Chicago, March, 1967).

tentatively suggested on the basis of changes in the Uptown area and the Norridge - Harwood Heights district (both have experienced low-income white, not black, in-migration). This relationship is consistent with the notion that overcrowding follows from doubling-up with friends and family and the renting of rooms to lodgers. The extra income gained from so doing allows the household to pay high rents when family income is low. The undue stress of this concentration of people on the physical structure of the dwelling unit results in physical deterioration at a later date. For various reasons, previously discussed, landlords are not likely to maintain the property under these conditions.

Racial change and housing quality, 1940-1960.

The relationship between racial change and housing quality is examined in more detail for seven selected community areas. The results are summarised in Figs. 18, 19 and 20. Four of the community areas, Woodlawn, Englewood, North Lawndale and Near North Side, have experienced racial change, (as defined in the KEY TO FIGS. 18-20). The other three areas are almost completely white, except for a Japanese minority in Uptown. These three areas are used for comparative purposes; Auburn - Gresham and Gage Park are random choices, while Uptown has experienced considerable low income, white in-migration, mostly from Appalachia. The three figures show a general tendency although there are interesting local variations. Most

Fig. 18 OVERCROWDING - 1940 and 1950

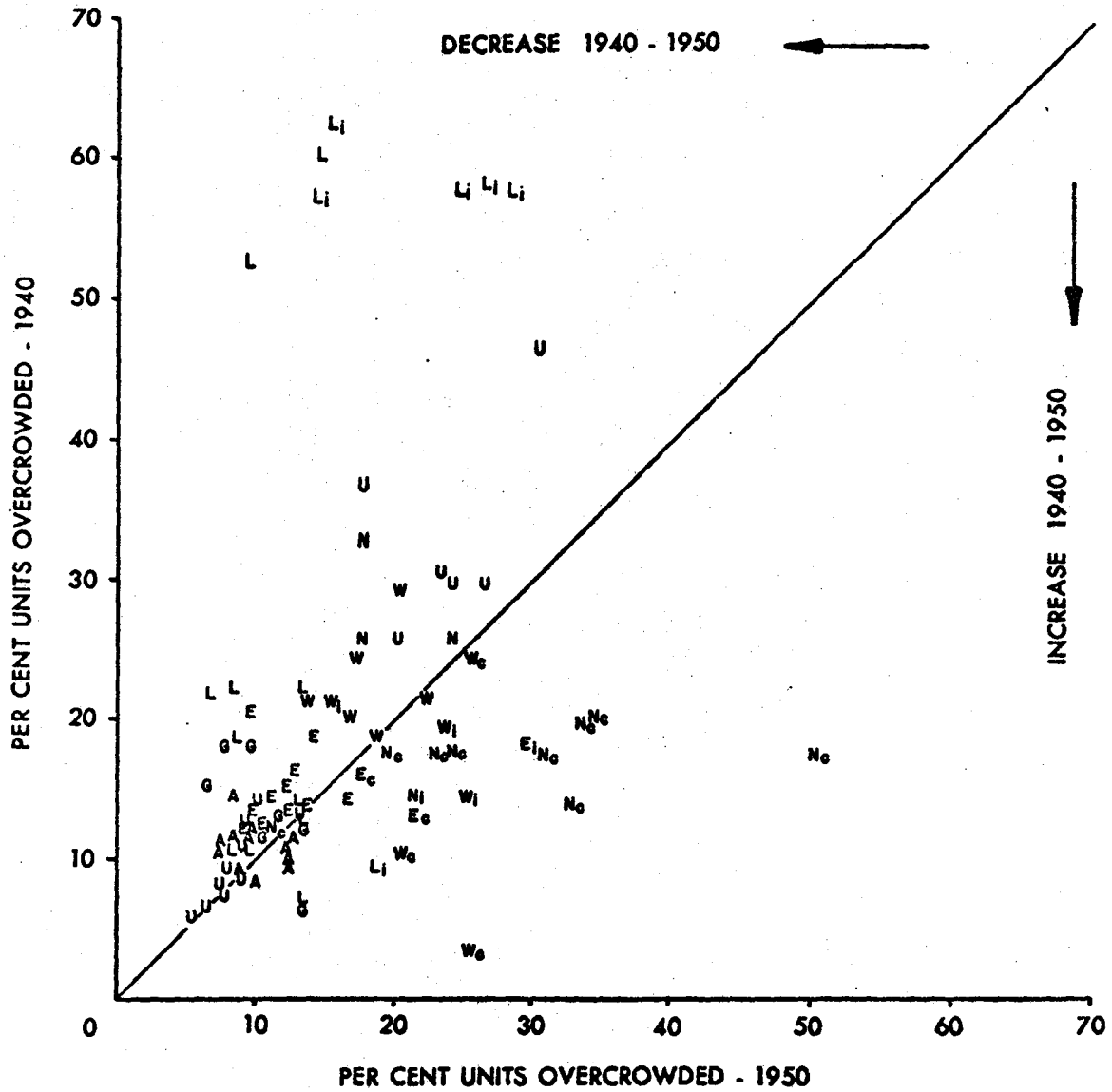


Fig. 19 OVERCROWDING - 1950 and 1960

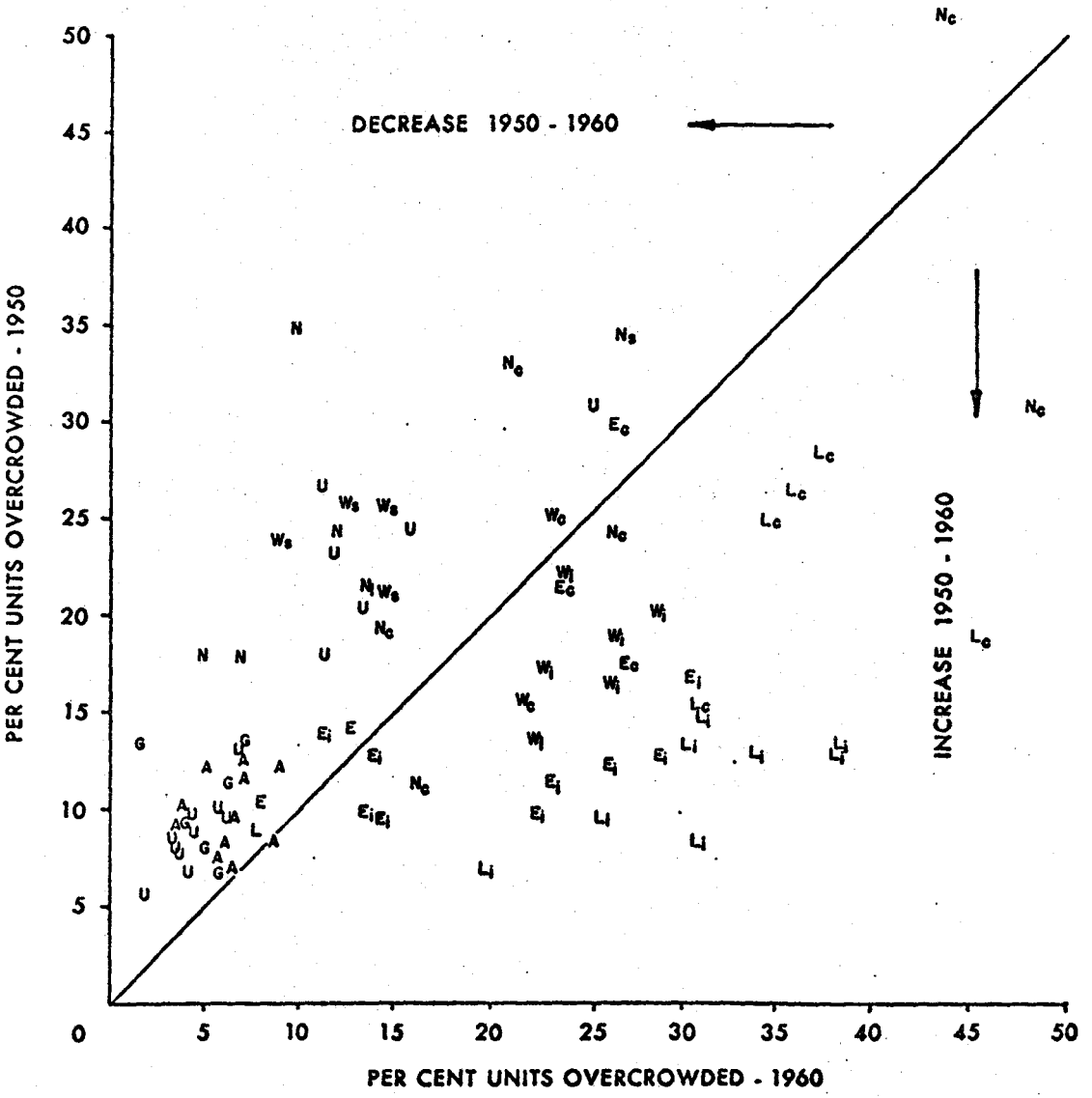
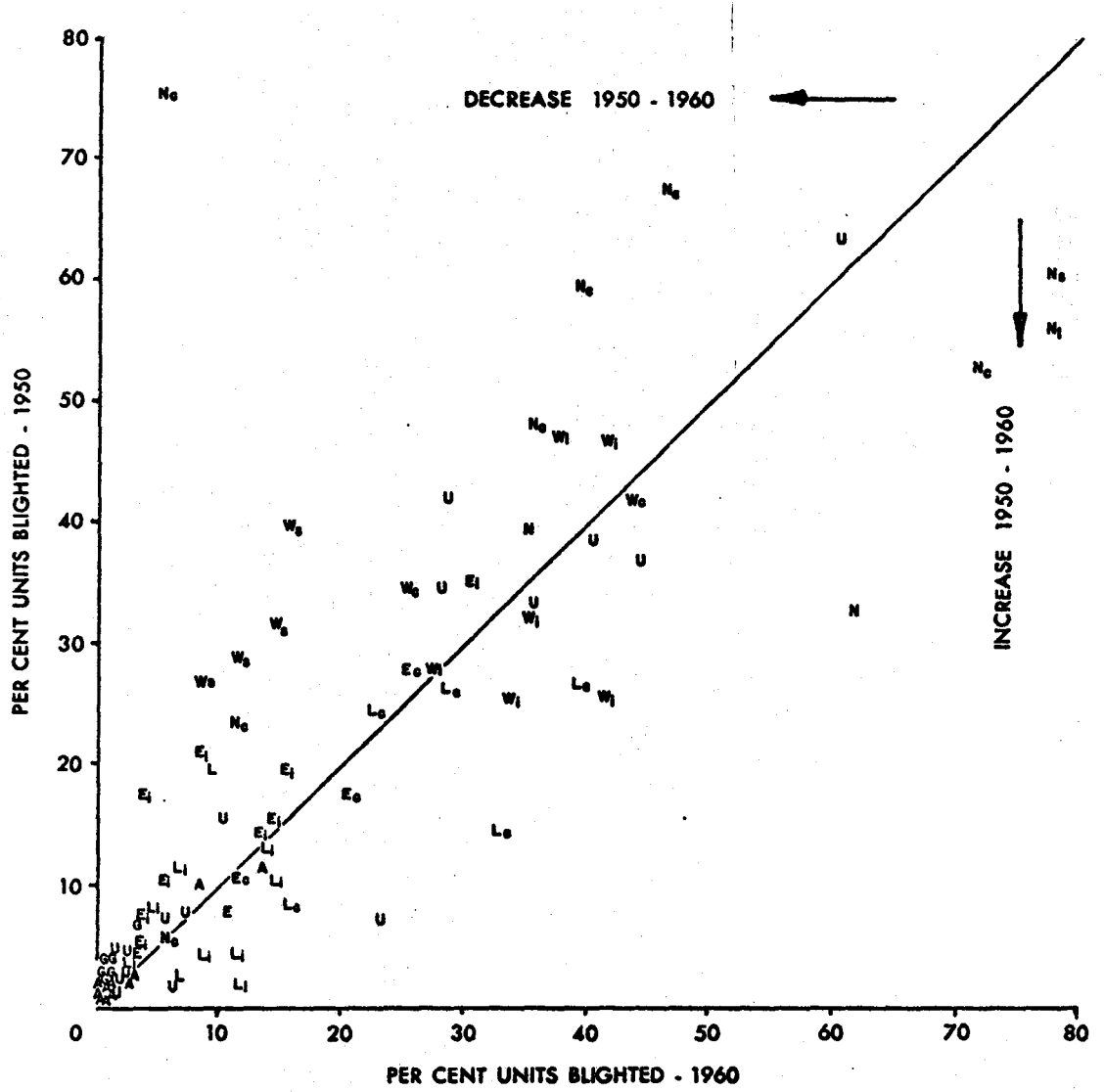


Fig. 20 HOUSING CONDITION - 1950 and 1960



KEY TO FIGS. 18 TO 20

The letters designate census tracts located in the following community areas of Chicago:

U-UPTOWN
G-GAGE PARK
A-AUBURN GRESHAM
L-NORTH LAWNDALE
N-NEAR NORTH SIDE
W-WOODLAWN
E-ENGLEWOOD

The subscripts i, c, s and l denote the racial character of the tract. The categories, i and c, correspond to those used by the Duncans in their study of the Negro population of Chicago -- see footnote 11. Thus, i represents invasion, c represents consolidation, s represents the same (or very slight positive change) and l represents loss. Although the Duncans define their categories very precisely, they are used here in a loose way. Invasion occurs when the percentage of the population that is Negro increases from a very small amount (say, less than 2%) to a more substantial percentage (say, greater than 10%). Consolidation occurs when there is an increase in the percentage. Negro, given an already significant percentage -- examples would be increases from 62% to 98% and 17% to 85%. Very slight positive change, no more than 3% is classed as s, and l represents any percentage decline.

tracts that undergo racial change also show an increase in overcrowding and poor housing condition. The tracts within the all-white community areas, and the mostly white tracts in community areas undergoing racial change, either show little change or a decline in the degree of overcrowding and proportion of poor housing. This tendency is perhaps clearest for change in overcrowding from 1940 to 1950, where almost all the tracts undergoing racial change are in the area of increase, below, and to the right of, the no change line. The exception is in Lawndale where sizeable decreases occur in tracts which are invaded by blacks and abandoned by Polish and Russian Jews.

The tendency is weaker in the period from 1950 to 1960. The conditions in Woodlawn and Near North Side appear to be the major contributors to the weakening of the relationship. Unlike tracts in other areas, those in Near North Side show little tendency to cluster, although the majority of the tracts are in the area of decrease. In Woodlawn, those census tracts which show little or no racial change from 1950 to 1960 are found clustered in the areas of decrease in both Figs. 19 and 20. These are tracts which were already 97-99% black in population by 1950. As previously noted, it is perhaps too early (in 1960) to observe deterioration in housing condition in the areas of recent black in-migration. There are also some striking absolute differences in housing quality between the all-white areas clustered on the lower end of the scales, and the tracts experiencing racial change.

Too little is known about other possible factors which may be operating in these situations to make any strong inferences or causal connections. Nonetheless, there does seem to be a positive relationship between racial change and a reduction in the quality of available housing. In contrast, once the racial change has stabilised, the degree of overcrowding declines, as does the proportion of poor housing. The evidence to support this last point is, however, slender.

1950-1960.

Many of the changes in the pattern of overcrowding from 1940 to 1950, and 1950 to 1960, have been discussed. The change in physical condition can only be measured by comparing the categories, dilapidated and no private bath (1950) with that of blighted (1960) -- it will be remembered that the latter is a composite classification.

The change in percent of housing stock occurring in these categories is shown in Fig. 21.[18] In general, there has been a decline in physical deterioration throughout the city -- only about 7% of the tracts show any sizeable increase (over 6%); in contrast, almost 30% of the tracts showed declines of over 5%. In Fig. 18, the darkest areas are those which increased in residential blight from 1950 to 1960; the zero contour is shown

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[18] Because the areal units are not comparable, except in some of the older suburbs, a similar map cannot be produced for the suburban area.

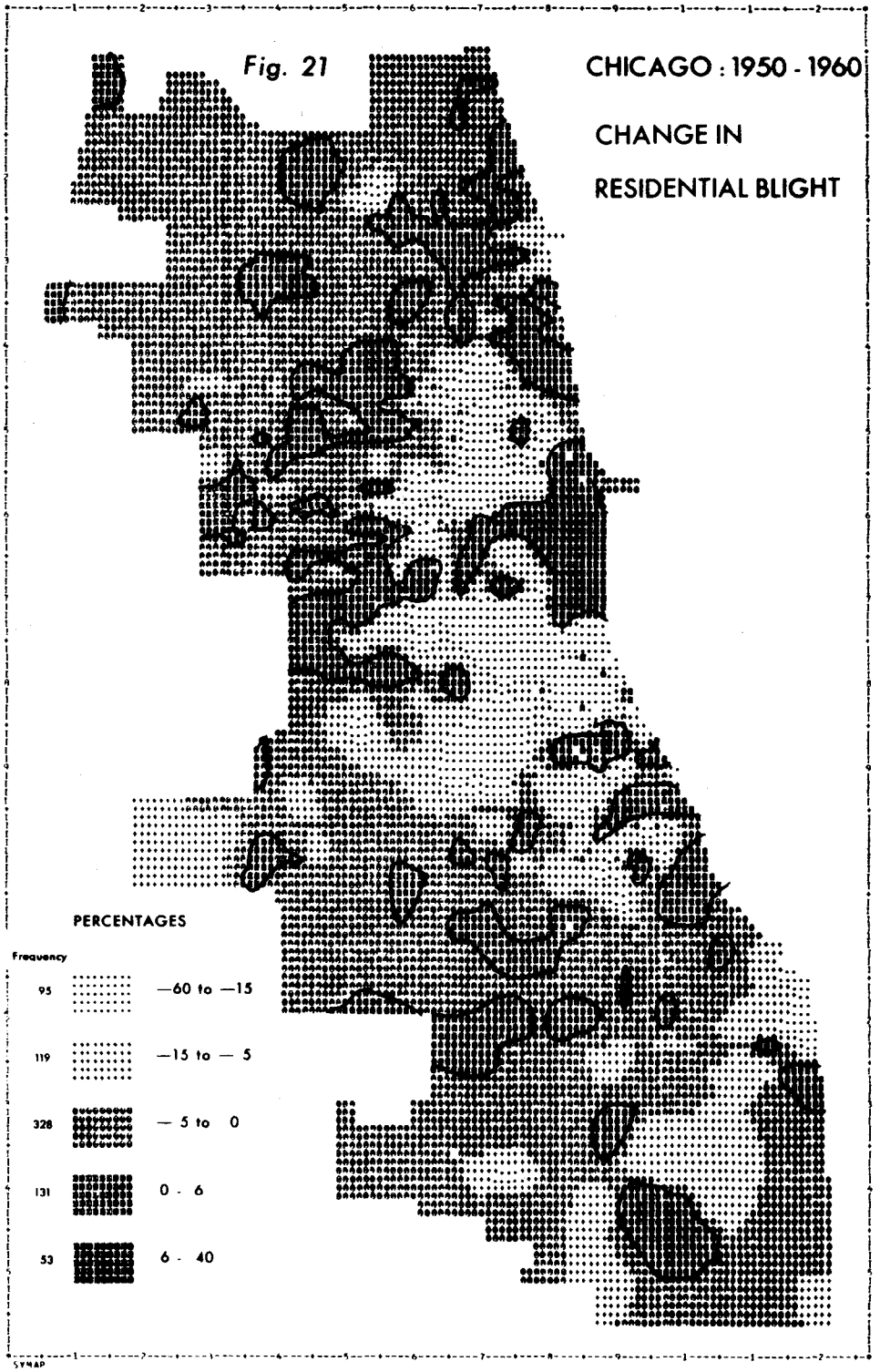
Fig. 21
CHICAGO : 1950 - 1960
CHANGE IN
RESIDENTIAL BLIGHT
PERCENTAGES
Frequency
95
—60 to —15
119
—15 to — 5
328
— 5 to 0
131
0 - 6
53
6 - 40
SYMAP

by the dark line. The areas of greatest decline are in the areas of poorest housing as identified from the 1950 and 1960 maps -- the broad band around the C.B.D., the areas along the branches of the Chicago River, the area around the Stockyards in New City, and the industrial areas in the extreme south of the city. The impact of public programs is certainly evident on both the South and West Side, e.g., in the Douglas district where there has been considerable redevelopment.[19]

The areas showing an increase seem to be adjacent to those areas which declined most; this is somewhat suggestive of a displacement effect (the term slum-shifting has been used in comments about urban renewal programs). Thus, tracts immediately adjacent to the Loop increased as did areas that were beyond the worst areas in 1950. Such districts as Lincoln Square, Logan Square, North Park, and Irving Park to the north, the Garfield Park and Lawndale areas to the west, and Woodlawn, West Englewood, and Auburn - Gresham to the south are the developing "gray areas."[20] Some, but not all, of these areas were

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[19]A description such as this scarcely does justice to the reality of the situation. A recent study of Chicago graphically illustrates the conditions in the blighted areas and the impact of renewal and expressway programs.
H.M. MAYER and R.C. WADE, Growth of a Metropolis -- Chicago, (Chicago, University of Chicago Press, 1969), pp. 375-410, p. 414, and p. 445.

[20]It is no surprise to find many of these areas appearing on the list of the City of Chicago's renewal and rehabilitation areas by the late 1960's.

experiencing pressure from expanding black residential districts closer to the central core.

Generalisation of the pattern.

In Chapter I, the idea is presented that the distribution of residential blight in an urban area can be thought of as a surface. As can be seen from the preceding maps, the surface has considerable variation with some areas having very high amounts of residential blight, while others have much less; this statement is more true of the central city than of the suburban area.

Trend surface fitting is one way in which individual variations are smoothed out and the regional (or general) trend becomes apparent -- local variations are thus represented by the residuals from the trend surface. This technique, therefore, provides a convenient general description.[21]

Figs. 22 and 23 show the third order trend surface for 1950 (dilapidated and no private bath) and 1960 (the composite measure, blighted, which is comparable to the 1950 variable).[22]

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[21]Goheen has used this method somewhat similarly to map factor scores and provides a concise discussion of trend surface analysis as a mapping tool.
P. GOHEEN, Victorian Toronto 1850-1900, (Department of Geography, Research Paper No. 127, University of Chicago, 1970), pp. 111-114.

[22]The standard SYMAP procedure has been now provided with an additional elective which performs a trend surface analysis on the data supplied. Specified surfaces are then mapped in the usual manner of contour mapping. The trend surface analysis is a version of the Kansas program CC03.

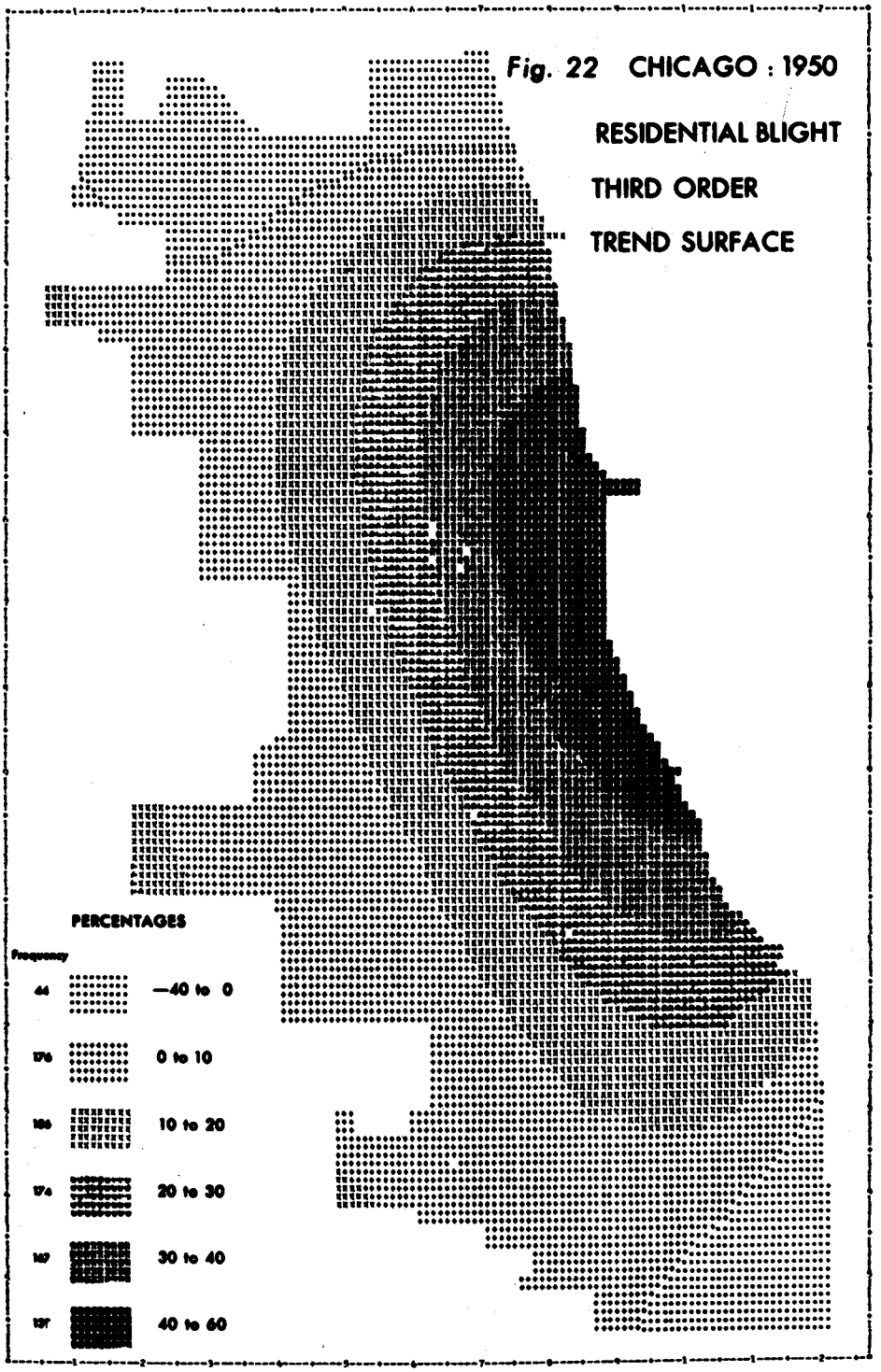
Fig. 22 CHICAGO : 1950
RESIDENTIAL BLIGHT
THIRD ORDER
TREND SURFACE
PERCENTAGES
Frequency
44
—40 to 0
176
0 to 10
186
10 to 20
174
20 to 30
147
30 to 40
127
40 to 60

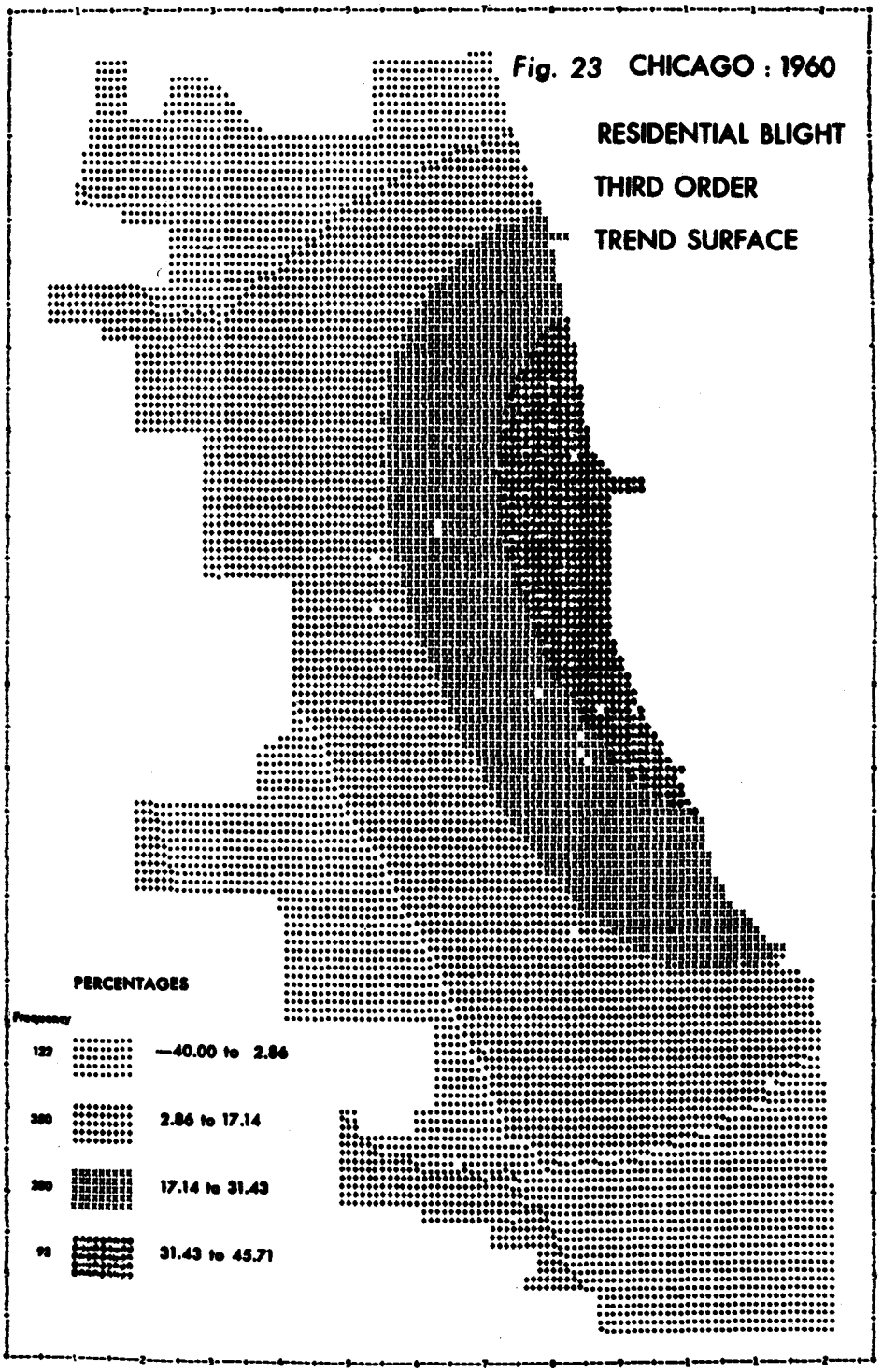
Fig. 23 CHICAGO : 1960
RESIDENTIAL BLIGHT
THIRD ORDER
TREND SURFACE
PERCENTAGES
Frequency
122 —40.00 to 2.86
300 2.86 to 17.14
280 17.14 to 31.43
93 31.43 to 45.71

The appropriate error measures for the trend surface fitting are shown in Table 2. In both cases, the third order surface is only a slightly better fit than the second order surface which, when mapped, showed a similar pattern -- the differentiation occurs at the city boundary where there is an upturn on the third order surface. The fifth and sixth order surfaces when mapped seemed to "decompose" and were impossible to interpret.

A very definite zonal pattern to the regional trend is apparent for both time periods. This is remarkably similar to Burgess' generalised zonal model for urban areas. There is some southward distortion of the concentric zones as a result of the importance of the South Side ghetto element and the poor housing areas around the Calumet River.

TABLE 2

Trend Surface Analysis: Error Measures

Surface	Total Variation	Variation Explained by Surface	Coefficient of Determination	Coefficient of Correlation
		1950		
First Degree	457,812.37	72,323.50	0.158	0.397
Second Degree	457,812.37	167,316.44	0.365	0.605
Third Degree	457,812.37	208,405.00	0.455	0.675
		1960		
First Degree	310,424.50	44,918.88	0.145	0.380
Second Degree	310,424.50	94,705.94	0.305	0.552
Third Degree	310,424.50	103,267.37	0.333	0.578

Summary.

The maps presented in this chapter show that poor housing quality is concentrated in only a few sections of the urban area, particularly in the central city around the central business district. Of the different measures used, overcrowding is more widespread than either structural condition and/or lack of plumbing facilities.

Through time, there is a general improvement in housing quality with fewer units being overcrowded and/or in poor condition. Some areas, however, did deteriorate. These are frequently adjacent to areas that showed the greatest reduction in poor quality or blighted housing. This reduction occurred in a broad band around the Loop area. Thus, the worst areas are at an increasing distance from the central core of the city. Some suburban "pockets" of low quality are also evident.

Other spatial relationships are observed. There are strong and persistent areal associations between industrial areas, areas of black residence, the rural-urban fringe and residential blight. The most persistent relationship is between the black areas and poor quality housing; the other associations weaken through time.

There appears to be a cyclical quality to the pattern of overcrowding. This, and the association with areas of black occupance, is investigated in greater detail for seven selected community areas. A tendency for overcrowding and deterioration

of the housing stock to occur as an area experiences racial change is noted. The deterioration seems to lag behind the overcrowding, but more information as to a possible relationship here is needed.

The spatial pattern of housing condition is nicely summarised in a zonal fashion through the fitting of a trend surface for both 1950 and 1960.

CHAPTER VI

EXPLANATION OF THE SPATIAL PATTERN

In this chapter, the hypotheses stated in Chapter four are tested. This done by using the results of a number of regression and correlation analyses. Regression equations can also be used in causal modelling. Following Blalock, some possible causal models are proposed and evaluated using correlation coefficients.[1]

The chapter falls into four sections. Firstly, the nature of the variables used and the inter-relationships among variables are discussed. Secondly, the results of the multivariate analysis are reported. Thirdly, the hypotheses are discussed in the light of the empirical results and, fourthly, there is the evaluation of alternative causal models.

The Data.

In Appendix 1, all variables employed in the analyses for 1950 and 1960, and in the analysis of change from 1950 to 1960, are operationally defined. Most of the inadequacies concerning the housing vaiables have already been noted (see Chapter 2 and Chapter 5, footnote 8).

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[1] H. BLALOCK, Causal inferences in nonexperimental research, (Chapel Hill, University of North Carolina Press, 1964), pp. 43-44.

The various socio-economic variables selected as explanatory (or independent) variables also have certain weaknesses. Possibly the major problem is the relative grossness of many of the variables. This is particularly true, for example, of the data on in-migration (see the comments in Appendix 1). Some measures might be made more sensitive. Thus, as an alternative to median income, the percent of families and unrelated individuals above and below some specified income levels could be used to measure high and low income.

One problem encountered in census data is that of missing data when medians are reported. If the base population is below 200 for sample data, the median value is not reported.[2] The interpolation method used to overcome this problem in the case of median income is outlined in Appendix 3.

A comparison of the means and standard deviations of the variables indicates in a general way how they have changed from 1950 to 1960 -- see Tables 3, 4 and 5.[3]

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[2]The particular computer programs in the Department of Geography Program Library at Iowa which are used, notably CORRE, do not take account of missing data. Therefore, blanks on the data tapes are treated as zero values and the results are affected accordingly. Since a number of library programs had already been modified, it was decided to overcome this problem differently, rather than undertake additional time-consuming modifications.

[3]The abbreviated names listed in Tables 3, 4 and 5 are used throughout this chapter.

TABLE 3

Mean and Standard Deviation of
Variables Used in the Analysis - 1950

Variable	Abbreviation	Mean	Standard Deviation	Coefficient of Variability
No private bath or dilapidated, percent	NPBORD	18.55	21.65	1.17
No running water or dilapidated, percent	NRWORD	7.18	12.57	1.75
Persons per room, percent	PERPRM	14.18	9.78	0.69
Foreign born, percent	FORBRN	13.73	7.02	0.51
Non-white, percent	NONWHT	12.06	28.38	2.35
Negro, percent	NEGRO	11.60	28.09	2.42
Households, number of	HHSLD	1302.56	915.81	0.70
Migrant 1, percent	MGRNT1	3.02	3.59	1.19
Migrant 2, percent	MGRNT2	10.16	6.15	0.61
Median income	INCOME	3631.13	1074.01	0.30
Fertility ratio	FRTRAT	0.40	0.17	0.43
Owner-occupied, percent	OWNED	38.40	24.98	0.65
Rented, percent	RENTED	59.76	24.78	0.41
Vacant, percent	VACANT	0.80	1.02	1.27
Single family dwelling units, percent	SFDU	27.48	28.47	1.04
Apartments, percent	APTS	29.55	27.01	0.91
Distance to CBD	DIST	7.62	5.12	0.67
Population change, 1940-1950, percent	POPCHG	12.80	44.31	3.46
Change in non-whites 1940-50, percent	CHGNWT	1358.50	8435.87	6.21

Coefficient of variability = standard deviation/mean

TABLE 4

Mean and Standard Deviation of
Variables Used in the Analysis - 1960

Variable	Abbreviation	Mean	Standard Deviation	Coefficient of Variability
Deteriorating, percent	DETER	11.47	14.18	1.24
Deteriorating, lacking plumbing facilities, percent	DETLPF	3.28	6.67	2.03
Dilapidated, percent	DILAP	2.94	8.14	2.77
Residential blight (1950), percent	RB1950	11.22	17.20	1.53
Bathroom, shared or none, percent	BTRMSN	9.43	15.39	1.63
Persons per room, percent	PERPRM	10.90	8.84	0.81
Negro, percent	NEGRO	15.92	32.92	2.07
Other race, percent	OTRACE	0.60	2.48	4.13
Foreign stock, percent	FORSTK	33.99	17.34	0.51
Foreign born, percent	FORBRN	10.71	7.43	0.69
Migrant 1, percent	MGRNT1	7.30	6.20	0.85
Migrant 2, percent	MGRNT2	40.61	10.57	0.26
Fertility ratio	FRTRAT	0.54	0.18	0.33
Owner occupied, percent	OWNED	47.16	29.76	0.63
Rented, percent	RENTED	48.65	31.10	0.64
Vacant, percent	VACANT	3.26	3.40	1.04
Single family dwelling units, percent	SFDU	43.17	36.64	0.85
Apartments, percent	APTS	24.46	27.87	1.14
Distance to CBD	DIST	9.71	6.92	0.71
Median income	INCOME	6389.16	2214.11	0.35

TABLE 5

Mean and Standard Deviation of
Variables Used in the Analysis 1950 - 1960

Variable	Abbreviation	Mean	Standard Deviation	Coefficient of Variability
Change in percent of residential blight	CHRBLT	-4.25	11.29	-2.65
Change in percent of persons per room	CHPPRM	-2.71	7.53	-2.78
Percentage change in population	POPCHG	2.99	63.21	21.14
Change in percent of foreign born	CHFORB	-2.05	6.05	-2.95
Change in percent of Negro	CHNGRO	10.15	25.33	2.50
Change in percent of non-white	CHNWHT	10.41	25.06	2.41
Percentage change in households	CHHSLD	14.57	99.90	6.86
Percentage change in income	DIFINC	64.72	184.51	2.85
Change in fertility ratio	CHFRAT	0.14	0.15	1.07
Change in percent of owner occupied	CHOWN	0.33	4.40	13.33
Change in percent of rented	CHRENT	-3.23	4.50	-1.39
Change in percent of vacant	CHVAC	2.60	2.92	1.12
Change in percent of apartments	CHAPTS	-1.33	11.48	-8.63
Change in percent of single family dwelling units	CHSFDU	3.66	11.15	3.05
Change in percent of movers	CHMOVR	39.54	14.66	0.37
Distance to CBD	DIST	6.13	2.94	0.48

As expected from the map interpretation, there is a substantial drop in the means for housing condition from 18.55 for NPBORD to 11.22 for RB1950. The decline is less for overcrowding with PERPRM in 1950 = 14.18 and PERPRM in 1960 = 10.90.

Other changes in the Chicago data are consistent with general trends in U.S. urban areas - the black population is increasing while the foreign born immigrants are decreasing, relative to the total population. There is a large increase in median income and, not unexpectedly, home-owning has increased relative to renting. The increased amount of vacancy indicates a relatively looser housing market in 1960.

The distribution of the variables can be determined from the construction of histograms and the use of a test for normality.[4] None of the variables are normally distributed, as indicated by the test for normality, except for FORBRN, 1950. For both 1950 and 1960, the housing variables are positively skewed and, in general, have a reverse J shape. The frequency distributions for the independent variables are summarised in Table 6. Given that almost all of the

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[4]The test for normality used is a Kolmogorov-Smirnov test, which compares the cumulative frequency distribution of the test variable against that of a normal distribution. This test is provided in NORML, a program in the Department of Geography Program Library, University of Iowa. This, and all other computations, were carried out on the University of Iowa's IBM 360.

TABLE 6

Summary Table for Frequency Distributions[a]

Variable Name	Skewness	Type of Modality
	1950	
FORBRN	normal	unimodal
NEGRO	positive	bi-modal
HSLD	positive	unimodal
INCOME	slight negative	unimodal
MGRNT1	positive	unimodal
MGRNT2	positive	unimodal
FRTRAT	slight negative	unimodal
OWNED	positive	bi-modal
RENTED	negative	tri-modal
VACANT	positive	unimodal
SFDU	positive	bi-modal
APTS	positive	unimodal
DIST	positive	unimodal
	1960	
NEGRO	positive	bi-modal
OTRACE	positive	unimodal
FORSTK	negative	tri-modal
FORBRN	positive	unimodal
MGRNT1	positive	unimodal
MGRNT2	slight positive	unimodal
FRTRAT	v. slight positive	unimodal
OWNED	positive	bi-modal
RENTED	positive	bi-modal
VACANT	positive	unimodal
SFDU	positive	bi-modal
APTS	positive	unimodal
HSLD	positive	unimodal
INCOME	slightly negative	unimodal

[a]All variables are leptokurtic

variables are non-normal, this raises the question of transformations to achieve normality. The necessity of having normally distributed variables is less of a problem here since no statistical inference is undertaken. Also, with transformation, the meaning of the original data is distorted. No transformation of variables is undertaken.

Inter-relationships among variables.

Not only is it useful to know something about the nature of the variables prior to a regression (or any statistical) analysis, but the amount of inter-relationship among the dependent (criteria) variables, and among the independent (predictor) variables should be known. This is determined by principal components analysis.

The Dependent Variables.

There are three possible measures of housing quality in 1950. As can be seen from Table 7, they are quite highly intercorrelated.[5] No test of significance is reported here or elsewhere in the analysis, since no inferences are being made from a sample to a population; rather, the number of tracts at each time period is the population. Gould observes:

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[5]Unless otherwise stated, all calculations using 1950 data are based on 1060 observations. A number of tracts were excluded from the analysis

(a) where either the total population or number of dwelling units was less than 50 and
(b) where a tract could be identified as completely containing institutional or public land.

TABLE 7

Housing Quality Variables - 1950
Correlation Coefficients[a]

	NPBORD	NRWORD	PERPRM
NPBORD	1.000	0.780	0.754
NRWORD		1.000	0.634
PERPRM			1.000

[a]Correlations equal to or greater than ±0.5 are underlined.

TABLE 8

Housing Quality Variables - 1950
Factor Matrices[a]

Unrotated factor matrix:

	F1	F2	F3	h^2
NPBORD	0.938	-0.039	0.344	0.999
NRWORD	0.891	-0.404	-0.208	1.000
PERPRM	0.879	0.451	-0.156	1.000
Percent total variance	81.5	12.2	6.2	99.9
Eigen value	2.45	0.368	0.186	

Rotated factor matrix:

	F1	F2	F3
NPBORD	0.426	0.407	0.808
NRWORD	0.890	0.293	0.349
PERPRM	0.288	0.900	0.328
Percent total variance	35.2	35.4	29.5

[a]Factor loadings equal to or greater than ±0.50 are underlined.

> "Very often whole populations can be investigated, yet the results of inferential tests of significance are still conscientiously reported. But having investigated a whole population, to what are we now inferring our results?"[6]

Others, such as Harvey, have attempted to answer this question.[7] He argues that inferences are possible if certain additional assumptions are made.

Table 8 shows that in the orthogonally rotated factor matrix, each variable loads strongly on a distinct cluster. One measure, however, NRWORD, is a sub-category of NPBORD, and is subsequently dropped from the analysis. This is partly for reasons of economy of effort and partly because there is no 1960 variable similar to NRBORD; almost all housing units would likely have running water. In 1950, this category is a small proportion of the urban housing stock -- 6%.

The principal component in the unrotated factor matrix, F1, explains 81.5% of the total variance. This factor can be interpreted as a poor quality housing dimension. The factor scores from this principal component are used in a regression analysis as the dependent variable. The independent variables are factor scores from the rotated

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[6]P. GOULD, "Is 'statistix inferens' the geographical name for a wild goose", Economic Geography, vol. 46, no. 2, supplement, (1970), p. 442.

[7]D. HARVEY, Explanation in Geography, (London, Edward Arnold, Ltd., 1960), pp. 281-286.

factor matrix of the variables selected as independent variables in 1950. (See Table 13).

There are six variables in 1960 which measure various aspects of housing quality, such as physical condition, plumbing facilities, and overcrowding.[8] The intercorrelations among these variables are shown in Table 9. It should be remembered that the variable, DETLPF, is a subcategory of DETER, and the variable RB1950 is a composite variable, including DETLPP and DILAP. It is not too surprising, therefore, to find RB1950 inter-correlated with every other variable. Both DILAP and PERPRM are related to RB1950, but their relationships with the other variables are somewhat less. Consideration of the rotated factor matrix in Table 10 lends some support to the idea that DILAP and PERPRM are somewhat independent of the other variables, since they load highly and singly on F2 and F3. The other variables tend to load (i.e., to cluster together) on F1, although F4 might be interpretable as a deterioration factor. In light of this, and bearing in mind the composite mature of RB1950 and its comparability to NPBORD (1950), this variable is selected for further analysis. DILAP, which measures the worst physical conditions, and PERPRM, the sole measure of overcrowding, are also retained

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[8]Unless otherwise stated, all calculations using 1960 data are based on 1216 observations. A number of tracts were again excluded on the same grounds as those in 1950.

TABLE 9

Housing Quality Variables - 1960
Correlation Coefficients[a]

	DETER	DETLPF	DILAP	RB1950	BTRMSN	PERPRM
DETER	1.000	0.771	0.348	0.612	0.563	0.484
DETLPF		1.000	0.306	0.779	0.793	0.431
DILAP			1.000	0.644	0.492	0.396
RB1950				1.000	0.964	0.509
BTRMSN					1.000	0.455
PERPRM						1.000

[a]Correlation equal to or greater than ±0.5 are underlined.

TABLE 10

Housing Quality Variables - 1960
Factor Matrices[a]

Unrotated factor matrix:

	F1	F2	F3	F4	F5	F6	h^2
RB1950	0.949	0.097	-0.231	0.143	0.086	0.097	0.999
BTRMSN	0.908	-0.036	-0.281	0.277	0.111	-0.081	0.999
DETLPF	0.868	-0.404	-0.085	-0.016	-0.274	0.000	0.999
DETER	0.786	-0.350	0.215	-0.436	0.153	-0.007	0.999
PERPRM	0.651	0.190	0.693	0.245	-0.021	-0.002	0.999
DILAP	0.635	0.699	-0.113	-0.299	-0.082	-0.020	0.999
Percent total variance	65.37	13.67	11.30	7.29	2.088	0.275	99.8
Eigen value	3.922	0.820	0.678	0.437	0.125	0.017	

Rotated factor matrix:

	F1	F2	F3	F4	F5	F6
RB1950	0.843	0.376	0.218	-0.281	-0.097	0.112
BTRMSN	0.924	0.204	0.184	-0.236	-0.101	-0.070
DETLPF	0.616	0.049	0.162	-0.546	-0.543	0.002
DETER	0.290	0.140	0.221	-0.916	-0.092	0.004
PERPRM	0.209	0.172	0.939	-0.203	-0.057	0.003
DILAP	0.260	0.944	0.166	-0.111	-0.022	0.001
Percent total variance	35.7	18.8	17.8	22.1	5.4	0.3

[a]Factor loadings equal to or greater than ±0.5 are underlined.

but the other variables are dropped.

Since there are only two pairs of variables that are comparable from 1950 to 1960 - NPBORD (1950) and RB1950 (1960), and PERPRM (1950) and PERPRM (1960) - there can only be two measures of change in housing quality.[9] They are uncorrelated with a correlation coefficient of 0.052.

The Independent Variables.

The inter-relationships between the independent variables are assessed in a similar manner. Most of the intercorrelations in 1950 are as expected, given some knowledge of urban spatial structure and social structure in American cities - see Table 11. Thus, FORBRN is negatively related to NEGRO and NONWHT which are themselves highly and positively inter-correlated, NEGRO being a subset of NONWHT. This is quite reasonable considering the antipathy between immigrant, ethnic populations and blacks in U.S.cities. The relative economic disadvantage of the coloured groups is illustrated by the negative correlations with the income measure. The measures of migration and the fertility ratio are not strongly related to any of the other variables. There is a set of strong inter-relationships amongst the tenure, type of dwelling unit, income, and distance variables. These are also as expected. Home owning, OWNED, is positively and strongly related to SFDU, INCOME, and DIST, and strongly negatively

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[9]Unless otherwise stated, all calculations using 1950-1960 data are based on 718 observations -- see Appendix 5.

TABLE 11

Independent Variables - 1950
Correlation Coefficients[a]

	PORBRN	NONWHT	NEGRO	HHSLD	MGRNT1	MGRNT2	INCOME	FRTRAT	OWNED	RENTED	VACANT	SFDU	APTS	DIST
PORBRN	1.000	-0.609	-0.607	-0.015	-0.133	-0.226	0.089	-0.066	-0.076	0.084	-0.103	-0.216	-0.165	-0.261
NONWHT		1.000	0.996	-0.078	-0.078	0.229	-0.532	0.047	-0.384	0.384	-0.028	-0.280	0.326	-0.201
NEGRO			1.000	-0.082	-0.086	0.220	-0.523	0.049	-0.372	0.373	-0.032	-0.271	0.314	-0.193
HHSLD				1.000	0.089	0.039	0.126	-0.178	-0.046	0.044	0.095	0.001	0.244	0.169
MGRNT1					1.000	0.217	-0.123	-0.025	-0.049	0.030	0.280	0.100	0.156	0.329
MGRNT2						1.000	-0.252	0.036	-0.180	0.165	0.242	-0.081	0.295	-0.061
INCOME							1.000	-0.021	0.673	-0.668	-0.011	0.610	-0.445	0.438
FRTRAT								1.000	0.168	-0.174	-0.000	0.175	-0.298	0.131
OWNED									1.000	-0.996	-0.066	0.927	-0.798	0.649
RENTED										1.000	0.018	-0.933	0.793	-0.657
VACANT											1.000	0.035	0.190	0.073
SFDU												1.000	-0.649	0.730
APTS													1.000	-0.437
DIST														1.000

[a]Correlations equal to or greater than ±0.5 are underlined.

TABLE 12

Independent Variables - 1960
Correlation Coefficients[a]

	NEGRO	OTRACE	PORSTK	PORBRN	MGRNT1	MGRNT2	FRTRAT	OWNED	RENTED	VACANT	SFDU	APTS	DIST	INCOME
NEGRO	1.000	-0.006	-0.772	-0.536	0.061	0.313	0.383	-0.441	0.405	0.015	-0.316	0.350	-0.249	-0.522
OTRACE		1.000	0.049	0.197	0.075	-0.039	-0.016	-0.212	0.184	0.145	-0.174	0.241	-0.140	-0.164
PORSTK			1.000	0.871	-0.366	-0.256	-0.495	-0.119	-0.085	-0.106	-0.082	-0.176	-0.169	0.257
PORBRN				1.000	-0.289	-0.217	-0.408	-0.221	0.219	0.011	-0.376	0.089	-0.363	-0.047
MGRNT1					1.000	0.006	0.177	-0.059	0.030	0.216	0.078	0.175	0.348	-0.067
MGRNT2						1.000	0.388	-0.041	0.029	0.045	-0.007	0.078	-0.012	-0.040
FRTRAT							1.000	-0.005	-0.026	0.035	0.105	-0.154	0.149	-0.199
OWNED								1.000	-0.902	-0.322	0.919	-0.799	0.661	0.782
RENTED									1.000	0.291	-0.946	0.934	-0.636	-0.720
VACANT										1.000	-0.213	0.347	-0.106	-0.240
SFDU											1.000	-0.703	0.751	0.702
APTS												1.000	-0.497	-0.552
DIST													1.000	0.509
INCOME														1.000

[a]Correlations equal to or greater than ±0.5 are underlined.

related to APTS and RENTED. The latter two are negatively related with DIST and INCOME. There is also a positive relationship between INCOME and DIST but it is not especially marked.

Some of these inter-relationships are reflected in the rotated factor matrix in Table 13. For example, Factor 2 reflects the non-white-immigrant antipathy, while Factor 1 is the cluster of tenure, type of dwelling unit, income, and distance variables. The other factors represent a migration dimension (F3) and dimensions characterised by single variables, e.g., fertility ratio.

The inter-relationships are very similar in 1960 - Tables 12 and 14. The black - immigrant antipathy has increased, while the negative relationship between NEGRO and INCOME still persists (-0.522). The cluster of inter-relationships in tenure, type of dwelling unit, distance, and income is very similar to that in 1950, although the effect of the increased vacancy rate can be observed. Distance from the Central Business District is more strongly associated with income, increasing from 0.438 to 0.509. Comparison of Tables 13 and 14 also shows a similar factor structure, a not unexpected result.

There is less inter-relationship among the variables measuring change from 1950-1960 in the independent variables, than in the 1950 and 1960 sets themselves. There are only

TABLE 13

Independent Variables - 1950
Factor Matrices[a]

Unrotated factor matrix:

	F1	F2	F3	F4	F5	F6	h^2
FORBRN	0.094	-0.863	-0.062	-0.200	-0.001	0.076	0.803
NONWHT	-0.606	0.711	-0.241	0.148	0.006	-0.006	0.952
NEGRO	-0.595	0.713	-0.251	0.152	0.007	-0.006	0.949
HHSLD	-0.004	-0.075	0.508	0.597	0.083	0.567	0.949
MGRNT1	0.007	0.171	0.701	-0.291	-0.571	-0.088	0.939
MGRNT2	-0.283	0.328	0.410	-0.301	0.385	-0.045	0.600
INCOME	0.772	-0.145	0.064	0.261	0.229	-0.026	0.742
FRTRAT	0.174	0.264	-0.260	-0.611	0.033	0.650	0.965
OWNER	0.947	0.219	-0.085	0.037	0.073	-0.065	0.963
RENTED	-0.946	-0.231	0.054	-0.016	-0.089	0.069	0.964
VACANT	-0.048	0.122	0.618	-0.290	0.444	-0.127	0.697
SFDU	0.880	0.368	0.075	0.032	0.031	-0.056	0.920
APTS	-0.793	-0.101	0.382	0.164	0.042	0.018	0.814
DIST	0.686	0.394	0.318	0.088	-0.272	0.098	0.818
Percent total variance	36.5	17.2	12.7	8.4	5.9	5.7	86.2
Eigen value	5.10	2.41	1.76	1.18	0.82	0.80	

Rotated factor matrix:

	F1	F2	F3	F4	F5	F6
FORBRN	-0.231	-0.835	-0.162	-0.066	0.140	0.042
NONWHT	-0.303	0.921	0.016	-0.051	0.079	0.049
NEGRO	-0.292	0.922	0.008	-0.055	0.085	0.050
HHSLD	-0.018	-0.038	0.041	0.969	-0.041	-0.072
MGRNT1	-0.018	-0.032	0.212	0.022	-0.944	-0.025
MGRNT2	-0.144	0.228	0.717	-0.008	-0.070	0.087
INCOME	0.716	-0.353	-0.022	0.203	0.192	-0.163
FRTRAT	0.135	0.042	0.033	-0.075	0.012	0.968
OWNER	0.969	-0.113	-0.068	-0.053	0.033	0.055
RENTED	-0.971	0.114	0.028	0.053	-0.021	-0.061
VACANT	0.016	-0.071	0.819	0.054	-0.125	-0.050
SFDU	0.950	0.011	0.040	0.012	0.116	0.050
APTS	-0.753	0.156	0.261	0.285	-0.101	-0.250
DIST	0.739	0.074	-0.025	0.225	-0.459	0.065
Percent total variance	33.4	18.8	9.5	8.1	8.7	7.6

[a]Factor loadings equal to or greater than ± 0.5 are underlined.

TABLE 14

Independent Variables - 1960
Factor Matrices[a]

Unrotated factor matrix:

	F1	F2	F3	F4	F5	h^2
OWNED	0.969	0.032	-0.036	0.036	-0.031	.944
RENTED	-0.921	-0.059	0.013	-0.056	0.045	.858
SFDU	0.919	0.228	0.091	0.031	-0.040	.907
INCOME	0.833	-0.164	0.038	0.040	0.079	.729
APTS	-0.826	0.016	0.233	-0.038	0.058	.748
DIST	0.734	0.322	0.353	-0.016	0.012	.768
NEGRO	-0.506	0.700	-0.303	-0.141	-0.150	.880
VACANT	-0.348	0.069	0.566	0.240	0.045	.716
OTRACE	-0.259	-0.130	0.377	0.469	-0.713	.955
FORBRN	-0.187	-0.886	0.009	0.237	0.038	.877
FORSTK	0.158	-0.937	-0.033	0.181	0.104	.948
MGRNT2	-0.086	0.425	-0.306	0.645	0.310	.794
MGRNT1	-0.022	0.420	0.725	-0.087	0.051	.712
FRTRAT	-0.014	0.666	-0.157	0.429	-0.031	.654
Percent total variance	36.14	22.59	9.93	7.20	6.21	82.07
Eigen value	5.06	3.16	1.39	1.01	0.87	

Rotated factor matrix:

	F1	F2	F3	F4	F5
OWNED	0.959	-0.040	-0.132	-0.011	0.075
RENTED	-0.919	0.017	0.106	-0.006	-0.042
SFDU	0.941	0.139	0.017	0.013	0.030
INCOME	0.808	-0.240	-0.044	-0.062	0.114
APTS	-0.798	0.076	0.304	-0.080	-0.079
DIST	0.790	0.229	0.298	-0.054	-0.011
NEGRO	-0.467	0.766	-0.159	0.222	0.024
VACANT	-0.278	-0.131	0.765	0.189	0.035
OTRACE	-0.159	-0.096	0.072	0.004	-0.957
FORBRN	-0.252	-0.879	-0.101	-0.106	-0.140
FORSTK	0.071	-0.945	-0.159	-0.156	-0.012
MGRNT2	-0.034	0.116	0.026	0.880	0.070
MGRNT1	0.025	0.367	0.725	-0.148	-0.151
FRTRAT	0.073	0.478	0.025	0.632	-0.140
Percent total variance	35.47	19.95	9.93	9.50	7.23

[a]factor loadings equal to or greater than ±0.50 are underlined.

a few high correlation coefficients in Table 15 one of which is because of a subset condition, CHNWHT and CHNGRO (0.996). Population change and change in the number of households are quite naturally positively related. The lack of inter-correlation between the change variables is reflected in the rotated factor matrix in Table 16 where there is a difference of only 12% in the amount of total variance explained by the first and seventh factor. Although all of the selected variables are used in the regression analyses, an effort is made to obtain a more parsimonious solution without removing meaningful variables. Some variables are removed from the set of independent variables and the correlation and factor matrices assist in choosing the variables for removal.

For 1950 and 1960, the scores of the rotated factor matrix, shown in Tables 13 and 14, are used as independent variables in a regression analysis. All of the factors are reasonably interpretable and are normally distributed and independent of each other.

Canonical Correlation

Canonical correlation is a procedure whereby the inter-relations between two sets of measurements can be observed. Initially developed by Hotelling, the canonical correlation is the maximum correlation between linear functions of the two sets of measurements. One set is the

TABLE 15

Independent Variables 1950-60
Correlation Maxtrix[a]

	POPCHG	CHFORB	CHNGRO	CHNWHT	CHHSLD	DIFINC	CHFRAT	CHOWN	CHRENT	CHVAC	CHAPTS	CHSFDU	DIST	CHMOVR
POPCHG	1.000	-0.127	0.072	0.070	0.605	0.007	-0.046	0.292	-0.110	-0.184	0.010	0.029	0.270	0.027
CHFORB		1.000	-0.700	-0.696	-0.031	0.086	-0.362	0.127	-0.081	-0.062	0.259	-0.132	0.014	-0.244
CHNGRO			1.000	0.996	-0.021	-0.071	0.431	-0.141	0.117	0.026	-0.280	0.118	0.001	0.397
CHNWHT				1.000	-0.022	-0.070	0.428	-0.146	0.116	0.037	-0.275	0.116	-0.002	0.407
CHHSLD					1.000	-0.004	-0.108	0.075	-0.025	-0.037	0.257	-0.013	0.100	-0.080
DIFINC						1.000	-0.059	0.014	0.002	-0.021	0.027	-0.025	0.011	0.010
CHFRAT							1.000	-0.361	0.148	0.200	-0.056	0.013	-0.352	0.425
CHOWN								1.000	-0.717	-0.239	-0.180	0.270	0.312	-0.158
CHRENT									1.000	-0.353	0.113	-0.209	-0.022	-0.002
CHVAC										1.000	0.125	-0.063	-0.384	0.186
CHAPTS											1.000	-0.472	-0.075	-0.044
CHSFDU												1.000	0.070	0.053
DIST													1.000	-0.197
CHMOVR														1.000

[a]Correlations equal to or greater than ±0.50 are underlined.

TABLE 16

Independent Variables -- 1950 - 1960
Factor Matrices[a]

Unrotated factor matrix:

	F1	F2	F3	F4	F5	F6	F7	h^2
POPCHG	0.039	0.558	-0.538	0.397	0.042	0.203	0.095	.812
CHFORB	0.761	-0.254	0.112	-0.009	0.069	0.110	0.283	.753
CHNGRO	-0.897	0.250	-0.108	-0.039	0.011	-0.215	-0.080	.933
CHNWHT	-0.898	0.244	-0.105	-0.032	0.014	-0.218	-0.078	.931
CHHSLD	0.126	0.286	-0.615	0.516	-0.042	0.302	-0.190	.871
DIFINC	0.104	-0.031	-0.124	-0.007	0.971	-0.019	-0.201	.997
CHFRAT	-0.676	-0.266	0.043	0.175	0.028	0.221	0.227	.662
CHOWN	0.374	0.749	0.290	0.161	0.026	-0.199	0.181	.883
CHRENT	-0.221	-0.461	-0.578	-0.546	0.010	0.238	-0.003	.950
CHVAC	-0.172	-0.351	0.412	0.622	-0.064	-0.095	-0.342	.840
CHAPTS	0.305	-0.464	-0.427	0.393	-0.015	-0.273	0.109	.735
CHSFDU	-0.135	0.507	0.414	-0.146	0.008	0.565	-0.070	.793
DIST	0.227	0.552	-0.310	-0.327	0.012	-0.348	0.078	.686
CHMOVR	-0.571	-0.078	0.098	0.278	0.219	0.032	0.613	.843
Percent total variance	24.16	16.65	12.51	10.95	7.19	6.49	5.56	83.51
Eigen values	3.38	2.33	1.75	1.53	1.01	0.909	0.778	

Rotated factor matrix:

	F1	F2	F3	F4	F5	F6	F7
POPCHG	-0.087	0.176	-0.839	-0.248	0.016	0.087	0.009
CHFORB	0.844	0.073	0.094	-0.079	-0.135	-0.022	0.045
CHNGRO	-0.932	-0.054	0.007	-0.037	0.077	0.321	-0.017
CHNWHT	-0.931	-0.052	0.009	-0.031	0.071	0.237	-0.014
CHHSLD	0.004	-0.025	-0.919	0.052	-0.094	-0.120	-0.004
DIFINC	0.057	-0.004	-0.003	-0.009	-0.009	0.004	0.997
CHFRAT	-0.336	-0.282	0.020	0.311	0.074	0.602	-0.068
CHOWN	0.129	0.836	-0.127	-0.319	0.208	-0.079	-0.002
CHRENT	-0.065	-0.931	0.034	-0.259	-0.103	0.013	0.005
CHVAC	-0.107	0.217	0.075	0.864	-0.167	0.006	0.006
CHAPTS	0.275	-0.095	-0.210	0.127	-0.768	0.031	-0.005
CHSFDU	-0.028	0.144	-0.077	0.014	0.874	0.035	-0.014
DIST	-0.113	0.241	-0.100	-0.724	-0.068	-0.276	0.017
CHMOVR	-0.239	0.055	0.028	0.071	-0.034	0.880	0.039
Percent total variance	19.6	13.0	11.7	11.6	10.6	10.3	7.2

[a]factor loadings equal to or greater than ±0.50 are underlined.

predictors and the other set is the criteria. In the program used in this analysis, there are as many canonical correlations as there are criteria.[10]

The attraction of this method is that it allows the relationship to be considered between the sets of variables chosen to represent housing quality and the sets of independent variables. This is helpful since PERPRM, RB1950 and NPBORD are all aspects of the basic phenomenon which is being studied. Thus, the analysis is not confined to how each one of these relates to a set of predictors, as in the multiple regression case.

Although there are a number of canonical correlation coefficients reported, the first canonical correlation is of most interest. The contribution made by the individual variables to the canonical variates can be observed from the canonical vectors associated with the first canonical correlation.

The results of the canonical correlation analysis for 1950 are shown for two sets of predictors in Tables 17

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[10]The program used is CANON, a version of the Canonical Correlation program presented in Cooley and Lohnes. This program finds q latent roots of the canonical equation (where q is the number of criteria). The elements of the canonical equation are substituted from a matrix. This matrix is the matrix of inter-correlations between p predictors and q criteria, and is square, symmetric, and of the order (p + q). The first canonical correlation is related to the first root, the second coefficient to the second root and so on.
W. W. COOLEY and P. R. LOHNES, Multivariate Procedures for the Behavioral Sciences, (New York, J. Wiley and Sons, Inc., 1962), pp. 52-54.

and 18. The first correlation coefficient of 0.897 is only reduced to 0.874 when some predictor variables are removed. The variables dropped are NONWHT, APTS, and SFDU, because they are highly and positively correlated with NEGRO, RENTED, and OWNED respectively. The criteria are dominated by the overcrowding variable. The variables measuring tenure, colour, and income seem to be the most important predictors.

In the 1960 analysis, the correlation coefficients are again high. The same pattern is detected in the criteria as in 1950 (one set of criteria comprises 4 single census measures; the other comprises the composite measure, RB1950, and PERPRM, -- see Tables 19 and 20. In the case where four criteria variables are used, the most important predictors are INCOME, FORSTK, and NEGRO. For the two variable criteria, they are FRTRAT, NEGRO, INCOME and MGRNT2.

The correlation coefficient is lower for the change variables, the criteria are still dominated by CHPPRM, and the strongest predictors are CHNGRO, CHFORB, and CHRENT -- see Table 21.

The conclusions drawn from the canonical analysis are that there are fairly strong relationships between the selected independent variables and the housing quality variables, especially with PERPRM, the variable measuring overcrowding. The relationship between the variables measuring change in residential blight and a set of variables measuring change in the independent variables is less strong. The variables

TABLE 17

Canonical Vectors 1950
(From First Correlation)

Predictors (13)		Criteria (2)	
NONWHT	0.559	PERPRM	0.957
SFDU	0.385	NPBORD	0.291
FRTRAT	0.119		
VACANT	-0.003		
MGRNT2	-0.006		
FORBRN	-0.014		
MGRNT1	-0.017		
APTS	-0.017		
NEGRO	-0.109		
DIST	-0.114		
RENTED	-0.157		
INCOME	-0.255		
OWNED	-0.640		

First correlation
coefficient = 0.897
Second correlation
coefficient = 0.392

TABLE 18

Canonical Vectors 1950
(From First Correlation)

Predictors (9)		Criteria (2)	
NEGRO	0.479	PERPRM	0.960
MGRNT2	0.013	NPBORD	0.281
MGRNT1	0.004		
VACANT	-0.001		
FORBRN	-0.047		
DIST	-0.062		
INCOME	-0.287		
RENTED	-0.523		
OWNED	-0.639		

First correlation
coefficient = 0.874
Second correlation
coefficient = 0.362

TABLE 19

Canonical Vectors 1960
(From First Correlation)

Predictors (10)		Criteria (4)	
NEGRO	0.400	PERPRM	0.920
OTRACE	0.032	BIRMSN	0.342
VACANT	0.071	DETER	0.184
MGRNT2	0.020	DILAP	0.048
MGRNT1	-0.045		
OWNER	-0.096		
RENTED	-0.166		
DIST	-0.185		
FORSTK	-0.506		
INCOME	-0.712		

First correlation
coefficient = 0.839
Second correlation
coefficient = 0.582
Third correlation
coefficient = 0.245
Fourth correlation
coefficient = 0.188

TABLE 20

Canonical Vectors 1960
(From First Correlation)

Predictors		Criteria	
FRTRAT	0.701	PERPRM	0.969
NEGRO	0.504	RB1950	0.244
APTS	0.167		
SFDU	0.146		
VACANT	0.034		
FORSTK	0.009		
OTRACE	-0.013		
MGRNT 1	-0.023		
RENTER	-0.052		
FORBRN	-0.061		
OWNER	-0.095		
MGRNT 2	-0.149		
DIST	-0.212		
INCOME	-0.348		

First correlation coefficient = 0.920
Second correlation coefficient = 0.613

TABLE 21

Canonical Vectors 1950-60
(From First Correlation)

Predictors (11)		Criteria (2)	
CHNGRO	0.768	CHPPRM	0.990
CHRENT	0.407	CHRBLT	0.139
CHOWN	0.096		
DIST	0.081		
CHHSLD	0.052		
CHAPTS	0.037		
CHMOVR	0.018		
DIFINC	-0.000		
CHVAC	0.010		
CHSFDU	-0.113		
CHFORB	-0.460		

First Canonical correlation = 0.670
Second Canonical correlation = 0.382

that appear most consistently as the primary predictors are NEGRO and INCOME. Other variables that stand out are the tenure variables in 1950 and FORSTK, MGRNT2, and FRTRAT in 1960. This gives some indication as to what might be expected from the multiple regression analyses, which are a form of canonical correlation where the number of criteria variables is one.

Multiple Regression Analyses.

A number of regression analyses are reported in a summary fashion in Table 22. These are least squares linear regression models and are used here in an exploratory fashion.

The summary results are quite satisfactory in the sense that, for some equations, there is an excellent goodness of fit, as measured by the multiple correlation coefficient, a reasonably high percentage of the sum of squares is "explained", and the standard error of estimate for the predicted value is low. This is particularly true for the case where PERPRM, the overcrowding measure, is the dependent variable. This also holds true in both 1950 and 1960, the results being fairly similar. The most noticeable difference is that the reduction of the independent variable set has little effect on the 1950 results, but considerably more on the 1960 results.[11] The correlation coefficient is reduced from 0.911 to 0.813 and thus, the percent sum of squares explained

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[11]The variables removed in the 1950 analysis are NONWHT, SFDU, APTS. In the 1960 case, the variables removed are SFDU, APTS, FORBRN. All, are highly and positively intercorrelated with other variables which are retained.

TABLE 22

Multiple Regression Analysis
Summary

Dependent Variable	Number of Idependent Variables	Multiple Correlation Coefficient	Standard Error of Estimate	Percent 'Explained' Sum of Sqs.	N
		1960			
PERPRM	14	0.911	3.67	82.96	1216
PERPRM	10	0.813	5.18	66.03	1216
RB1950[a]	14	0.763	11.19	58.18	1216
RB1950	10	0.735	11.71	54.05	1216
DILAP	14	0.518	7.00	26.91	1216
DILAP	10	0.477	7.18	22.76	1216
		1950			
NPBORD	14	0.788	13.41	62.14	1060
NPBORD	9	0.764	14.04	58.32	1060
PERPRM	13	0.888	4.53	78.80	1060
PERPRM	9	0.866	4.92	74.94	1060
NPBORD[b]	11	0.818	4.19	66.91	617
PERPRM[b]	11	0.910	4.65	82.81	617
		1950-1960			
CHRBLT	14	0.433	10.28	18.74	718
CHRBLT	11	0.366	10.59	13.42	718
CHPPRM	14	0.700	5.43	48.99	718
CHPPRM	11	0.679	5.58	46.06	718
CHRBLT[c]	11	0.371	10.55	13.78	729
CHPPRM[c]	11	0.455	6.76	20.70	718

[a] composite measure comparable to the NPBORD (1950) category.

[b] population change and change in non-white population (1940-50) are included in set of independent variables.

[c] a set of 1950 measures are used as independent variables.

falls from 82.96 to 66.03.

When the physical condition of the dwelling unit and lack of plumbing facilities are considered, as measured by NPBORD (1950) and RB1950 (1960), the goodness of fit is consistently less than for PERPRM using the same independent variables; the level of explanation is also correspondingly lower. The standard error of estimate is much higher, indicating that the predicted value lies within a wider range of values than is the case for PERPRM. When the 1950 and 1960 results are compared, they are again fairly similar. In neither the 1950 or 1960 results does the reduction in the number of independent variables have much effect on the goodness of fit.[12] The level of explanation is much less satisfactory for the one variable that measures only the structural condition of the dwelling unit -- DILAP in 1960.

The weakest results are obtained for the analysis of the spatial variation in those variables which measure change in the physical state of the dwelling unit and overcrowding from 1950 to 1960. Again, however, it is noticeable that the results are more satisfactory for CHPPRM than for CHRBLT.[13]

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[12]The variables removed are the same as those listed in footnote 11.

[13]Two variables, CHHSLD, CHNWHT, are removed from the set of independent variables with relatively little effect on the results. CHHSLD is highly and positively correlated with POPCHG and CHNWHT is similarly related to CHNGRO.

The regression analysis of change data is modified and continued in two ways.

(a) The lower correlation coefficients for CHRBLT and CHPPRM indicate that there is a considerable scatter of observations about the least squares equation. Therefore, the estimate of the true slope is not likely to be particularly accurate. The working hypothesis that change in the variables selected as predictors in 1950 and 1960 would explain the spatial variation in change in housing quality does not appear to be particularly appropriate. An alternative hypothesis is that the amount of change in housing quality in an area is related to the antecedent conditions in the area. That is, knowing something about the 1950 scores on selected variables allows the prediction of the amount of change from 1950 to 1960. However, as shown in Table 22, the resulting correlation coefficients are only slightly improved for CHRBLT (0.366 to 0.371) but are considerably less for CHPPRM (0.455 against 0.679). Neither set of variables seems to be strongly related to the amount of change in housing quality.

(b) Examination of individual beta weights and the amount of sum of squares reduced by individual variables for the 1950 - 1960 change data, suggests that population change in a tract (as measured by POPCHG and CHHSLD) is related to change in housing quality -- see Tables 29 and 30. Since it is possible to readily calculate percentage change in total population and non-white population from 1940 to 1950, these two variables are added to the set of independent variables

for the 1950 analysis. The expectation is that they would be positively associated with measures of housing quality since they measure the change of population in a tract, which in most cases would be an increase, and the increasing numbers of a low income minority group that experiences discrimination in the housing market. In so doing, however, the number of observations is almost halved to 617. Since no suburban data are available for 1940 all the suburban tracts are removed, while 269 tracts had no nonwhite population in 1940 and, hence, no base population. Thus, this regression is based on central city observations, and particularly those with a non-white population in 1940. The addition of these two variables does lead to an increase in the goodness of fit, but this may be due to the elimination of a number of observations whose scores are at some distance from the least-squares surface rather than these two additional variables (see the next section for additional comment on this point).

The Effect of Individual Variables.

While the results of the regression are, in general, reasonable, with respect to goodness of fit, the relationships of individual variables are of greater interest and bear directly on the hypotheses developed in Chapter 4. Tables 23 - 34 indicate how the individual variables relate to the dependent variables and how each contributes to the amount

TABLE 23

Multiple Regression 1950
Dependent Variable -- PERPRM

	Correlation Coefficient	'B' Value	Beta Weight
NEGRO	0.796	0.191	0.548
RENTED	0.549	-0.100	-0.253
MGRNT 2	0.250	0.026	0.016
VACANT	0.012	0.016	0.002
MGRNT 1	-0.013	-0.036	0.013
DIST	-0.340	-0.064	-0.034
FORBRN	-0.403	-0.084	-0.060
OWNED	-0.553	-0.152	-0.388
INCOME	-0.689	-0.003	-0.329

Stepwise Multiple Regression:

Order of Entry	Percent Sum of Squares Reduced by Each Variable
1. NEGRO	63.3
2. INCOME	10.3
3. OWNED	1.1
4. FORBRN	0.1
5. DIST	0.1
6. RENTED	0.1
7. MGRNT2	0.0
8. MGRNT1	0.0
9. VACANT	0.0

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
1060	0.866	75.00	4.92

TABLE 24

Multiple Regression 1950
Dependent Variable -- NPBORD

	Correlation Coefficient	'B' Value	Beta Weight
NEGRO	0.594	0.267	0.347
RENTED	0.549	-1.405	-1.602
MGRNT2	0.230	0.008	0.002
VACANT	0.070	-0.251	-0.012
MGRNT1	0.050	0.379	0.063
FORBRN	-0.225	-0.056	-0.018
DIST	-0.410	-0.762	-0.180
OWNED	-0.563	-1.464	-1.698
INCOME	-0.674	-0.007	-0.347

Stepwise Multiple Regression:

Order of Entry	Percent Sum of Squares Reduced by Each Variable
1. INCOME	45.4
2. NEGRO	8.1
3. DIST	2.0
4. RENTED	1.4
5. MGRNT1	0.8
6. VACANT	0.4
7. OWNED	0.2
8. FORBRN	0.0
9. MGRNT2	0.0

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
1060	0.764	58.22	14.04

TABLE 25

Multiple Regression 1960
Dependent Variable -- PERPRM

	Correlation Coefficient	'B' Value	Beta Weight
NEGRO	0.754	0.117	0.436
PRTRAT	0.695	25.982	0.520
RENTED	0.373	-0.003	-0.011
MGRNT 2	0.294	-0.054	-0.065
APTS	0.260	0.021	0.066
MGRNT 1	0.103	0.009	0.006
VACANT	0.094	0.012	0.005
OTRACE	0.016	-0.100	-0.028
DIST	-0.243	-0.176	-0.138
SFDU	-0.296	0.018	0.075
FORBRN	-0.408	-0.083	-0.070
OWNED	-0.424	-0.004	-0.013
INCOME	-0.593	-0.001	-0.250
FORSTK	-0.627	0.041	0.080

Stepwise Multiple Regression:

Order of Entry		Percent Sum of Squares Reduced by Each Variable
1.	NEGRO	56.8
2.	PRTRAT	19.4
3.	INCOME	5.5
4.	DIST	0.7
5.	MGRNT 2	0.2
6.	FORBRN	0.1
7.	SFDU	0.1
8.	OTRACE	0.1
9.	APTS	0.0
10.	FORSTK	0.0
11.	MGRNT 1	0.0
12.	VACANT	0.0
13.	RENTED	0.0
14.	OWNED	0.0

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
1216	0.911	82.96	3.67

TABLE 26

Multiple Regression 1960
Dependent Variable -- PERPRM

	Correlation Coefficient	'B' Value	Beta Weight
NEGRO	0.754	0.096	0.358
RENTED	0.373	-0.017	-0.060
MGRNT2	0.294	0.089	0.106
MGRNT1	0.103	0.004	0.005
VACANT	0.094	-0.003	-0.001
OTRACE	0.016	-0.057	-0.016
DIST	-0.243	-0.114	-0.089
OWNED	-0.424	0.030	0.101
INCOME	-0.593	-0.002	-0.501
FORSTK	-0.627	-0.125	-0.245

Stepwise Multiple Regression:

Order of Entry		Percent Sum of Squares Reduced by Each Variable
1.	NEGRO	56.8
2.	INCOME	5.5
3.	FORSTK	1.9
4.	MGRNT2	1.0
5.	OWNED	0.4
6.	DIST	0.3
7.	RENTED	0.1
8.	OTRACE	0.0
9.	MGRNT1	0.0
10.	VACANT	0.0

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
1216	0.813	66.03	5.18

TABLE 27

Multiple Regression 1960
Dependent Variable -- RB1950

	Correlation Coefficient	'B' Value	Beta Weight
RENTED	0.512	-0.083	-0.151
NEGRO	0.447	-0.047	-0.090
VACANT	0.302	0.579	0.034
OTRACE	0.219	0.723	0.104
MGRNT1	0.084	-0.211	-0.076
MGRNT2	-0.070	-0.273	-0.168
FORSTK	-0.349	-0.394	-0.397
DIST	-0.388	-0.344	-0.138
OWNED	-0.598	-0.194	-0.336
INCOME	-0.634	-0.002	-0.257

Stepwise Multiple Regression

Order of Entry		Percent Sum of Squares Reduced by Each Variable
1.	INCOME	40.2
2.	FORSTK	3.7
3.	OWNED	3.5
4.	MGRNT2	2.6
5.	OTRACE	1.2
6.	DIST	1.1
7.	VACANT	1.0
8.	RENTED	0.5
9.	MGRNT1	0.2
10.	NEGRO	0.1

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
1216	0.735	54.05	11.71

TABLE 28

Multiple Regression 1960
Dependent Variable -- DILAP

	Correlation Coefficient	'B' Value	Beta Weight
NEGRO	0.381	0.048	0.194
RENTED	0.245	-0.033	-0.126
OTRACE	0.207	0.602	0.183
MGRNT1	0.038	-0.034	-0.026
MGRNT2	0.021	-0.055	-0.071
VACANT	0.021	-0.158	-0.066
DIST	-0.186	-0.041	-0.035
FORSTK	-0.285	-0.062	-0.132
OWNED	-0.297	-0.032	-0.117
INCOME	-0.363	-0.00073	-0.199

Stepwise Multiple Regression:

Order of Entry		Percent Sum of Squares Reduced by Each Variable
1.	NEGRO	14.5
2.	OTRACE	4.4
3.	INCOME	2.4
4.	MGRNT2	0.5
5.	RENTED	0.3
6.	OWNED	0.2
7.	FORSTK	0.2
8.	VACANT	0.2
9.	DIST	0.1
10.	MGRNT1	0.0

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
1216	0.477	22.76	7.18

TABLE 29

Multiple Regression 1950-60
Dependent Variable -- CHPPRM

	Correlation Coefficient	'B' Value	Beta Weight
CHNWHT	0.604	0.309	1.028
CHNGRO	0.600	-0.192	0.646
CHFRAT	0.374	7.571	0.151
CHRENT	0.272	0.474	0.283
CHMOVR	0.232	-0.021	0.041
POPCHG	0.192	0.025	0.210
DIST	0.027	0.045	0.018
CHHSLD	0.015	-0.009	-0.119
CHSFDU	-0.015	-0.030	-0.044
DIFINC	-0.049	-0.00007	-0.002
CHVAC	-0.083	0.052	0.020
CHAPTS	-0.111	0.032	0.049
CHOWN	-0.190	0.196	0.114
CHFORB	-0.545	-0.274	-0.220

Stepwise Multiple Regression:

Order of Entry	Percent Sum of Squares Reduced by Each Variable
1. CHNWHT	36.4
2. CHRENT	4.1
3. POPCHG	3.1
4. CHFORB	2.4
5. CHFRAT	1.1
6. CHHSLD	0.7
7. CHAPTS	0.3
8. CHOWN	0.3
9. CHNGRO	0.3
10. CHSFDU	0.2
11. CHMOVR	0.1
12. DIST	0.0
13. CHVAC	0.0
14. DIFINC	0.0

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
718	0.700	48.99	5.43

TABLE 30

Multiple Regression 1950-60
Dependent Variable -- CHRELT

	Correlation Coefficient	'B' Value	Beta Weight
DIST	0.168	0.764	0.193
CHHSLD	0.148	0.025	0.221
CHNWHT	0.134	0.583	1.284
CHNGRO	0.126	-0.476	-1.068
CHRENT	0.025	-1.156	-0.461
POPCHG	0.009	-0.019	-0.049
CHVAC	0.005	-0.728	-0.189
DIFINC	0.005	0.001	0.016
CHSFDU	-0.015	-0.027	-0.027
CHAPTS	-0.043	-0.086	-0.087
CHFRAT	-0.082	-9.297	-0.121
CHFORB	-0.086	0.036	0.019
CHMOVR	-0.102	-0.114	-0.148
CHOWN	-0.117	-1.490	-0.580

Stepwise Multiple Regression:

Order of Entry	Percent Sum of Squares Reduced by Each Variable
1. CHOWN	3.2
2. DIST	2.8
3. CHMOVR	2.6
4. CHRENT	2.5
5. CHHSLD	2.1
6. CHFRAT	1.3
7. CHVAC	1.3
8. CHNWHT	1.2
9. CHNGRO	0.8
10. POPCHG	0.5
11. CHAPTS	0.4
12. CHSFDU	0.1
13. DIFINC	0.0
14. CHFORB	0.0

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
718	0.433	18.74	10.26

TABLE 31

Multiple Regression 1950
Dependent Variable -- PERPRM

	Correlation Coefficient	'B' Value	Beta Weight
NEGRO	0.839	0.169	0.485
RENTED	0.556	0.207	0.524
POPCHG	0.335	0.032	0.145
MGRNT2	0.256	-0.059	-0.037
CHGEWT	0.111	-0.00005	-0.043
MGRNT1	0.090	0.132	0.048
VACANT	0.056	0.362	0.038
DIST	-0.400	-0.137	-0.072
OWNED	-0.556	0.133	0.339
FORBRN	-0.589	-0.073	-0.052
INCOME	-0.759	-0.003	-0.329

Stepwise Multiple Regression:

Order of Entry	Percent Sum of Squares Reduced by Each Variable
1. NEGRO	70.2
2. INCOME	10.1
3. POPCHG	1.1
4. OWNED	0.9
5. FORBRN	0.1
6. MGRNT2	0.1
7. DIST	0.1
8. MGRNT1	0.1
9. VACANT	0.0
10. RENTED	0.0

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
617	0.910	82.81	4.65

TABLE 32

Multiple Regression 1950
Dependent Variable -- NPBORD

	Correlation Coefficient	'B' Value	Beta Weight
NEGRO	0.614	0.261	0.339
RENTED	0.542	-3.913	-4.485
MGRNT2	0.258	-0.077	-0.022
MGRNT1	0.198	0.676	0.112
POPCHG	0.113	-0.009	-0.018
VACANT	0.108	-3.193	-0.150
CHGEWT	0.030	-0.00007	-0.027
FORBRN	-0.368	-0.037	-0.012
DIST	-0.552	-1.515	-0.355
OWNED	-0.557	-3.904	-4.505
INCOME	-0.754	-0.008	-0.397

Stepwise Multiple Regression:

Order of Entry	Percent Sum of Squares Reduced by Each Variable
1. INCOME	56.9
2. NEGRO	4.0
3. DIST	2.7
4. OWNED	2.4
5. MGRNT1	0.6
6. VACANT	0.2
7. RENTED	0.1
8. POPCHG	0.0
9. MGRNT2	0.0
10. FORBRN	0.0

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
617	0.818	66.91	14.19

TABLE 33

Multiple Regression 1950-60
Dependent Variable -- CHRBLT

	Correlation Coefficient	'B' Value	Beta Weight
INCOME	0.226	0.001	0.083
DIST	0.162	0.095	0.026
SFDU	0.120	-0.020	-0.046
OWNER	0.115	2.339	4.596
VACANT	0.107	3.236	0.271
FORBRN	0.094	-0.023	-0.014
MGRNT1	0.084	0.193	0.035
MGRNT2	0.054	0.149	0.079
APTS	0.024	0.091	0.222
RENTER	-0.115	2.248	4.359
NEGRO	-0.237	-0.079	0.197

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
718	0.371	13.78	10.55

TABLE 34

Multiple Regression 1950-60
Dependent Variable -- CHPPRM

	Correlation Coefficient	'B' Value	Beta Weight
FORBRN	0.342	0.191	0.173
INCOME	0.193	0.001	0.125
OWNER	0.127	0.075	0.219
VACANT	0.047	1.202	0.153
DIST	0.027	0.130	0.051
SFDU	0.027	-0.079	-0.236
MGRNT2	-0.051	0.203	0.151
MGRNT1	-0.088	-0.449	0.121
RENTER	-0.129	0.098	0.282
APTS	-0.215	-0.080	-0.291
NEGRO	-0.354	-0.054	-0.203

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
718	0.455	20.70	6.76

of sum of squares reduced.[14]

Although the results are in some ways disappointing, in that several variables do not appear to be related to poor housing quality, some relationships are evident. While each table is of itself interesting, only the overall results are commented on at this point. The variables, NEGRO and INCOME, are generally consistently and strongly related to the variables measuring residential blight in both 1950 and 1960. There is an important distinction as shown by the stepwise multiple regression results. When PERPRM is the dependent variable, then NEGRO is the principal explanatory variable, followed by INCOME - Tables 23, 25, and 26. But, when variables measuring physical condition and plumbing deficiencies (such as NPBORD, RB1950) are the dependent variables, then INCOME is the principal explanatory variable, -- Tables 24 and 27. The only measure of the structural condition of the dwelling unit DILAP (1960), is explained best by NEGRO, OTRACE, and INCOME -- Table 28.

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[14]The detailed tables are generally presented for the smaller set of indpendent variables except for the 1950-1960 analysis. Also, Tables 26 and 27 allow a comparison of two sets of predictor variables for PERPRM - 1960. The conclusions in this section concerning the individual variables are based on the order of entry of a variable in the stepwise regression analysis, the amount of sum of squares reduced by the variable and the beta weight (magnitude and sign). Beta weights are the standardised regression coefficients.

Colour, as measured by change in non-white, is again the most powerful explanatory variable for CHPPRM, but when CHRBLT is the dependent variable, no variables emerge as either powerful or principal explanatory variables -- Tables 29 and 30.

Tables 31 and 32 show that the addition of POPCHG and CHGNWT in 1950 is not the principal reason for the increases in explained variation, although POPCHG ranked third behind NEGRO and INCOME in the case of PERPRM. It is the absence of the generally all white suburban tracts which raises the percent sum of squares reduced by NEGRO and, thus, the overall level of explained variation is also raised.[15] -- compare Tables 31 and 23. A similar situation occurs with NPBORD, where the explanatory power of INCOME rises considerably while POPCHG reduces a very small amount of total sums of squares -- compare Tables 32 and 24. The overall regression results for the use of the 1950 variables as predictors of the change in housing quality variables are judged to be sufficiently weak that this line of investigation is not pursued -- see Tables 33 and 34.

These results are described as disappointing in that a number of variables which are postulated as being related to physical condition and overcrowding, contribute very little

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[15] CHGNWT proves to be an unusual variable with a very high mean and standard deviation. This is readily explained in that some tracts experienced very large absolute increases in nonwhite population from 1940 to 1950 while the base population for 1940 is very small (often under 5).

to explaining the spatial variation of the dependent variables, i.e., they reduce very little of the total sums of squares. Thus, even though the direction of the relationship may be as specified, there are a number of hypotheses which cannot be accepted. The hypotheses and the meaning of these results will be discussed subsequently in this chapter.

Multiple Regression using Factor Scores.

An alternative analytical procedure is suggested in the research design; it is also briefly discussed in this chapter. This procedure is to take the principal components of the unrotated factor matrices in 1950 and 1960 and use the factor scores as values for the dependent variable in a regression analysis. The factor scores from the rotated factor matrices for 1950 and 1960 are then used as independent variables in the regression equation.

The major advantage in this procedure in terms of research strategy is that it eliminates the need for canonical correlation analysis, and reduces greatly the number of variables to be handled in the regression analysis. A possible disadvantage is that the researcher cannot draw conclusions concerning the relationship between selected individual variables and the phenomenon under study. Also, there are often problems in interpreting the factors in a meaningful way.

Some expectations are developed concerning the outcome of the regression analysis. The hypotheses stated

in Chapter four, the knowledge of the factor structures (Tables 8, 10, 13, and 14), and the initial regression results for individual variables, all assist in the statement of these expectations. The presence of certain variables, loading heavily on a factor, allows some predictions as to which factors are related to the poor housing quality component and to the relative strength of the relationship. Also, the direction of the relationship can be predicted.

It is expected that the factor measuring income and tenure will be strongly and negatively related to the poor housing factor. Conversely, the factor which indicates a racial-ethnic antipathy is also expected to show a strong relationship but in a positive direction. The other factors, measuring mobility, vacancy rates and the fertility ratio are not expected to be strongly related, although it is possible to predict direction, e.g., the factor representing other race is expected to be negatively related to the principal component.

The results of the regression analyses are shown in Tables 35 and 36.[16] These tables show that these expectations are largely confirmed for both years. The only difference is that in 1950 the racial - ethnic factor is the most

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[16]The factor structure for 1950 is somewhat different from that shown in Fig. 10. This is due to the removal of one variable, HHSLD, from the analysis; however, the structure is not much different.

TABLE 35

Multiple Regression with Factor Scores - 1950

F1 (Y)	F2 (X_1)	F3 (X_2)	F4 (X_3)	F5 (X_4)	F6 (X_5)
NPBORD (0.922)	INCOME (0.714)	AMGRT1 (0.997)	NONWHT (0.899)	VACANT (0.967)	FRTRAT (0.956)
NRWORD (0.856)	OWNER (0.963)	AMGRT2 (0.997)	NEGRO (0.808)		
PERPRM (0.948)	RENTER(-0.964)		FORBRN(-0.869)		
	SFDU (0.953)				
	APTS (-0.738)				
	DIST (0.782)				

Order of Entry	Regression Coefficient	Percent Sum of Squares Reduced by Each Variable
F4	0.573	33.6
F2	-0.528	28.6
F6	0.230	5.4
F3	-0.047	0.2
F5	-0.019	0.0

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
1060	0.82	67.24	0.562

TABLE 36

Multiple Regression with Factor Scores - 1960

F1 (Y)	F2 (X_1)	F3 (X_2)	F4 (X_3)	F5 (X_4)	F6 (X_5)
DETER (0.786)	OWNER (0.958)	NEGRO (0.767)	AMGRT1 (0.725)	AMGRT2 (0.880)	OTRACE
DETLPF (0.869)	RENTER(-0.919)	FORSTK(-0.945)	VACANT (0.765)	FRTRAT (0.632)	(-0.957)
DILAP (0.635)	SFDU (0.941)	FORBRN(-0.879)			
RB1950 (0.949)	APTS (-0.798)				
BTRMSN (0.908)	DIST (0.790)				
PERPRM (0.651)	INCOME (0.808)				

Order of Entry	Regression Coefficient	Percent Sum of Squares Reduced by Each Variable
F2	-0.593	35.2
F3	0.384	14.7
F6	-0.154	2.4
F5	0.089	0.8
F4	0.062	0.4

N	Multiple Correlation Coefficient	Explained Variation	Standard Error of Estimate
1216	0.73	53.29	0.684

strongly related variable, although there is not a great deal of difference between this factor and that of income-tenure. In 1960, the income - tenure factor is considerably stronger. This can be explained by the higher loading of PERPRM on the principal component which is also composed of fewer variables in 1950. Previous results indicate that NEGRO and NONWHT are strongly related to PERPRM. Also, there is a contrast in the variables which load heavily on the racial-ethnic factor; two ethnic variables and one racial variable in 1960, and vice versa in 1950, with a separate racial factor, F6, in 1960.[17] In 1950, the sign of the regression coefficient is not as predicted for F3 and F5, but the values are so close to zero that this is relatively unimportant.

The conclusions are that these two regressions confirm the results obtained from using original untransformed variables as predictors in regression equations.

Residuals from Regression.

In some cases, a considerable amount of sums of squares is reduced by the selected variables (or more accurately, by a few of the selected variables); this ranges from 82.96 to 13.78. This, however, raises the question of whether any order is apparent in the unexplained variation which is represented by the residuals from regression. Or, to consider it

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[17]This reflects the data availability in 1950 and 1960.

in a different way, whether or not the residuals are spatially distributed in a random or non-random manner. If it is found that the pattern is random, then the addition of other independent variables would not be worthwhile (this does not preclude the replacement of an independent variable by another measure, perhaps a more sensitive one). If, however, the residual values are non-random, then there is still some order in the unexplained variation, and additional variables should be sought.[18]

The use of the contiguity ratio is one way of measuring randomness in a spatial pattern. To use this method, however, is extremely laborious for a very large number of observations and an alternative procedure is proposed. This is described in Appendix 4. Only one set of results from this procedure is presented.[19] These are for PERPRM (1960) with 10 independent variables and are shown in Table 37.

These results suggest that residuals from this particular regression equation are non-random, since the

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[18]A concise discussion of residuals from regression and their utility is presented in Draper and Smith. N. R. DRAPER and H. SMITH, Applied Regression Analysis, (New York, J. Wiley and Sons, Inc., 1966), Chapter 3, pp. 86-99.

[19]The residuals investigated are from one of the better fitting equations ($r^2 = 0.813$). Unsatisfactory results from this equation would suggest that the residuals from poorer fitting equations are also likely to be non-random. There are also time and budget constraints on applying this procedure to other sets of residuals.

TABLE 37

Correlation Between Residuals:
Dependent Variable -- PERPRM 1960

	Class	Correlation Coefficient	N
A	All near neighbours within 0.5 miles	0.671	843
A(i)	No more than 3 near neighbours within 0.5 miles	0.600	479
A(ii)	More than 3 near neighbours within 0.5 miles	0.734	364
B	All near neighbours within 1.0 miles	0.592	1117
B(i)	No more than 3 near neighbours within 1.0 miles	0.330	237
B(ii)	More than 3 near neighbours within 1.0 miles	0.638	880

correlation coefficients for all near neighbours at the 0.5 mile and 1.0 mile limits are reasonably high. The relationship between the residual for any given tract and the mean residual for the near neighbour tracts is weaker for the sets of tracts with no more than three near neighbours, for both distances. The tracts which are in the set, "no more than three near neighbours", tend to be larger tracts and, thus, are more likely to be in the suburban and peripheral areas where, for example, townships are used as tracts. Variation in attribute scores between units may be greater with these larger units. Also, the use of the mean as a measure gives an undue weight to extreme values. For a larger number of neighbours, the weight of the extreme values would be diminished and the mean would be a more representative measure, than would be the case for an N of 3.

A sample set of three near neighbours could be drawn from the set, 'more than 3 near neighbours'. If the mean residual is calculated for the sample set, and then correlated against the residual for the given tract, this would yield a coefficient which could be compared to that for the three or less near neighbour set. This would indicate if the small N is having an effect on the mean and, hence, the correlation coefficient.

Since the residual values do appear to be correlated, a next step would be to map the residuals so as to observe

the areas of greatest deviance. This knowledge might aid in the selection of additional variables. It might be noted that this procedure can be generalized by making the distance limit a variable and also varying the number of near neighbours used as a determinant of subsets.

Change in Housing Quality from 1950 to 1960.

Neither the variables measuring change in the selected independent variables from 1950-1960 or the 1950 set of independent variables themselves prove to be strongly related to changes in housing quality. It is entirely possible that to treat the amount of change over all observations obscures some possible relationships; it should be noted, however, that CHNWHT reduces over one third of the total sum of squares for CHPPRM -- see Table 29. It also has a very high beta weight with a positive sign. Thus, some relationships can be identified.

The effect of public programs is quite noticeable in certain areas of the central city (Chapter 5, page 91). If the amount of change is examined in those tracts where an urban renewal project or a public housing project has been initiated in the period 1950-1960, then a consistent trend emerges -- the location of these specific projects is shown in Fig. 24. In almost all cases, there is a substantial decrease in the amount of physically deficient housing in the tract, which is only to be expected, given the substantial

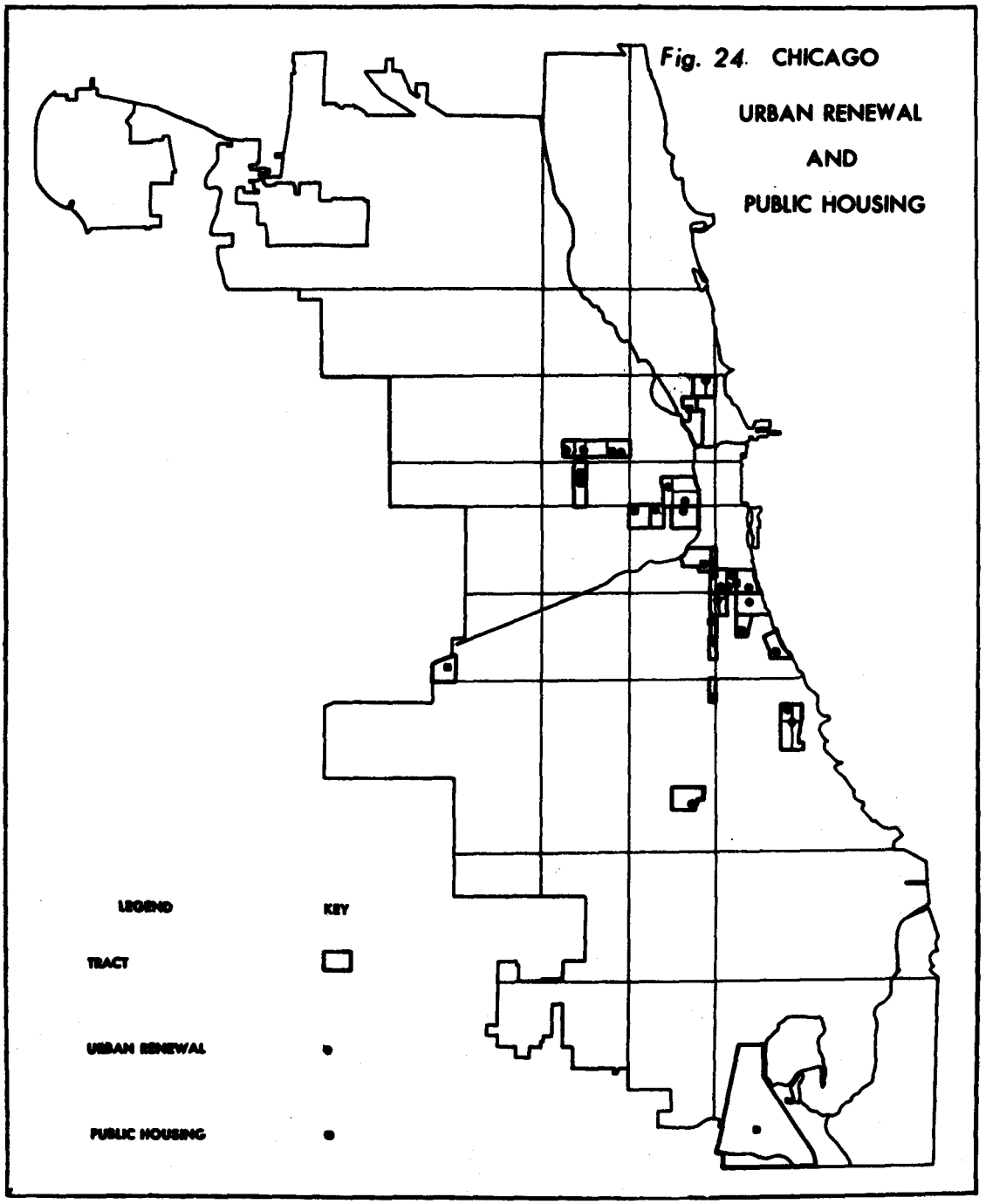
Fig. 24 CHICAGO
URBAN RENEWAL
AND
PUBLIC HOUSING
LEGEND
KEY
TRACT
URBAN RENEWAL
PUBLIC HOUSING

demolition associated with such projects. The mean decrease for such tracts is around -20% compared to a mean of about -8% for all tracts showing a decline, and a mean of around -4% for all tracts. Thus, a binary variable measuring whether or not such projects are located in a tract could well be used as an explanatory variable. This could be widened to include all public works programs if data are available.

One way in which the analysis of change can be extended, and hopefully improved, is to create subsets of tracts. Thus, for example, one two-fold classification might be (a) tracts which increased in residential blight and (b) tracts which decreased in residential blight. A three-fold classification might be (a) tracts which showed a marked increase in residential blight (b) tracts which showed a marked decrease in residential blight and (c) all other tracts -- this group could be thought of as being stable. Operational definitions of "marked" can readily be made.

It should be noted that such a grouping would reduce the variation in the dependent variable. This procedure would lead to some difficulties in regression analysis. Firstly, the amount of variation to be explained is less and a higher correlation coefficient will be obtained than if the observations were to be sampled randomly. Also, the numerical value of the slope (or 'b' coefficient) will also be misleading.[20] This follows from excluding observa-

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[20]BLALOCK, op. cit., p. 119.

tions which may have low scores on a variable which is strongly and positively related to the dependent variable. Thus, the influence of the independent variable is exaggerated.

A grouping based on scores on an independent variable avoids these problems. Thus, a grouping based on the independent variables would allow the comparison of regression coefficients since their value will be unaffected except for sampling error.[21]

The Hypotheses and the Regression Results.

Each hypothesis stated in Chapter four is considered in turn.

(a) The first hypothesis deals with income and quality of housing. The expected relationship is that, within a tract, the higher the degree of residential blight, the lower the level of income (other things being equal). There is a consistent, negative and strong relationship between INCOME and the housing quality variables, as evidenced by the correlation coefficients, the 'b' values and the beta weights, both in

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[21]Such a grouping has been created through the use of multiple discriminant analysis. No further analysis using these subsets has yet been undertaken. It might be noted that INCOME proved to be the most powerful discriminant variable from the 1950 set of independent variables, when the a priori grouping was based on CHRBLT. This emphasises the importance of the relationship between INCOME and poor housing quality as measured by structural condition and plumbing deficiency. If the a priori grouping is based on CHPPRM, then NEGRO or NONWHT would likely be the major discriminatory variable.

1950 and in 1960.[22] Thus, this hypothesis is accepted.

(b) The second hypothesis concerns tenure. The relationship suggested here is that the higher the level of home-owning, then the higher the level of housing quality. The corollary of this is that the greater the degree of renting, the greater is the likelihood of residential blight. The relationship between owner-occupancy (as measured by OWNED and SFDU)[23] and the dependent variables is not especially strong, although in the case of PERPRM (1950) and RB1950 (1960), OWNED ranks third in the order of variables reducing the sums of squares. Also, with respect to CHRBLT, change in owner-occupancy is the most powerful variable. The direction, however, is as expected -- negative. Thus, this hypothesis can probably be accepted although it is clear that owner--occupancy is not an important variable.

The relationship between renting (as measured by RENTED and APTS)[24] and the housing quality variables is

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[22]The correlation coefficients, the 'b' values, and the beta weights from the individual tables are used repeatedly throughout this section as evidence for statements. Thus, this phrase is understood for the review of each hypothesis.

[23]SFDU is included in the full set of independent variables but is removed to achieve a smaller set of independent variables.

[24]APTS is treated like SFDU - see footnote 23.

consistently weak and the direction is not always as expected. For RENTED, the direction is negative and not as expected; for APTS, however, the direction is not consistent. In the case of the change analysis, the relationship is stronger and, for CHPPRM, in the predicted direction. This hypothesis, therefore, cannot be accepted.

(c) The relationship between non-whites and housing quality is expressed in the third hypothesis. The expected relationship is positive, i.e., the greater the percentage of the population which is non-white, the greater the incidence of poor housing. This hypothesis is accepted. The non-white population is dominated by the black population, as measured by NEGRO.[25] NEGRO is very strongly related to PERPRM and is the most powerful predictor after INCOME, for the housing deficiency variables. This is not true for RB1950, however. The direction of the relationship is also consistently as predicted, except for RB1950. In the 1950-1960 analysis, CHNGRO is over-ridden by CHNWHT.[26] In the case of PERPRM, CHNWHT is strongly related in the expected direction.

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[25] In a few parts of the urban area, OTRACE (non-white but not black) is the more dominant category, e.g., in Chinatown and Uptown.

[26] Support for this statement comes from the fact that when CHNWHT is removed from the set of independent variables, then CHNGRO becomes the primary predictor.

In the case of CHRBLT, however, CHNWHT has a high beta weight but does not contribute a great deal to the reduction of sums of squares; the direction is as predicted.

The results for OTRACE in 1960 are interesting. This variable is quite strongly related to DILAP (1960) but only weakly related to the other dependent variables. There is an interesting change in the direction of the relationship, however. With PERPRM, the direction is negative but with RB1950 and DILAP, the direction is positive. A possible interpretation is that while other racial minorities do not suffer greatly from overcrowding, their residential environment is not of high quality.

(d) Another hypothesis stated is that there is a positive relationship between the percentage of foreign born and/or non-native Americans and residential blight. Except for one case, this relationship is weak and negative. In 1960, FORSTK is more strongly related to RB1950 than most other variables (except INCOME), but it is still not a strong relationship and the direction is still negative. This hypothesis is, therefore, not accepted, since it appears that there is little or no relationship between the immigrant population (either first or second generation) and housing quality.

(e) The hypotheses concerning recent migrants and rates of natural increase are related. It is through in-migration and natural increase that the low income population concentrations "maintain" themselves. Natural increase is of

necessity operationally measured by the fertility ratio since data on natural increase are not readily available for census tracts (see Appendix 1). As discussed in Appendix 1, the variables on migration are crude, especially MGRNT2 for both 1950 and 1960 -- it is an over-estimate of the amount of short distance in-migration into a census tract but how much of an over-estimate is not known.

The expected direction of the relationship is positive. In general, the two migration variables show only weak relationships with the housing quality variables. It is difficult to find any consistency in the direction of the relationship. There is a tendency for the direction to be as predicted for 1950 but this is reversed for 1960. When the 1950 analysis based on the central city tracts is considered, the relationship between MGRNT1, the long distance in-migrants, and NPBORD strengthens somewhat and for both NPBORD and PERPRM, the direction is predicted. The in-migrants being measured here do not, therefore, include those migrating directly to the suburban areas from outside of the county. This latter group is likely to be wealthier than most migrants and less likely to be associated with areas of poor housing quality. On the basis of these results then, this hypothesis is not accepted.

(f) The hypothesis on the "spillover" effect from public clearance activities is not tested in the regression analysis. This hypothesis states that, within the areas adjacent to those parts of the city where large scale public works projects have occurred, the level of residential blight is expected to be higher than if such projects had not occurred. A binary variable on whether or not a tract was within a specified distance of a tract containing public clearance activities might be a useful independent variable for the analysis of change for 1950 to 1960. The expectation is that tracts within the specified distance are likely to show increases in residential blight than tracts which are not.

A partial test of the "spillover" hypothesis is possible, however.[27] For each census tract containing a public housing or urban renewal project initiated in the period 1950-1960, it is possible to rank the tracts closest to the project tracts up to a range of one mile. The amount of change in residential blight is known -- NPBORD and RB1950 are used although PERPRM (1950) and PERPRM (1960) could equally well be used. Table 38 contains the mean and median amount of change for the first near neighbours, i.e., the

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[27] An attempt was made to collect data on public works activities that lead to clearance but it is extremely difficult to allocate this on a census tract basis.

closest tracts to the project tracts, the second near neighbours, and so on to the 30th near neighbour. Beyond thirty, the sample size becomes quite small. The number of near neighbours is determined only for an area of one mile surrounding each tract. These results are also plotted in Fig. 25. They show that the areas immediately adjacent to the project tracts do not experience an increase, but experience a decrease throughout the one mile range. Before rejecting the hypothesis however, further investigation is necessary. Almost 75% of the tracts in the central city experienced a decrease, and the mean decrease was around -8%. This raises the question of whether or not the decreases in tracts adjacent to project tracts are less than might be expected, as a result of possible offsetting increases in blight which may follow from the "spillovers". A similar test is required with a sample of tracts with no major public works activities equal in number to the number of project tracts.

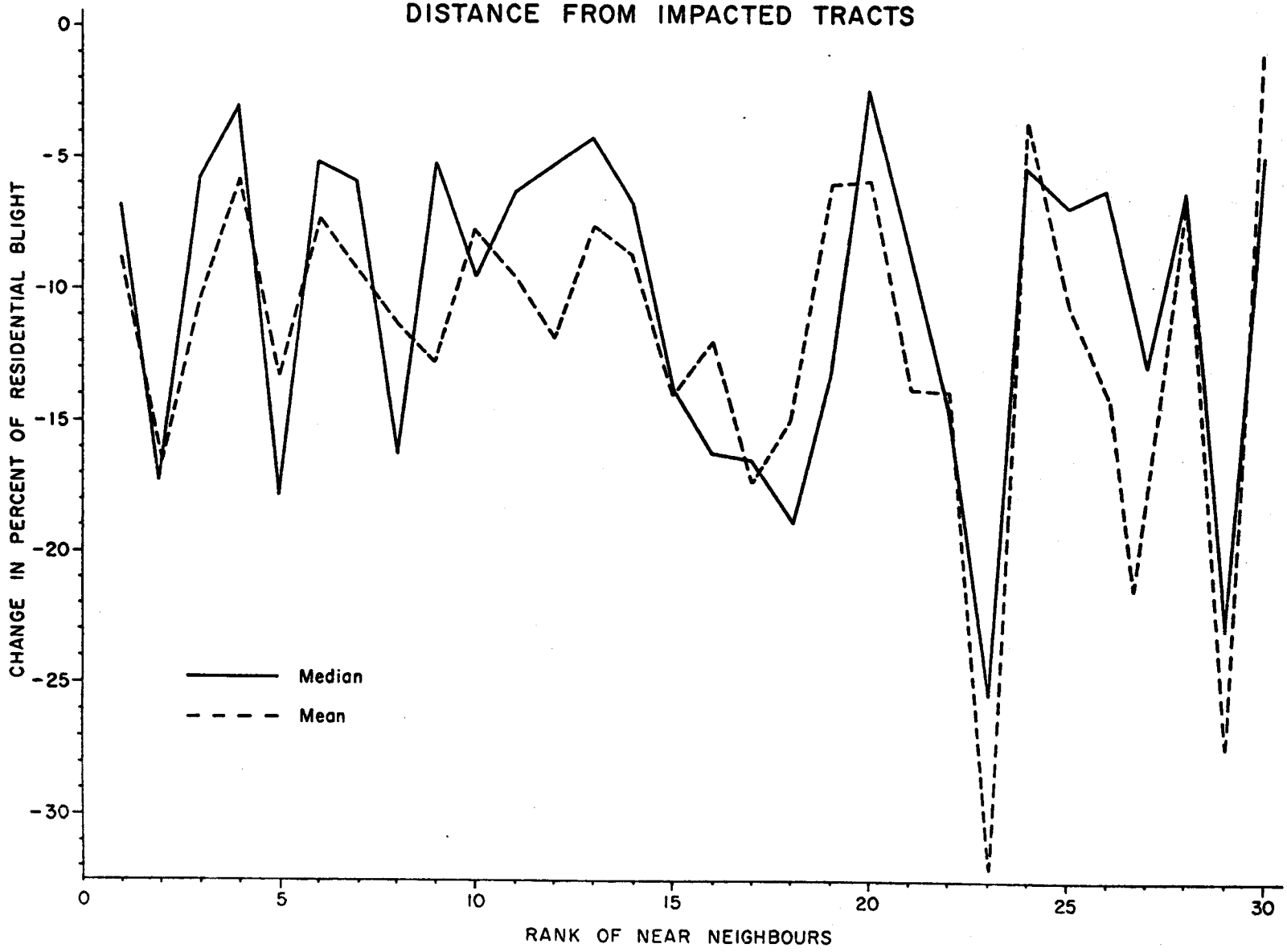
Some other data at the household level bear on this hypothesis. A study of Chicago households displaced by clearance for public housing projects in 1957-58 indicates that the majority of relocatees interviewed found housing which is in better condition and less crowded than

TABLE 38

Median, Mean and Standard Deviation
of Change in Residential Blight
By Distance from Impacted Tracts

Rank of Near Neighbours	Median	Mean	Standard Deviation	Number of Near Neighbours Up to 1 Mile
1	-6.92	-8.75	20.42	27
2	-17.33	-16.56	19.28	27
3	-5.92	-10.47	20.24	25
4	-2.94	-5.67	13.53	25
5	-17.75	-13.36	23.27	25
6	-5.10	-7.30	18.44	25
7	-5.79	-9.25	24.05	28
8	-16.26	-11.24	17.19	29
9	-5.09	-12.80	26.63	28
10	-9.53	-7.56	20.09	24
11	-6.29	-9.45	17.02	27
12	-5.33	-11.76	20.62	24
13	-4.23	-7.52	19.56	26
14	-6.60	-8.62	16.47	24
15	-13.70	-13.82	21.24	24
16	-16.26	-11.88	18.04	27
17	-16.43	-17.40	13.97	20
18	-18.84	-14.91	13.00	19
19	-13.09	-5.99	21.36	17
20	-2.46	-5.92	19.93	22
21	-8.77	-13.76	13.95	19
22	-14.49	-13.85	21.43	20
23	-23.57	-31.82	22.41	9
24	-5.43	-3.55	7.87	13
25	-6.99	-10.52	22.74	14
26	-6.15	-14.10	15.06	12
27	-12.96	-21.36	24.59	11
28	-6.24	-6.26	14.03	14
29	-22.89	-27.26	19.26	11
30	-4.81	-0.93	17.50	12

FIG. 25 MEAN AND MEDIAN CHANGE IN RESIDENTIAL BLIGHT WITH DISTANCE FROM IMPACTED TRACTS



their former residences.[28] Generally, however, this housing is obtained at increased cost to the household.

For all households (N = 197) the percentage living in substandard housing (same definition as variable NPBORD) declines from 83.1 to 41.5 after relocation. The decline in overcrowding is much less; 33.7% lived in housing units with 1.01 or more persons per room, and after relocation this falls to 29.8. The percentage of households renting is the same before and after relocation - 84.6%. The gross rent paid by these households, however, rises from $57 per month to $85, an increase of almost 32%. Overall, the percent of income allocated annually for rent increased from 16.6% to 26.3%. This would likely bring about some re-allocation of expenditures within the household budget. The increased cost is particularly serious for those with low income. Of the renting households, 40% had incomes of less than $3000 annually. The percent of household income spent for rent by this group rises from 35.3% to 45.9% after relocation. A commonly quoted rule of thumb is that a household should spend about 20% of its annual income on housing. After relocation, 65% of the renting households (which comprise most of the sample households)

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28 _____, Rehousing Residents displaced from public housing clearance sites in Chicago, 1957 - 1958, (Department of City Planning, City of Chicago, 1960).

are paying 24% or more of their annual income for rent.

Those households which purchased homes also experience increased housing costs. Half of the owner households made down payments of more than $8,500 which is equivalent to more than 33% of the median purchase price of $21,500. By contrast, the median price received for the former residence is $10,400 (this is the acquisition price paid by the Housing Authority). For over 65% of the owner-occupiers, such a down payment is substantially in excess of the household annual income. Most owners purchased their new homes through installment contracts (57.6%) and conventional mortgages (33.3%). The former arrangement, however, does not provide the usual equity protection afforded by a title deed and mortgage loan. In terms of monthly payments for these loans, 57% of the home-owners are paying $150 or more per month or $1800 or more per annum. This represents 31% of the median owner-occupier income.

Thus, on an individual household basis it is true to say that quality of the housing unit imporved after relocation. However, there is only a small decrease in the proportion of households living in crowded dwelling units. To achieve this improvement, the majority of households, whether they owned or rented, paid substantially more for their housing. It is reasonable to assume that cuts in other areas of household expenditures would be necessary unless

household income somehow increased. Since those with low incomes already paid what appears to be a disproportionate amount for housing, the increase in cost for housing would pose serious problems. These data raise the question of how long the poorer households could remain in costly, standard, but crowded, dwelling units. How long the units might remain standard is another question.

Two other aspects of these data deserve comment. Almost 60% of the relocating households moved to dwelling units in census tracts which are within approximately two miles of the tract in which the former residence is located. Few households moved more than four miles. The residential environment which the households were leaving was of low quality. In 1950, in the tracts containing the project sites, the percentage of dwelling units substandard is 61% (taken over all 12 tracts). Also, 26% of the units are overcrowded (more than 1.51 persons per room). These percentages did not differ greatly, however, from the non-white average for Chicago -- 56% and 24% respectively.

In 1960, two years after the clearance and the forced move, housing conditions in the census tracts which "received" the relocated households are considerably poorer than in the city as a whole. Of the central city housing stock, 13.6% are substandard and 11.2% are overcrowded (more than

1.01 persons per room). Around half of the reception tracts, however, had over 25% of their stock in these categories.

Since it is possible to identify tracts into which the individual households moved, the notion that "spillover" is associated with increases in poor housing quality can be examined for these reception tracts. 72% of the reception tracts show a decline in substandard housing (CHRBLT) but 54% show an increase in overcrowding (CHPPRM). Five tracts received almost a quarter of the relocation households; they all show an increase in CHPPRM, while two increase and three decrease in CHRBLT. This suggests that there is a positive association between "spillovers" and change in overcrowding, but the relationship with change in substandard housing tends to be negative.

Thus, while the neighbourhood context has improved for the relocatee households, it is still an inferior residential environment.[29] It is unfortunate that more data are not available on this hypothesis. With the 197 relocated households moving into 82 tracts their impact is difficult to assess (almost half the reception tracts received only

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[29]The sample on which these data are based represents 38% of the households relocated from public housing project sites during 1957-58 (or 0.66% of all families displaced by public works and redevelopment projects in the period 1948-1958). The sample households were contacted through a variety of sources; a forwarding address left at the relocation office accounted for nearly half the contacts. The quality of housing occupied by the other 62%, and the cost of this housing to them is not known.

one sample household). The discussion of this hypothesis illustrates some of the problems, and insights that can be gained, from cross-level analysis, even on a descriptive basis.

(g) The two hypotheses concerning distance from the CBD can be tentatively accepted although the relationship is not strong. Figs. 26 to 29 show that the housing quality variables do decline with distance; the gradients for physical deterioration and plumbing deficiencies are steeper than those for overcrowding. The relationship as measured by the correlation coefficient, is weaker for PERPRM. This is supported by other evidence, e.g., ability to reduce total sums of squares. The relationship between NPBORD and DIST is stronger when only the central city tracts are considered. This is as expected when the scattergram of these variables is considered -- Fig. 26.

Through time, the gradients do become less steep in both cases, with the most marked change being for NPBORD and RB1950. This is again indicative of the reduction in physical deterioration in those areas closer to the CBD core -- Figs. 30 and 31.

(h) There is a hypothesis concerning the relationship between a tract containing some amount of residential blight and the surrounding tracts and their levels of residential blight. The question at issue here is whether or not the values of

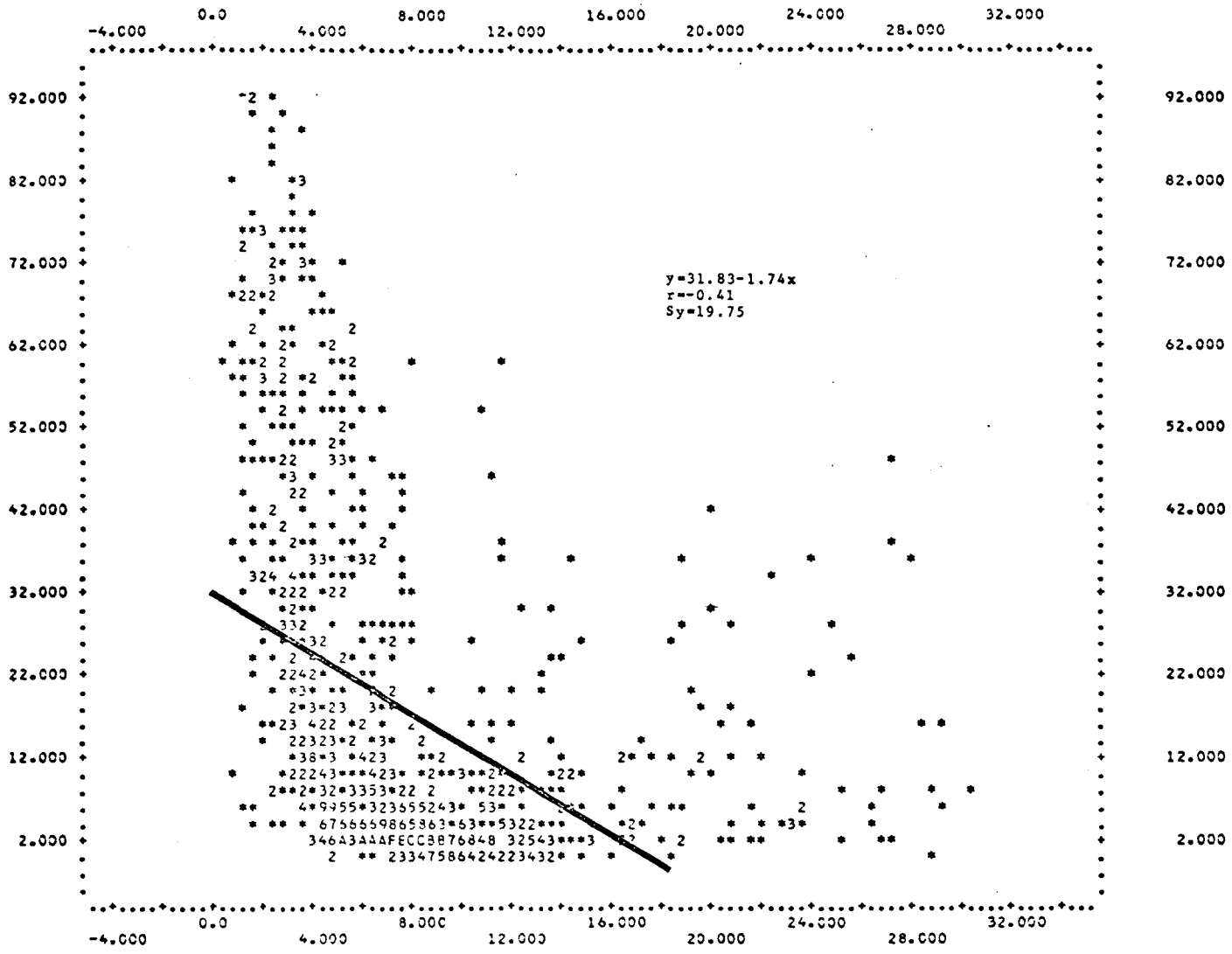


Fig. 26 SCATTERGRAM OF DISTANCE (x) WITH NPBORD (y) , 1950

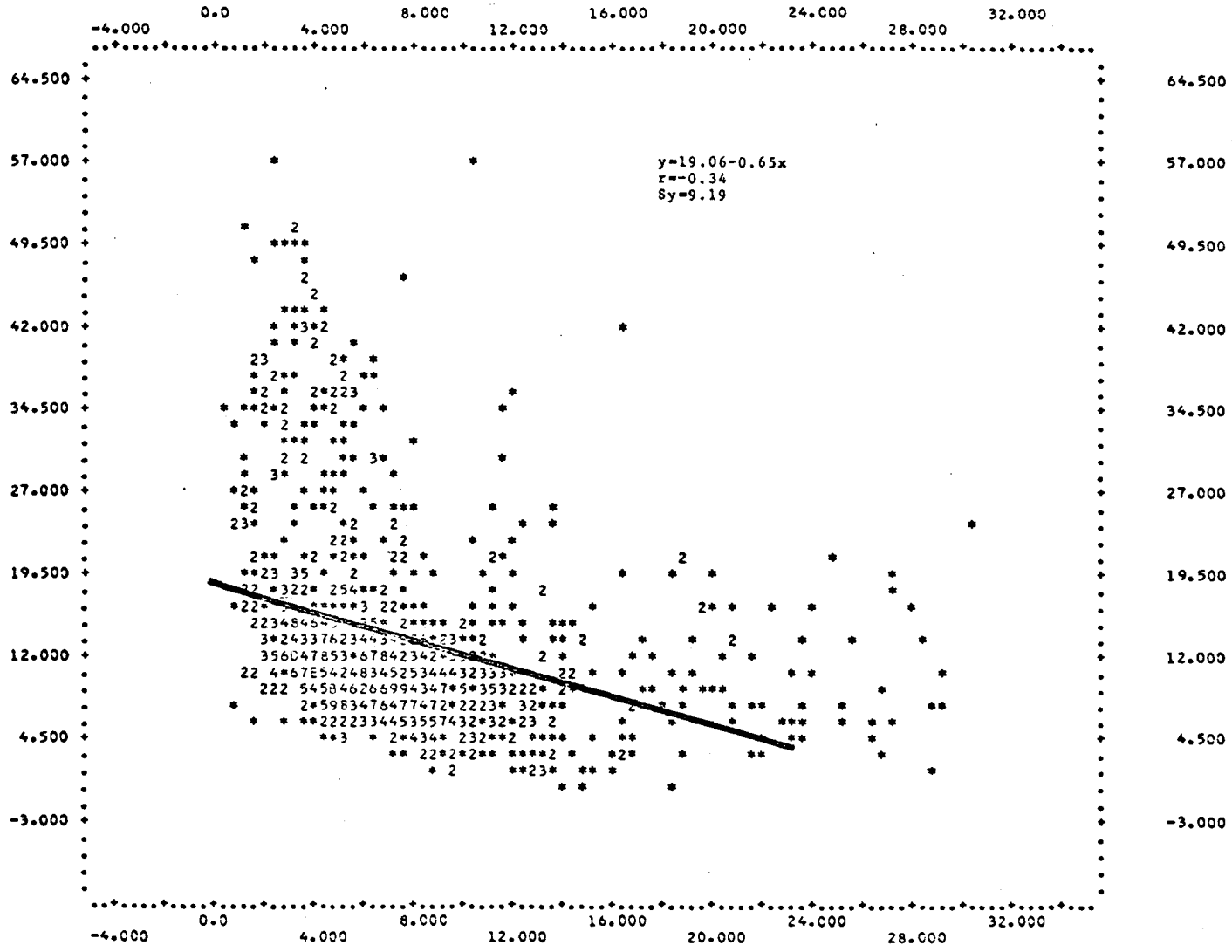


Fig. 27 SCATTERGRAM OF DISTANCE (x) WITH PERPRM (y), 1950

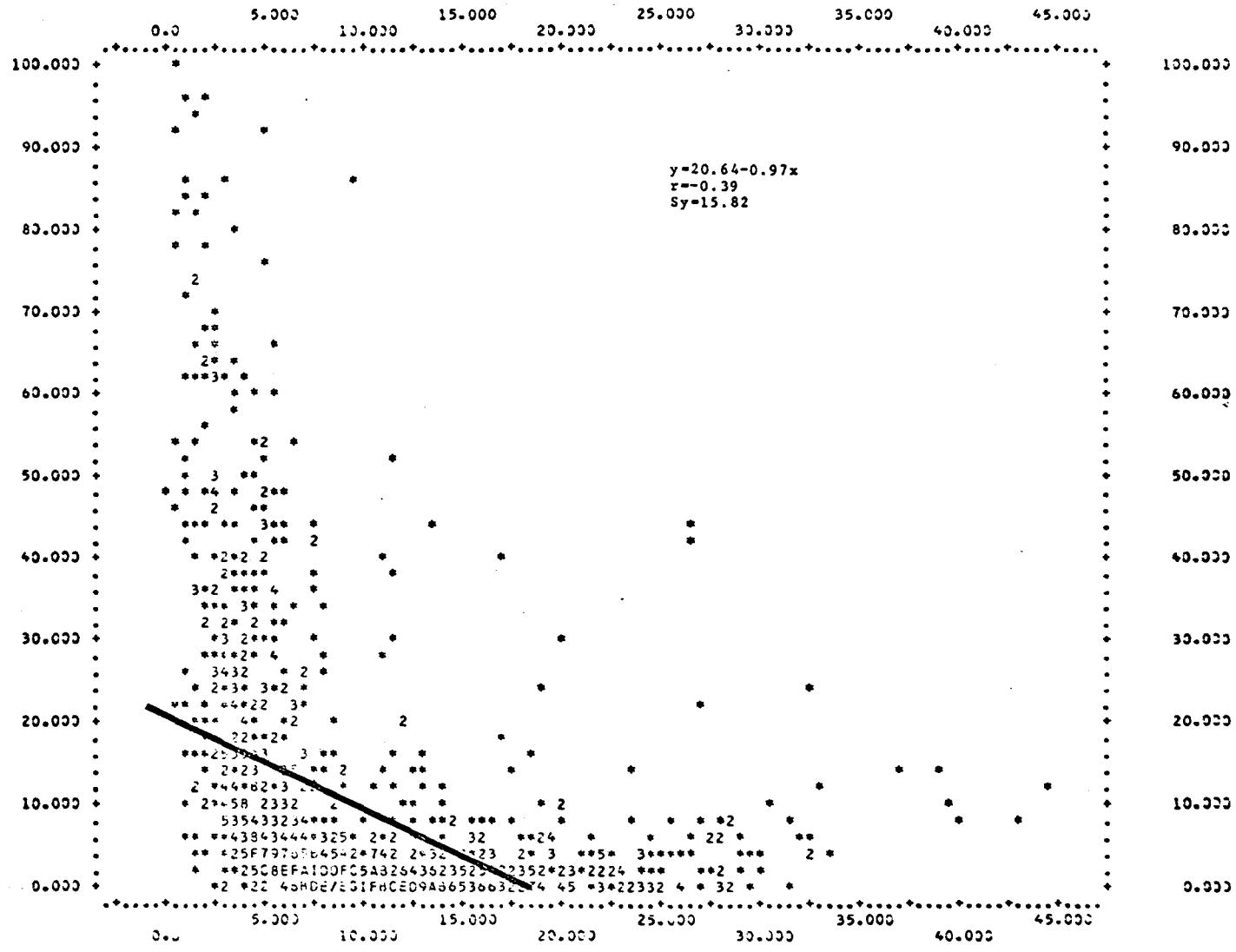


Fig. 28 SCATTERGRAM OF RESIDENTIAL BLIGHT '1950' (y) AND DISTANCE (x), 1960

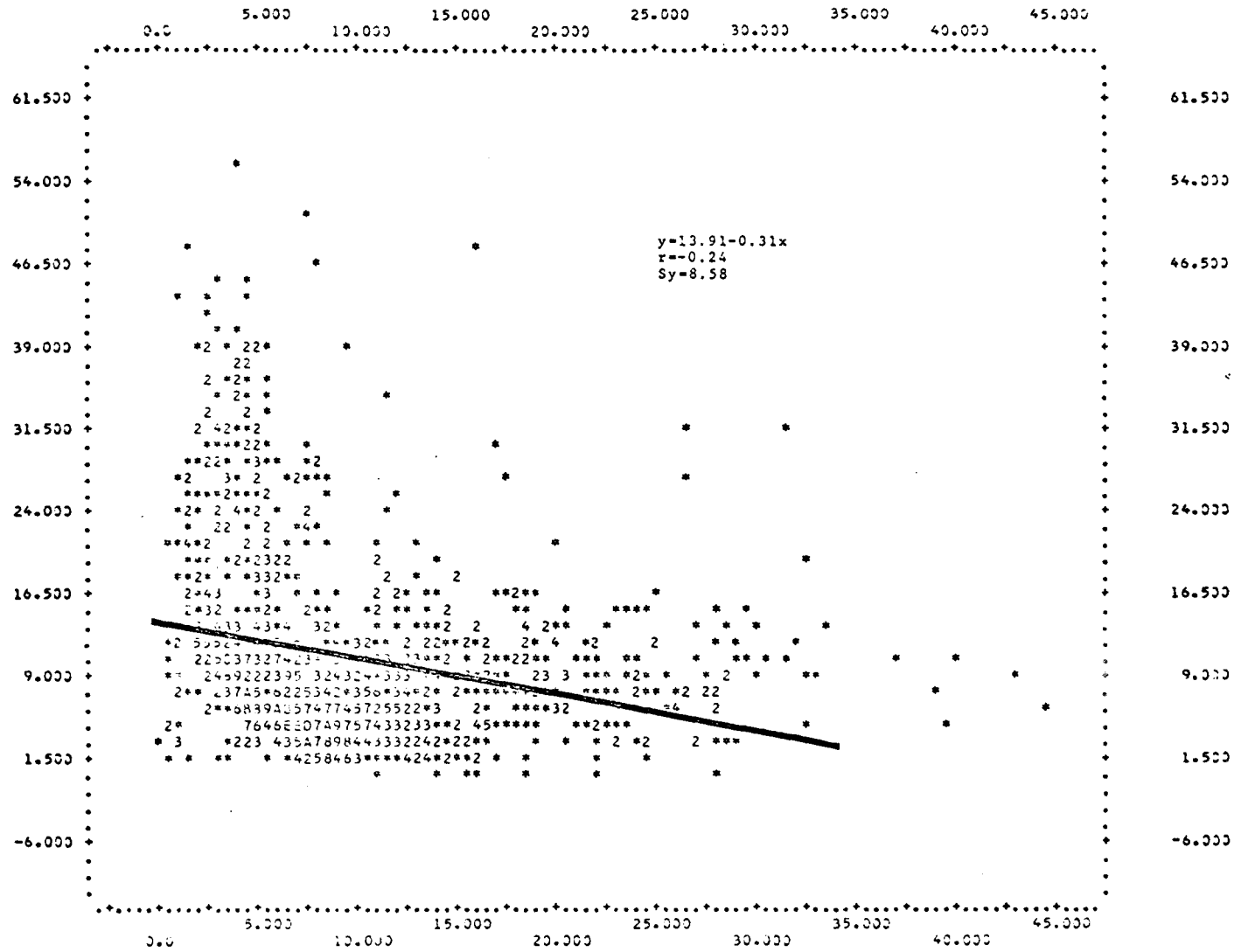


Fig. 29 SCATTERGRAM OF OVERCROWDING (y) AND DISTANCE (x), 1960

FIG. 30 DISTANCE AND RESIDENTIAL BLIGHT

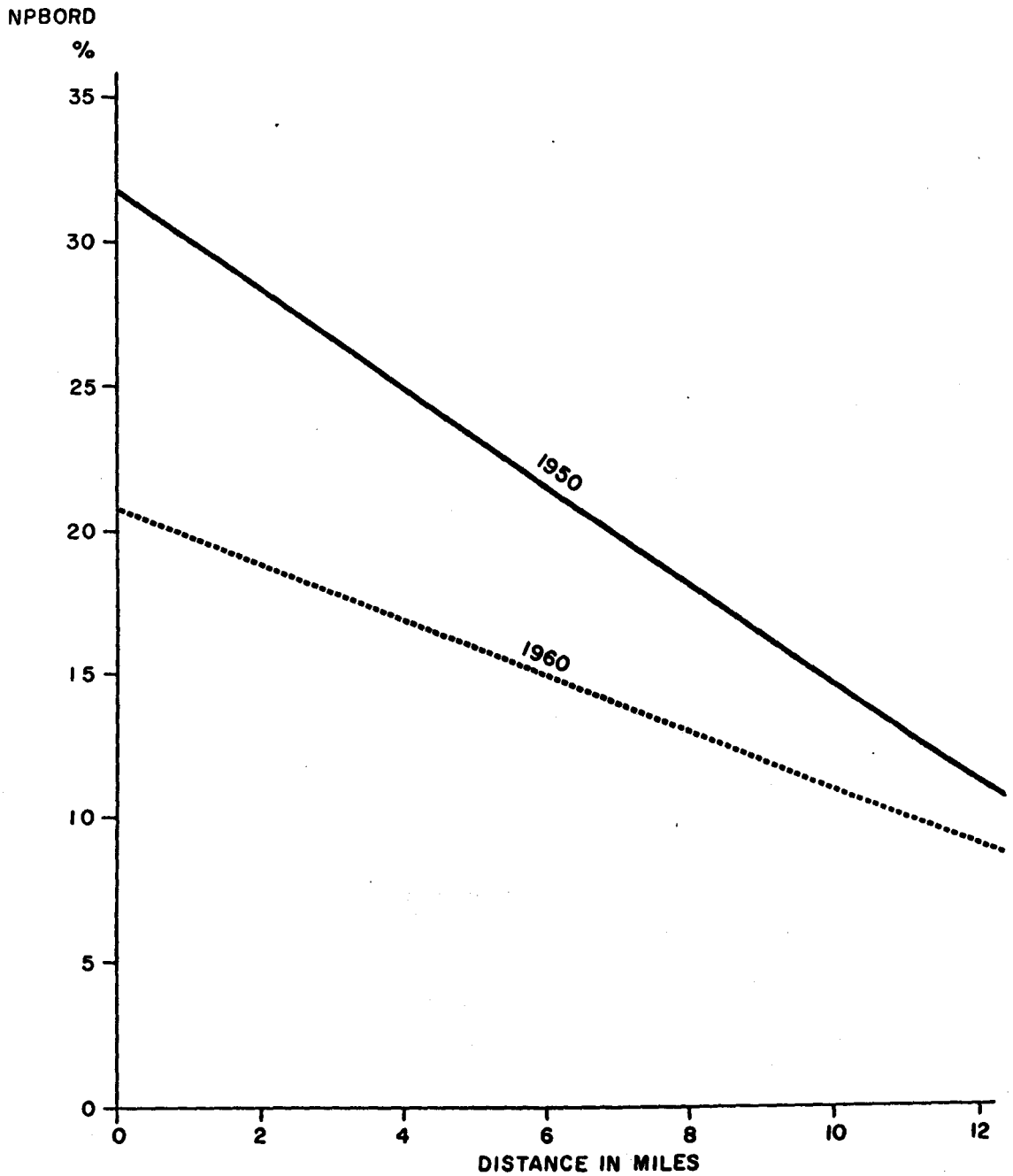
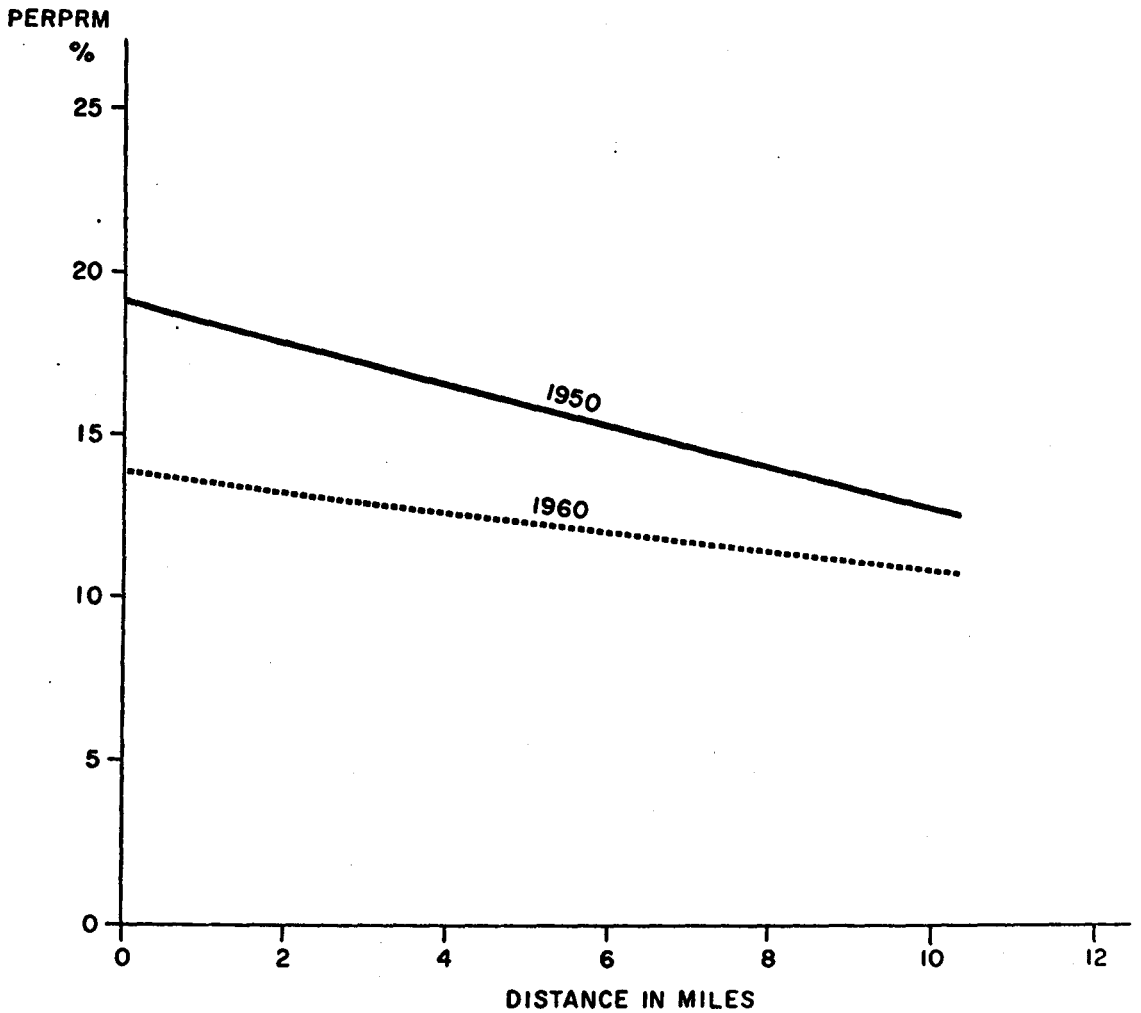


FIG. 31 DISTANCE AND OVERCROWDING



residential blight are spatially distributed in a random or non-random manner, i.e., are they spatially autocorrelated or not. The diagrams presented in Chapter 5 indicate that they are, quite highly in some cases. Although this is a subjective interpretation, no formal test of contiguity seems necessary.[30]

Had the pattern been random (or spatially non-correlated) then the research would have been rather trivial for, as Gould says,

> "....why we should expect independence in spatial observations that are of the slightest intellectual interest....I cannot imagine."[31]

Finally, it should be noted that the hypothesis on the relationship between change in the housing quality variables and change in the independent variables has been discussed and rejected. However, an alternative hypothesis suggesting that the antecedent conditions in 1950 (as measured by the independent variables) are related to change in residential blight from 1950 to 1960 is also rejected.

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[30]Especially when the effort required to create a contiguity matrix for such a large number of observations is considered--recall the comments in Appendix 4.

[31]Gould, op. cit., p. 443.

Partial Correlation Analysis

The acceptance or rejection of the hypotheses is based on the results of the regression analysis, using the beta weights to assess the relative strength and direction of the relationsip between independent and dependent variables. These relationships can also be examined using partial correlation coefficients.

Since NEGRO and INCOME are consistently and strongly related to the measures of housing quality, it is these inter-relationships that are examined. This also allows consideration of Muth's position that it is INCOME (or poverty to be more specific) that is the cause of substandard housing.[32] He implies that the association between poor quality housing and the black population is a function of the low incomes of the black population relative to the population as a whole. If this is true, then holding income constant leads to the expectation of zero correlation between NEGRO and substandard housing.

Table 39 contains the results of the partial correlation analysis. Holding income constant, the relationship between NEGRO and NPBORD in 1950, and between NEGRO and RB1950, and DILAP, in 1960 still persists (though weakly for DILAP). There is some reduction from the zero-order correlation but this is expected. For comparison, the partial coefficient

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[32]R. MUTH, Cities and housing; the spatial pattern of urban residential land use,(Chicago, University of Chicago Press, 1969), p. 127.

TABLE 39

Partial Correlation Analysis

1 9 5 0

NEGRO=1, INCOME=2, NPBORD=3, PERPRM=4

r_{12}= -0.52, r_{13}= 0.59, r_{14}= 0.80, r_{23}= -0.67, r_{24}= -0.69, r_{34}= 0.75

Partial Correlation Coefficients

$r_{13\cdot2}$ = 0.38 $r_{23\cdot1}$ = -0.51

$r_{14\cdot2}$ = 0.71 $r_{24\cdot1}$ = -0.52

1 9 6 0

NEGRO=1, INCOME=2, RB1950=3, DILAP=4, PERPRM=5

r_{12} = -0.52, r_{13} = 0.45, r_{14} = 0.38, r_{15} = 0.75

r_{23} = -0.63, r_{24} = -0.36, r_{25} = -0.59

r_{34} = 0.64, r_{35} = 0.51, r_{45} = 0.40

Partial Correlation Coefficients

$r_{13\cdot2}$ = 0.18 $r_{23\cdot1}$ = -0.59

$r_{14\cdot2}$ = 0.24 $r_{24\cdot1}$ = -0.21

$r_{15\cdot2}$ = 0.65 $r_{25\cdot1}$ = -0.35

1 9 5 0

Partial Correlation Coefficients

$r_{13\cdot4}$ = -0.03 $r_{23\cdot4}$ = -0.31

1 9 6 0

Partial Correlation Coefficients

$r_{13\cdot5}$ = 0.12 $r_{23\cdot5}$ = -0.48

$r_{14\cdot5}$ = 0.13 $r_{24\cdot5}$ = -0.16

between INCOME and the same housing measures is shown, holding NEGRO constant. Again, the relationship persists and quite strongly (DILAP is again weaker). Similarly, the relationships between NEGRO and PERPRM in 1950 and 1960 persist when income is held constant. This procedure allows investigation of another possible inter-relationship. The suggestion is made in some literature that congestion and overcrowding breed slums.[33] In Chapter five, there is also the suggestion that overcrowding in certain areas occurs with racial change, and that declines in quality (as measured by structural conditions and plumbing deficiency) lag behind.

Given the strong relationship between NEGRO and PERPRM, and the weaker relationship with housing condition, it is hypothesised that the relationship between NEGRO and substandard housing occurs because PERPRM is an intervening variable in the relationship. Again referring to Table 39, it is clear that this hypothesis has some merit. The partial coefficient between NEGRO and NPBORD in 1950, holding PERPRM constant is almost zero while in 1960, the partial coefficient is very low. Again, the partials for INCOME and substandard housing are shown for comparison. In this case, controlling for PERPRM

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[33] Ibid., p. 13. Muth also notes this point although he does not subscribe to it. He argues later (p. 271) that crowding in poor quality housing areas is a response to higher housing prices.

has less impact and the relationship persists. A second order partial for INCOME and NPBORD, controlling for PERPRM and NEGRO, produces no change from $r_{23.4}$

This analysis indicates that the relationships between INCOME and NEGRO and the measures of housing quality are independent of each other. An alternative approach, not explicitly considered so far, leads to a suggestive conclusion -- that overcrowding in some way acts as a link between NEGRO and the housing condition measures. This kind of hypothesis suggesting direction, sequence and causality can be considered in a causal model framework.

Causal Models

Blalock argues that one can use correlational data to make inferences about the adequacy of causal models, by eliminating those causal models which make predictions that are inconsistent with the data.[34] To do this, however, requires certain basic and restrictive assumptions.

One assumption is that the researcher is dealing with a recursive system in which ordinary least squares procedures can be used to estimate constants. Such a system

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[34]BLALOCK, op. cit., p. 62.

is shown here:

$$X_1 = e_1 \qquad (1)$$

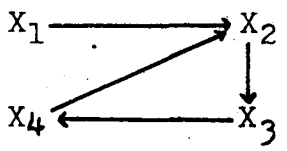
$$X_2 = b_{21}X_1 + e_2 \qquad (2)$$

$$X_3 = b_{31.2}X_1 + b_{32.1}X_2 + e_3 \qquad (3)$$

and so on to the i th case.

X_i is a variable, b_{ij} is the regression coefficient between i (dependent) and j (independent), and e_i is a measure of the effect of all outside variables on X_i. In this system, X_1 is independent of other variables in the causal system. X_3, however, depends on X_1 and X_2 and e_3 but it has no effect on either previous variable. Other assumptions are that the error terms are uncorrelated, that outside variables, while operating do not have a confounding influence on the variables under examination, that the relationships between variables are linear and that the effect of several variables is additive.

Basic to the argument is the point that if b_{21} is zero, then X_2 does not depend on X_1 and the $r_{21} = 0$. The disappearance of a 'b' value under a control, as $b_{31.2}$, is equivalent to the disappearance of the comparable partial correlation. Consider this causal model:



where $X_1 \longrightarrow X_2$ means X_1 causes X_2.

If the causal links between four variables are as shown above, then $b_{13.2}$ should be zero (as should be $r_{13.2}$). Note that

the causal links suggest that there is an indirect relationship between X_1 and X_3 operating through X_2 and that b_{13} (or r_{13}) is not likely to be zero. Simple correlation coefficients can be used, however, thereby simplifying the computations. Consider again the above model. The prediction is that there is no direct relationship between X_1 and X_3; hence $r_{13.2} = 0$ Substituting the complete formula for the partial correlation coefficient,

$$r_{13.2} = \frac{r_{13} - r_{12} \cdot r_{23}}{\left[(1-r_{12}^2)(1-r_{23}^2)\right]^{\frac{1}{2}}} = 0 \qquad (4)$$

Therefore, $$r_{13} - r_{12} \cdot r_{23} = 0 \qquad (5)$$

and $$r_{13} = r_{12} \cdot r_{23} \qquad (6)$$

Thus, in the model used, the predictions are:

$$r_{13} = r_{12} \cdot r_{23} \qquad (6)$$

and

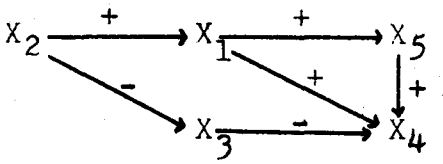
$$r_{14} = r_{12} \cdot r_{24} \qquad (7)$$

which is the same as saying $r_{13.2}$ and $r_{14.2}$ should be zero. To test the predictions, the expected value obtained by multiplying r_{12} and r_{23} is compared to the actual value for r_{13}.

Using this procedure, some hypothesised causal models are evaluated. These models suggest causal links between some independent variables and the variables measuring residential blight for both 1950 and 1960. The procedure is also used to test a causal structure suggested by Muth

using this data. This illustrates the two principal uses of causal models.

Model 1



where X_1 is NEGRO, X_2 is AMGRT1, X_3 is INCOME, X_4 is NPBORD in 1950 and RB1950 in 1960, and X_5 is RENTED. This model describes the following situation. Many of the inmigrants into Chicago from other parts of the U.S. are black and are from rural areas. Thus they are likely to be poor. X_2 is seen as a common cause of X_1 and X_3. Two direct causes are posited for X_4 - they are the percentage of black people in a tract and the median income in the tract. The amount of renting in a tract is assumed to affect the amount of blight, since many blacks are renters.

The predictions and evaluation for Model 1 are shown in Table 40. They indicate that a direct link is necessary for X_1 (NEGRO) and X_3(INCOME). Otherwise the degree of fit is quite good. To evaluate the link X_3 to X_5, both X_2 and X_1, which operate on X_5 and X_3 must be held constant. The procedure is exactly the same, the difference being that equation (4) is for a second order partial. Following as before, this gives $r_{35} = r_{35.1} - (r_{23.1})(r_{25.1})$.

It is hypothesised that INCOME will directly affect RENTED (X_5), particularly with X_1 being linked to X_3.

TABLE 40

Predictions and Degrees of Fit

Predictions	1950 A	1950 E	1960 A	1960 E
Model 1				
$r_{13}=r_{12}\cdot r_{23}$	-0.52	0.01	-0.52	0.00
$r_{24}=r_{23}\cdot r_{34}$	0.05	0.08	0.08	0.04
$r_{25}=r_{12}\cdot r_{15}$	0.03	-0.03	0.02	0.03
$r_{35}=r_{35.1}-(r_{23.1})(r_{25.1})$	-0.67	-0.61	-0.72	-0.65
Model 2				
$r_{14}=r_{13}\cdot r_{34}$	0.59	0.39	0.45	0.33
$r_{15}=r_{13}\cdot r_{35}$	0.37	0.36	0.41	0.37
$r_{24}=r_{23}\cdot r_{34}$	0.05	0.08	0.08	0.04
$r_{25}=r_{23}\cdot r_{35}$	0.03	0.08	0.03	0.05
Model 3				
$r_{15}=r_{13}\cdot r_{35}$	0.37	0.36	0.41	0.37
$r_{16}=r_{13}\cdot r_{36}$	0.80	0.36	0.75	0.36
$r_{25}=r_{23}\cdot r_{35}$	0.03	0.08	0.03	0.05
$r_{26}=r_{26.1}-(r_{23.1})(r_{36.1})$	-0.01	-0.00	0.10	0.06
$r_{36}=r_{35}\cdot r_{56}$	-0.69	-0.38	-0.63	-0.27

A = Actual
E = Expected

(cont'd.)

TABLE 40 (cont'd.)

Predictions and Degrees of Fit

Predictions	1950 A	1950 E	1960 A	1960 E
Model 4				
$r_{14}=r_{16}\cdot r_{64}$	0.59	0.60	0.45	0.38
$r_{15}=r_{13}\cdot r_{35}$	0.37	0.36	0.41	0.37
$r_{17}=r_{16}\cdot r_{67}$	--	--	0.38	0.30
$r_{24}=r_{12}\cdot r_{16}\cdot r_{64}$	+0.05	0.05	0.08	0.03
$r_{24}=r_{23}\cdot r_{36}\cdot r_{64}$	+0.05	0.06	0.08	0.02
$r_{25}=r_{23}\cdot r_{35}$	0.03	0.08	0.03	0.05
$r_{26}=r_{26.1}-(r_{23.1})(r_{36.1})$	-0.01	-0.00	0.10	0.06
$r_{27}=r_{12}\cdot r_{16}\cdot r_{67}$	--	--	0.04	0.02
$r_{27}=r_{23}\cdot r_{36}\cdot r_{67}$	--	--	0.04	0.02
$r_{34}=r_{36}\cdot r_{64}$	-0.67	-0.52	-0.63	-0.35
$r_{37}=r_{36}\cdot r_{67}$	--	--	-0.36	-0.28
$r_{54}=r_{56}\cdot r_{64}$	0.55	0.41	0.51	0.19
$r_{57}=r_{56}\cdot r_{67}$	--	--	0.25	0.15

A = Actual
E = Expected

Muth, as has already been noted, implies that the black population does not have a direct causal relationship with substandard housing; the influence is through the operation of the income variable. To test this notion, the link between X_1 and X_4 is removed. This yields Model 2. (The terms are similar to Model 1).

Model 2

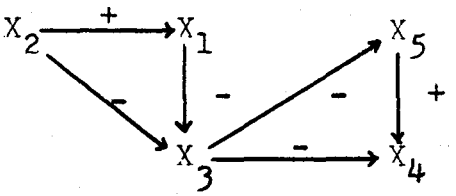
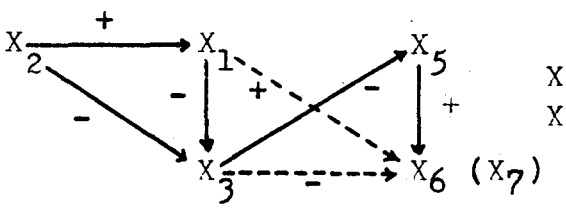


Table 40 contains the predictions and results for this model. The evaluation of the model does not support Muth's position since the degree of fit is poor for both 1950 and 1960 on r_{14} (less so in 1960). The link is restored. The degree of fit is good for the other predictions; the relationship between NEGRO and RENTED operates through income.

With the link restored, Model 2 becomes Model 3. X_4 is replaced by X_6 (PERPRM) and this variable is in turn replaced by X_7 (DILAP).

Model 3

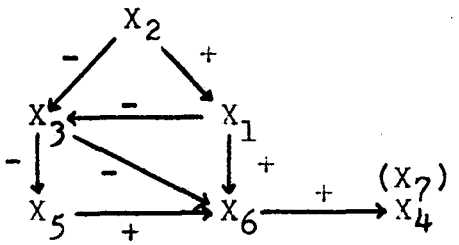


The fit for Model 3 is generally good, as Table 40 shows. The direct links between X_1 and X_6, and X_3 and X_6, are

removed (not simultaneously) but the resultant prediction does not correspond with the empirical data in either case. Very similar results are obtained if DILAP replaces PERPRM (these results are not tabled).

Another hypothesised causal model is evaluated. This is akin to controlling for PERPRM in the preceding section on partial correlation analysis.

Model 4



The goodness of fit is quite high, especially in 1950, and the model can be accepted as structured. This model also supports the notion that PERPRM is caused by NEGRO and INCOME, partly operating through RENTED, and that it precedes poor housing condition (as measured by DILAP, RB1950 and NPBORD). X_3 (INCOME), however, retains an influence on X_4, since the degree of fit on r_{34} is not especially good for 1960 data. The same is true for X_5 (RENTED).

X_2 (AMGRT1) is an exogenous variable which is conceived as a common cause of X_3 and X_1. The model could be further developed, perhaps, with the addition of other exogenous variables such as AMGRT2 and FORSTK. OTRACE could be substituted for NEGRO, and FRTRAT might well intervene between NEGRO and PERPRM.

It should be emphasised that these models have only been evaluated, not tested, and under some severe but necessary assumptions (which will usually be only very imperfectly met). Lack of criteria for evaluating the goodness of fit is another problem. Nonetheless, this use of causal models in an exploratory manner allows consideration of causality, unlike the usual use of regression and correlation analysis where the emphasis is on estimation.

Summary

This chapter contains the results of the empirical analysis. Firstly, the nature of the data, and the interrelationships among the dependent and independent variables are examined. This indicates that there is a considerable amount of variation in the dependent variables. Almost all the variables have skewed distributions. The correlation and factor matrices show that there are strong correlations among the dependent variables (as expected). There are also some marked clusters in the independent variables (except in the 1950 - 1960 set). The principal components analysis allows the identification of such variables as APTS, SFDU, NONWHT, and FORBRN which are very strongly interrelated with other variables. In some of the subsequent regressions, these variables are removed from the independent variable set. A set of interpretable factors is also

identified. As an alternative approach to using each independent variable, the factors are used as independent variables in a regression model.

Secondly, the results of the canonical correlation and the multiple regression analyses are reported and discussed. The canonical correlation indicates that there are strong relationships between the sets of the independent and dependent variables. Among the important predictor variables are INCOME, NEGRO, and the tenure variables. Using the regression equations as an estimating procedure, a generally satisfactory goodness of fit is achieved (as measured by the multiple correlation coefficient). This is especially true for PERPRM in both 1950 and 1960. The weakest results are for the measure of structural condition, DILAP, in 1960, and for the amount of change in substandard housing (CHRBLT).

In an effort to improve the analysis of the change data, a lagged regression equation is used with 1950 data as independent variables and 1950-1960 data as a dependent variable. This improves the fit for CHRBLT but the fit for CHPPRM weakens considerably. Introducing some change data for 1940-1950 into the 1950 regression model strengthens the fit, but, with a smaller number of observations from only the central city, it is the removal of suburban tracts which produces this change rather than the addition of the change variables.

The individual independent variables vary considerably in the strength of their relationship with the various dependent variables. The strongest relationships are between NEGRO and PERPRM, and DILAP, and between INCOME and NPBORD, and RB1950. Those variables have high beta weights compared to the other independent variables and are the major contributors to the reduction of sums of squares. The relationship of the dependent variables with those measuring tenure are uneven but are generally weak. The remaining variables tend to have weak relationships with the poor housing quality measures.

The multiple regression analysis using the factor scores confirms the relationships already described. The principal explanatory factors with the strongest beta weights are the income-tenure factor and the black-foreign origin factor. This holds for both 1950 and 1960. The direction of the relationship is as expected for almost all factors.

The residuals from one of the regression equations (PERPRM with 10 variables, 1960) are examined by a method which tests for correlation among the residuals. The correlation coefficients for this one case suggest that the residuals are spatially correlated. This, in turn suggests that additional variables might be sought to account for the deviances from the regression surface.

The third section of the chapter deals with the

acceptance or rejection of the hypotheses using the beta weight results. The hypotheses relating income, and home-owning in a negative manner, and non-whites in a positive manner with residential blight are all accepted. The hypotheses relating measures of ethnicity, in-migration, renting and natural increase are not accepted. There is an extensive discussion of the "spillover" hypothesis for two reasons. This hypothesis has important causal implications with respect to public policy. The partial test of this hypothesis illustrates how ecological and survey data might be combined. Unfortunately, the amount of survey data is limited. Two other hypotheses concerning distance from the C.B.D., and autocorrelation in the dependent variables are tested graphically. These hypotheses are accepted.

The important relationships between NEGRO and INCOME and poor housing quality are further examined using partial correlation analysis. Controlling for either NEGRO or INCOME does not remove the relationship. Thus the hypotheses are confirmed. Controlling for overcrowding, however, suggests that this measure may be acting as an intervening variable between NEGRO and the measures of structural condition and plumbing deficiency.

Finally, various causal models are evaluated using correlation analysis. These include hypothesised models and

a causal connection suggested by Muth. The Chicago data do not conform to Muth's expectation that the black population is related to poor housing quality through the operation of the income variable. However, another causal model suggests that this relationship does operate through overcrowding which is seen in this causal structure as preceding and causing substandard housing.

CHAPTER VII

CONCLUSIONS

This chapter contains an overview of the findings of this study, these having been summarised at the close of various chapters. Here it is seen that an integration of these findings supports further conclusions. The relationship of the findings to present knowledge and directions for future research are then discussed.

The Findings.

The spatial arrangement of residential blight, as measured by the census variables, is highly concentrated in a few parts of the urban area, primarily in the central city. A broad arc of blighted housing, centred on the C.B.D., is identified. Overcrowding, however, is generally more extensive than either structural deficiency or structural and plumbing deficiencies combined.[1]

The surface of residential blight comes to a peak around the C.B.D. (the Loop).[2] It slopes away quickly towards

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[1]This is shown by the maps and is confirmed by the difference in slope of the two gradients with respect to distance (Figs. 30 and 31).

[2]The census tracts which include the Loop are excluded from the analysis since the number of dwelling units is less than fifty.

the suburban "prairies" of standard housing. This general decline is broken by some upstanding ridges; along the northern branch of the Chicago River, to the west of the Loop along the axis of Madison Avenue, and southwards where the ridge broadens into a plateau-like area which reaches to Lake Michigan and is broken only by a few "sink holes", such as the Hyde Park-Kenwood area. There is a southern "range of hills" around the Lake Calumet - Calumet River area, while the suburban "prairie" is occasionally punctuated by some small outliers, particularly in the southern sector.

The generalisation of the pattern of the structural deficiencies in both 1950 and 1960, as shown by the trend surface maps, yields a strong concentric zone arrangement with a southwards distortion. One is immediately reminded of Burgess' well-known zonal patterns of land use in the city.[3]

There is a considerable decrease in poor housing quality from 1950 to 1960. Only 25% of the tracts show an increase (using poor structural condition and plumbing deficiency as the measure). With respect to overcrowding, change has been less pronounced. In 1960, about 80% of the tracts have less than 15% of the housing stock overcrowded and only 5% of the

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[3] E.W. BURGESS, "The Growth of the City: An Introduction to a Research Project," in R. PARK, E.W. BURGESS and R.D. McKENSIE, (eds.), The City, (Chicago, University of Chicago Press, 1925).

tracts have more than 30% of the dwelling units overcrowded; the corresponding figures for 1950 are 70% and 11%.

On the condition measure, the tracts experiencing the greatest decreases are those which have high percentage scores in 1950. In part, this is a consequence of public works programs in these areas, such as urban renewal and expressway construction. The tracts showing increases tend to be adjacent to the areas of greatest decrease, but are more distant from the city centre.[4] Thus poor housing conditions appear to be spreading outwards but not in all directions - certain axes are favoured. This pattern of growth is somewhat similar to that developed for the city as a whole by students of urban growth, e.g., Hurd.[5]

The pattern of overcrowding is quite similar from 1950 to 1960; the major changes are increases to the west and south of the 1950 areas of proportionately high overcrowding (more than 30% of the units are overcrowded). The change is mostly one of intensity with fewer tracts being overcrowded.[6] There is, however, a decline in overcrowding in the rural periphery. Positive change in overcrowding in the central city seems to be

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[4]The major exception is the tracts immediately adjacent to the Loop area - see again Fig. 21.

[5]R.M. HURD, Principles of City Land Values, (New York, Record and Guide, 1903), Chapter 1.

[6]From 1940 to 1950, in the central city, there is an increase in the number of tracts with a high proportion of dwelling units which are overcrowded, but the spatial pattern is less extensive in 1950.

associated with racial minority in-migration in this time period; this is also true for 1940 to 1950.

The multivariate analyses allows the specification of the relationships between these spatial variations and changes in residential blight and selected variables. Considering the exploratory nature of this study, the results are both informative and encouraging. The canonical correlations suggest that there is an established relationship between the sets of independent variables and the dependent variables (although this is admittedly weaker for the 1950-1960 change data). The multiple regression analyses confirm and clarify the nature and strength of these inter-relationships for both 1950 and 1960. The goodness of fit, as indicated by the multiple correlation coefficients, is pleasingly high. This is especially true for the variable measuring overcrowding. It is least true for the measure of structural condition alone and change in structural and plumbing deficiency from 1950 to 1960. This indicates that the set of selected variables is quite strongly related to the individual dependent variables.

The relationship between the individual variables and the various dependent variables is of greater interest, since this bears directly on the hypotheses tested. Many of the hypotheses are accepted. The relationship between poor housing quality and non-whites is as predicted -- positive. This is a strong relationship, particularly with respect to overcrowding.

Furthermore, change in the non-white population is strongly related to change in overcrowding in the predicted direction. This confirms the persistent spatial association between black residential areas and blighted areas noted in the map interpretation. These conclusions pertain to the black population which is by far the dominant non-white group. However, other racial groups are also positively related to residential blight. Income is another powerful and important variable in the analysis. The relationship here is also as predicted -- negative. The relationship is particularly strong with respect to the measures of structural condition and plumbing deficiency. These strong and important relationships are independent of each other as demonstrated by the partial correlation analysis and the causal models.

The other variables are, in general, less strongly related to the housing quality measures. The hypotheses concerning tenure are partly accepted, however. As expected, there is less residential blight in areas of owner-occupancy and more in areas of renting (the relationship with respect to renting is somewhat inconsistent, and the beta weights are not in the expected direction).

Other hypotheses which are accepted are as follows: (a) Distance to the C.B.D.: as distance increases, blight decreases. Again, this confirms the map evidence though the relationship is not especially strong. This relationship also changes through time as expected, with the 1960 gradient being

less steep, for both overcrowding and structural deficiency. This also confirms some of the changes noted in the map interpretation.

(b) The contiguity effect: the closer an area is to other blighted areas, the more likely it is to be blighted. This hypothesis is accepted on the basis of map evidence and no formal test is made.

(c) Natural increase in population: the greater the rate of natural increase, the more likely the area is to be blighted. There is a positive relationship between the fertility ratio and the overcrowding variable, and change in this ratio is also positively associated with change in overcrowding.

The variables measuring ethnicity are postulated as being positively related to blight but this is not the case. This hypothesis might have been confirmed with data from earlier censuses when this group was actively experiencing discrimination in housing. It was anticipated that a vestige of this would remain, and that the lower status of the ethnic population would also be reflected in a relationship with poor housing. This group, however, is gaining access to economic resources, and their propensity for home-owning also reduces the likelihood of this hypothesis being confirmed. The variables measuring in-migration are only weakly related to residential blight and the direction is inconsistent. This is likely a consequence of the census definitions, a problem discussed elsewhere,(Appendix 1).

The data are also inappropriate to properly test the notion that public works in blighted areas create population "spillovers" and thereby create pressure on the existing housing stock in adjacent areas, which possibly leads to deterioration. The evidence tends to contradict the hypothesis, both at the ecological level and on the basis of limited survey data drawn from another study. This evidence does suggest, however, that overcrowding does not greatly decline at the individual household level after relocation, and the tract data indicate a general increase in overcrowding in the receiving tracts. Therefore, the pressure is possibly being created but the data do not yet reveal the structural deterioration.[7]

This evidence, together with map evidence and the graphs of racial change and housing condition (Figs. 18, 19 and 20) lead to a consideration of overcrowding as an intervening variable. Both the partial correlation analysis and Model 4 in the evaluation of causal models suggest that this is a valid interpretation when the relationship between the percent of population that is black and structural deficiency is examined. Overcrowding does not play this role, however, when the relationship between income and structural deficiency is considered.

The strength and validity of the relationships between the selected variables and the housing quality variables is also

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[7]See again, footnote 17 in Chapter five.

demonstrated by the results of regression analyses utilising the factor structures derived from the principal components analysis. The orthogonal factors (representing the individual variables) are strongly related to the principal component (representing the dependent variable) in both 1950 and 1960. The direction of the relationships for all factors is as predicted in almost all cases. The most important explanatory factors for both periods are (1) a factor which is interpreted as a high income, owner occupancy of a single family dwelling unit dimension (with apartment renting loading in an opposite direction), and (2) a factor which is interpreted as a non-white racial dimension (with foreign-origin or ethnicity loading in an opposite direction). The former factor has the expected negative relationship and the latter factor has the expected positive relationship with the poor housing quality dimension.

Two other relationships are observed from the map interpretation but there is no statistical evaluation of these relationships. There is an association between poor quality housing and the areas of industrial activity in the study area. Poor quality housing is also found in the periphery of the Chicago area and this perhaps indicates a "rural shack" type of residence. Both occurrences are expected (on the basis of other studies) but lack of data precluded a test of the relationships.[8]

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[8]The other studies referred to are: (1) B.J.L. BERRY and R.A. MURDIE, Socio-economic Correlates of Housing Condition, (Toronto, Metropolitan Toronto Planning Board: Urban Renewal Study, 1965), on the poor quality housing in the fringe areas of Toronto and (2) the other references cited in footnote 5, Chapter three.

The Findings and Present Knowledge.

The conceptual framework developed in Chapter four is at the level of the household. The testing of the hypotheses admittedly does not increase our knowledge of the relationships between the behavior of the important decision-makers (households, landlords, owner-occupiers, public officials), and the condition of the dwelling units in an area. But our knowledge of the contextual relationships is greatly increased. This in itself is desirable since, as noted in the summary of the review of the literature, there is very little literature concerning the spatial pattern of residential blight. As to the literature on what causes blight, this is more extensive, though often speculative. The causal models also assist in relating the findings to the literature, although the scale of analysis should be borne in mind since cross level inferences are decidedly risky.[9]

There are some similarities between the spatial associations observed here and those commented on in Chapter 3. These are the decline in blight with distance from the city centre, and the close relationship between blight and industrial areas. It is not true to say that blight is increasing. It is true however that blight is spreading into areas of previously standard housing while it declines in the innermost part of the city. Existing blighted areas are strongly related to other blighted areas and it might be inferred that poor resi-

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[9]This does not prevent Muth from making this type of statement. He ignores this problem completely.
R. MUTH, Cities and Housing; the spatial pattern of urban residential land use, (Chicago, University of Chicago Press, 1969).

dential condition itself acts as a "blighting influence".

The extensive literature on the poor quality of housing occupied by the black minority up to the nineteen sixties is summarised and reviewed by McEntire.[10] The findings here confirm this relationship and indicate that it is a strong relationship. It also holds for other racial groups. Further insight is gained as to the nature of the relationship through specifying the inter-relationships between the variables measuring structural deficiency, overcrowding, non-whites and income. Muth tends to discount the relationship between blight and the black population, arguing that it is the low income of the non-whites that is the major determinant of housing condition.[11] He finds that this is the case in his study. The findings here demonstrate the persistence of the black minority group - poor housing relationship. Taking the notion of residential discrimination against blacks as a fact in U. S. society, the persistent relationship identified strengthens the implication that continued discrimination leads to the minority group being housed in crowded,

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[10] D. McENTIRE, Residence and Race; Final Report to the Commission on Race and Housing, (Berkeley, University of California Press, 1966).

[11] MUTH, op. cit., p. 127.

substandard accommodation.[12]

The actual price-quality relationship is not investigated here, but the survey data indicate that non-white relocatees pay a very substantial proportion of their income for standard (and substandard) housing in areas which are generally inferior to the rest of the urban area. Some people would term this "gouging".

Muth correctly argues that much of the previous literature is deficient in not regarding income as a principal cause of blight (this is discussed in Chapter three). The findings here support his conclusion that income is a major causal factor. The causal models indicate that low income leads to overcrowding. Muth, however, interprets overcrowding as a response to higher housing prices.[13]

U. S. housing policy is based on the premise that

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[12]Many people have argued that residential discrimination exists. Helper's study indicates that real estate brokers do practice discriminatory racial policies. The organised community resistance to open occupancy legislation and the necessity of having human rights commissions to investigate residential and other forms of discrimination also attest to its existence. R. HELPER, Racial Policies and Practices of Real Estate Brokers, (Minneapolis, University of Minnesota Press, 1969).

[13]On another but related point, these models agree with Muth's interpretation of the influx of low income in-migrants as a major stimulus of demand for housing in the central city. MUTH, op. cit., p. 271 and p. 127.

owner-occupancy is the ideal state of tenure. Implied in the rhetoric on this point is the belief that, given the "stake" in the property, the owner-occupier will maintain the property. Owner-occupiers also generally have a higher income than renters; thus they may have the resources to protect their "stake". The data here support the belief that there is a negative relationship between home owning and residential blight. Those who rent depend on the landlord to maintain the property. As rent strikes in New York and other cities indicate, they are often disappointed. Landlord behaviour is crucial to the whole problem of poor housing quality in urban areas. More studies of the type carried out by Sternlieb are urgently needed.[14]

As a consequence of housing and transportation policy decisions, many people have been uprooted from their residences and relocated. Gans and others have suggested that this process currently leads to relocation in areas likely to be redeveloped in a few years.[15] Other critics have used the term "slum-shifting". The evidence is slender but at the aggregate level it suggests that overcrowding does occur in the reception areas and that deterioration does indeed subsequently occur.

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[14] G. STERNLIEB, The Tenement Landlord, (New Brunswick, N.J., Urban Studies Center, 1966).

[15] H. GANS, The Urban Villagers, (New York, The Free Press, 1962).

Finally, the findings add to our knowledge concerning an important aspect of the spatial structure of the Chicago metropolitan area. Although the results are based on the Chicago metropolitan area, there are no grounds for not expecting similar results in other large metropolitan centres in the United States. Thus, the findings have wider application.

Future Research.

Since this is a complex problem which cuts across levels of analysis, there are many possible directions for future research.

One area of research is to seek confirmation of these results in other cities in the U. S. and for different sizes of urban areas. Use of Census data makes this possible. Also, the 1970 Census data will be available shortly. These could be used to extend the time perspective of the study for the Chicago metropolitan area. Unfortunately, data are no longer collected on structural condition and hence comparability is not completely possible.

Comparison with Canadian urban areas would also be useful since the underlying spatial structure of such cities is generally similar to many U. S. cities. Naturally, the non-white variable would be less important; perhaps recent Southern European immigrants might be the corresponding group in this situation.

The present framework could be further examined. The residuals from regression indicate areas of deviation from the

regression surface.

Consideration of these areas might lead to the addition of other variables to help reduce the residual terms. Linear relationships between the independent and dependent variables have been assumed. Determination of the functional relationships would assist in the development of a model which might include some non-linear relationships.

The somewhat disappointing results for the analysis of change in residential blight have already been discussed and a procedure for creating subsets of tracts based on change behavior outlined. Some specific hypotheses might be tested here; for example, that increases in overcrowding occur with increases in the non-white population and that these lag behind changes in structural condition.

Other variables might be added to the set of independent variables. Certain hypotheses could be developed concerning the relationship between educational levels and occupational group and housing quality. These variables are important in two ways. Firstly, allied to such variables as income and ethnic or racial character, this creates a set of variables which might define "life style". The underlying hypothesis here is that attitude toward consumption of housing and quality is a function of "life style".[16] Secondly, education and occupation are also

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[16] Robert Schmitt, a graduate student in the Department of Geography at the University of Iowa, is currently investigating this problem at the aggregate level, using 1960 Census data for Pittsburgh. His results should be available shortly.

the principal determinants of income.

An analysis of the process that generates residential blight would be strengthened by incorporating data at the household level. If these are combined with ecological data, then the "micro-macro" approach advocated by Dogan and Rokkan is possible.[17]

Thus, for example, a small section of a "slum" area might be selected for detailed investigation. Data would be sought on such variables as landlord maintenance expenditures, rates of return, investment in property, perception of market conditions, attitude toward tenants, etc. For the household, housing costs, residential case histories, attitude to dwelling unit and neighbourhood, are examples of appropriate variables. Others might well be considered. Clearly, there might well be serious problems in data collection, but it is argued here that these data would certainly assist in the development of explanatory models.

Poor housing quality is regarded as a public problem. It does not seem likely that it will disappear if we close our eyes and wait. If public policy is to be effective, it must be based on a clear understanding of the processes at work and the nature of the problem. This study is a first step in that direction.

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[17] M. DOGAN and S. ROKKAN (eds.), Quantitative Ecological Analysis in the Social Sciences, (Cambridge, Mass., M.I.T. Press, 1969), Introduction, p. 8.

APPENDIX 1

LIST OF VARIABLES AND DEFINITIONS

1950

1. No private bath or dilapidated, percent -
(Number of dwelling units with no private bath or dilapidated/all dwelling units) x 100.

2. No running water or dilapidated, percent -
(Number of dwelling units with no running water or dilapidated/all dwelling units) x 100.

3. Persons per room, percent -
(Number of dwelling units with 1.01 or more persons per room/all dwelling units) x 100
The ratio, persons per room, is found by dividing the number of persons in a household by the number of rooms in the dwelling unit (where these rooms are used as living quarters).

4. Foreign born, percent -
(Number of persons born outside the United States/total population) x 100.

5. Non-white, percent -
(Number of non-white persons/total population) x 100
Non-white is defined as Negro and other races which are not white, e.g., Japanese, American Indian.

6. Negro, percent -
(Number of negroes/total population) x 100.

7. Number of households -
A household includes all the persons who occupy a dwelling unit.

8. Migrant 1, percent -
(Number of persons who resided in a different county or abroad in 1949/number of persons, 1 year old and over, 1950) x 100. This variable essentially measures migration into an urban area. On the one hand, however, nothing is known about the distance moved, and secondly, in very large metropolitan areas (such as Chicago), persons residing in a different county may well be within the metropolitan area. Such people, however, did move into any given census tract and can be so classified.

9. Migrant 2, percent -
(Number of persons who resided in a different house, but in the same county, in 1949/number of persons, 1 year old and over, 1950) x 100.
Some of the persons in this category have almost certainly moved into any given census tract, but it is impossible to determine how many of the intra-urban movers should be so classified; one need only move into the neighbouring dwelling to be measured by this variable.

10. Median income -
The income figure used is the amount received by families and unrelated individuals before deductions for taxes. Thus, it is an over-estimate of disposable income available to households.

11. Fertility ratio -
(Number of children under 5/number of women between the ages 20-49)
The age group 20-49 has commonly been used to define women in the child bearing range, although obviously this is not an all-inclusive category.

12. Owner-occupied, percent -
(Number of owner-occupied dwelling units/all dwelling units) x 100. A dwelling unit is defined as owner-occupied if it is owned, wholly or in part, by a member of the household. All other occupied units are renter occupied.

13. Rented, percent -
(Number of rented dwelling units/all dwelling units) x 100.

14. Vacant, percent -
(Number of vacant dwelling units/all dwelling units) x 100.
This category includes those vacant units which were available for sale or rent.

15. Single family dwelling units, percent -
(Number of units which are one dwelling unit, detached/all dwelling units) x 100.

16. Apartments, percent -
(Number of units in the category "five dwelling units, or more, in a structure"/all dwelling units) x 100.

17. Distance to C.B.D. -
Distance between any tract and a tract in the Loop district (tract 511) as measured by the straight line distance (in miles) between tract coordinate points.

18. Population change, 1940-1950, percent -
(Total population in 1950 - total population in 1940/total population in 1940) x 100.

19. Change in non-whites, 1940-1950, percent -
(Non-white population in 1950 - non-white population in 1940/non-white population in 1940) x 100.

1960

Only those variables which are defined differently from the 1950 variables or are not used in the 1950 analysis are listed.

1. Deteriorating, percent -
(Number of dwelling units which are deteriorating/all dwelling units) x 100.

2. Deteriorating, lacking plumbing facilities, percent -
(Number of dwelling units which are deteriorating and lacking plumbing facilities/all dwelling units) x 100.

3. Residential blight (1950), percent -
(Number of units which are dilapidated + deteriorating, lacking plumbing facilities + sound, lacking plumbing facilities/all dwelling units) x 100.

4. Bathroom, shared, or none, percent -
(Number of dwelling units with no or a shared bathroom/all dwelling units) x 100.

5. Foreign stock, percent -
(Number of persons, born in the U.S., one or both of whose parents are foreign born + foreign born/total population) x 100

6. Migrant 1, percent -
(Number of persons who lived in a different house in 1955, outside of the S.M.S.A./number of persons five years old and over, 1960) x 100

7. Migrant 2, percent -
(Number of persons who lived in a different house in 1955, in the same central city + number of persons who lived in a different house in 1955, in another part of the S.M.S.A./ number of persons five years old and over, 1960) x 100
This category, though different from the 1950 variable, essentially measures the short distance movers within the S.M.S.A. Again, however, it is not possible to distinguish between those who moved into a tract and those who moved within a tract.

8. Apartments, percent -
(Number of units in the category, "5-9 units per structure" + number of units in the category "10 or more units per structure"/all dwelling units) x 100.

1950-60

Twelve of the sixteen variables used in the analysis of change from 1950 to 1960 are differences in percentage of the variable in 1950 and in 1960.

e.g. Percent foreign born, 1950 = 50%
Percent foreign born, 1960 = 25%
Change in percent, 1950-1960 = 25%

Three of the other four variables are percentage change variables i.e. (Value in 1960-value in 1950/value in 1950) x 100 These are population change, change in number of households and change in income.

The fourth variable is change in percent of movers. Since the categories used for residential mobility in 1950 and 1960 are not directly comparable, the best available measure is the crude distinction between those in a census tract who have changed residence and those who have not.

Comment: The variables selected are the operational measures for the hypotheses. Normally, there would be a full discussion of the choice of operational definitions, but the prior choice of census data (for reasons already stated) means that the variables (and definitions) are more or less given.

Although some comments on the variables (and possible alternatives) are made in the text and in the above list, a few additional remarks might be made.

(a) It is not possible to readily match data on natural increase with the census tracts. After discussing this problem with some staff members of the Population and Family Study Center at the University of Chicago, the fertility ratio is used as a surrogate measure. However, this ratio varies so little from tract to tract that it is dropped from the analysis.

(b) To improve the migration data would mean collecting data on household turnover from public utility companies or telephone companies. This task is clearly beyond the scope of this study.

(c) Most of the variables are self-explanatory and are reasonable measures for such things as tenure, colour, and immigrant origin. Apart from overcrowding, and measures of plumbing deficiency, the housing variables are highly subjective. Their

reliability is discussed elsewhere (Chapter 2).

(d) The data on the location of public housing and urban renewal projects and their date of initiation are from material provided by the Chicago Housing Authority and the Department of Urban Renewal, City of Chicago. The Northeast Illinois Metropolitan Planning Commission does not have such information for the suburban areas, although it may be possible that it is available from other sources.

(e) Other data are available on demolition totals (not just that resulting from urban renewal and public housing activities), but, again, the areal units do not readily correspond. This correspondence problem is a difficult one in urban studies but is unavoidable.

APPENDIX 2

COMMENT ON COMPUTER PRODUCED MAPS USING SYMAP

It is possible to use SYMAP and create maps showing data by small areal units within the larger outline, e.g., maps of data by census tracts. However, given the problems of creating and verifying a locational grid, and defining an outline for over 2,000 sub-units this is not attempted. Some precision is thereby lost since the user cannot refer to specific units (or tracts). On the other hand, the contour map is more like the natural surface that is discussed in Chapter 1.

These maps are based on a large number of control points and to show these on the housing variable maps would merely confuse the user further. The control points are shown on Figs. 32, 33, and 34. Each control point represents a census tract (and, thus, they are crude population distribution maps). The 1960 set of control points for the city is not exactly similar to the 1940 and 1950, since there are 845 control points as against 886 for 1940 and 1950. However, the pattern is very similar, the major changes being in those areas where the control points are very close together (the number of tracts in these areas were reduced), and in the peripheral areas of the city where population increases have brought about an increase in the number of tracts. The map for change 1950-1960 is based on 729 tracts. The reason for this smaller number of observations is discussed in Appendix 5.

One area where a number of census tracts are removed from the analysis is the Central Business District. Because of the interpolation character of the SYMAP program, however, this area is mapped; thus, those tracts adjacent to the CBD have a somewhat disproportionate visual effect.

In the course of the description and interpretation of the housing patterns, reference is of necessity made to a number of streets, community areas, municipalities and natural features. To avoid "over-populating" the maps with symbols, these are shown on three overlays which should be used in conjunction with the maps in Chapter 5. These overlays are Figs. 35, 36 and 37.

Although the provision of separate maps for the central city and the suburban areas weakens the notion of a metropolitan system, the variation and detail of the central city would have been substantially reduced in the final copies if a unified map had been used. As it is, some maps are not particularly satisfactory, and the difference in symbols is obscured in the final reduction.

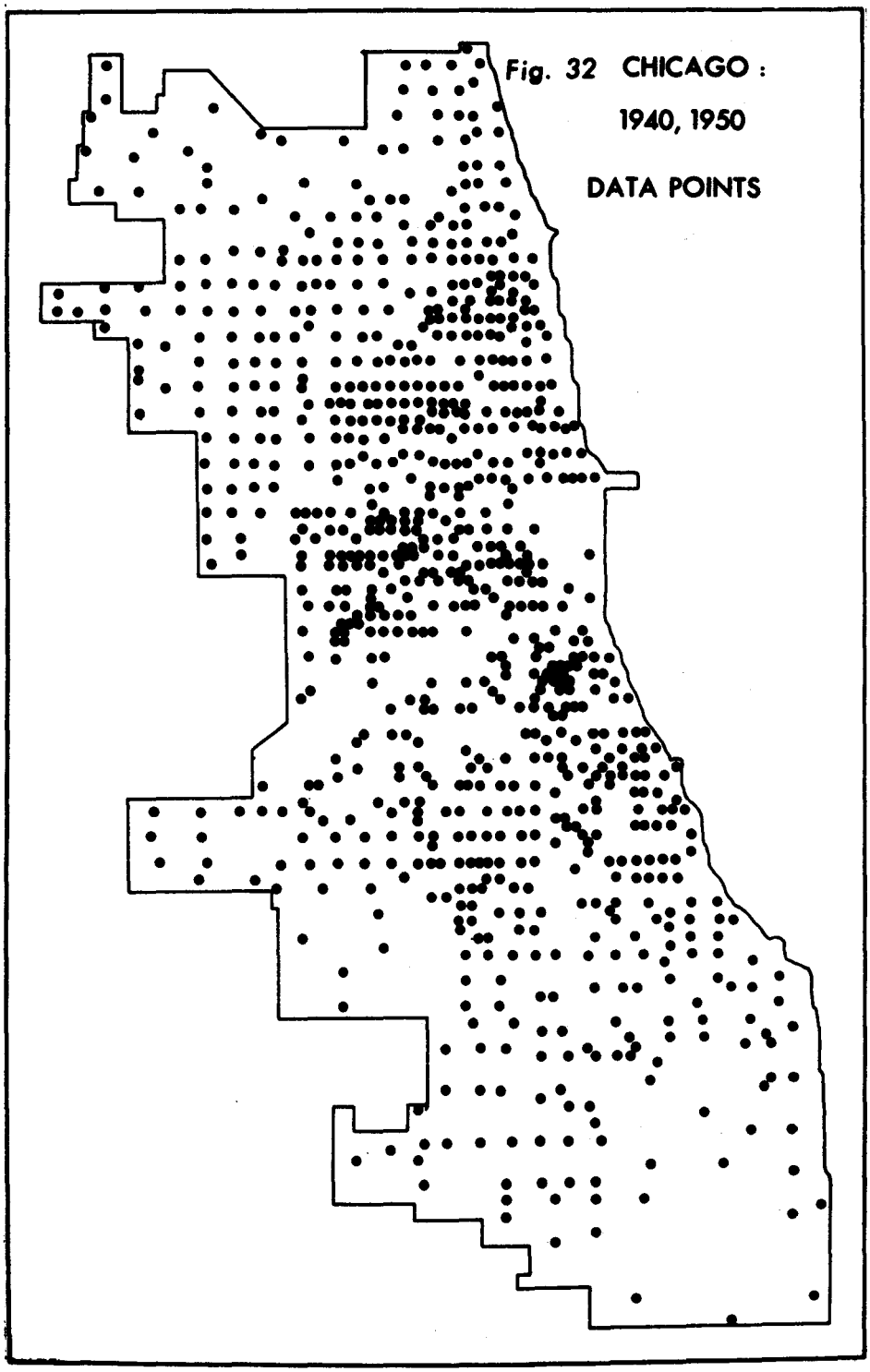
Fig. 32 CHICAGO :
1940, 1950
DATA POINTS

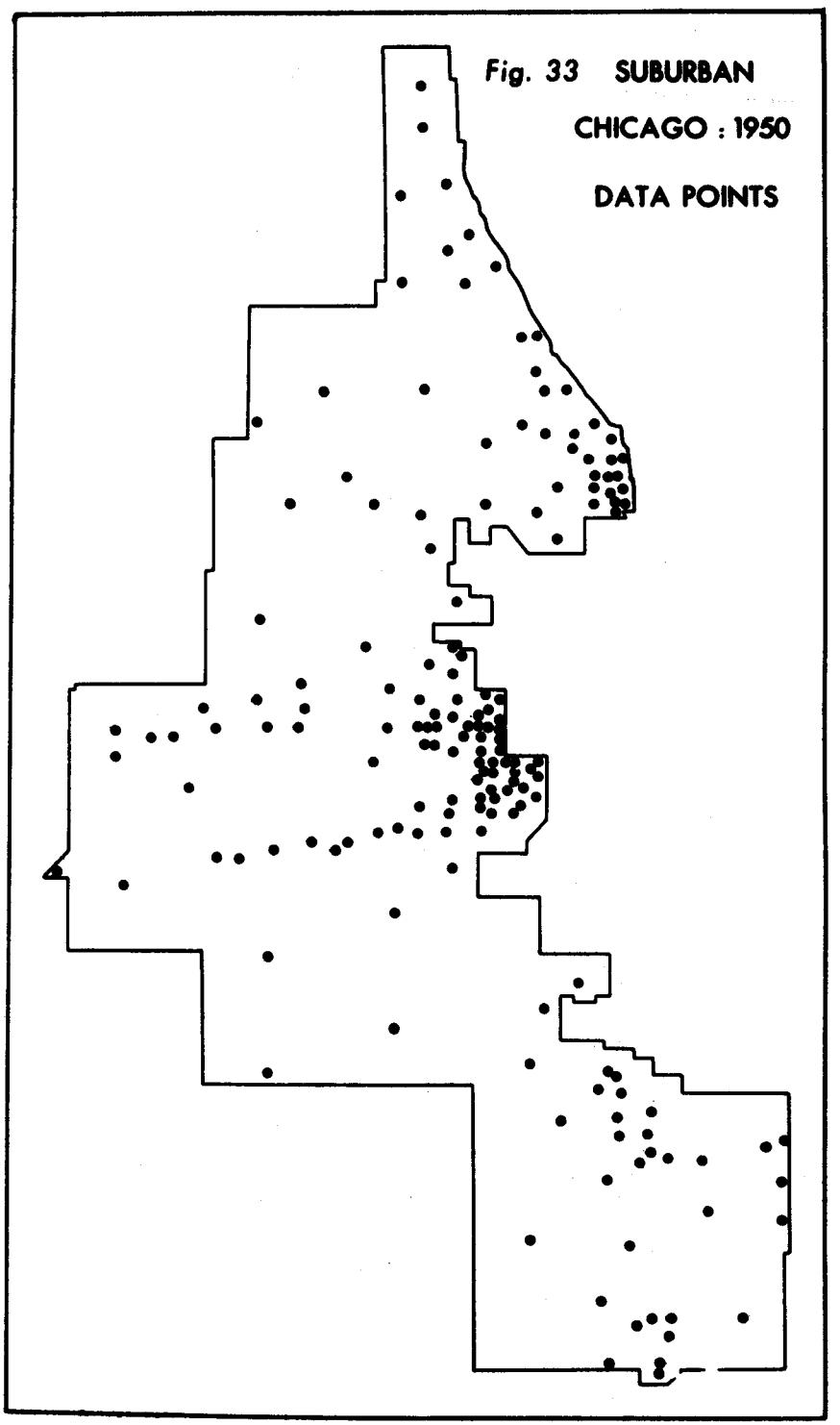
Fig. 33 SUBURBAN
CHICAGO : 1950
DATA POINTS

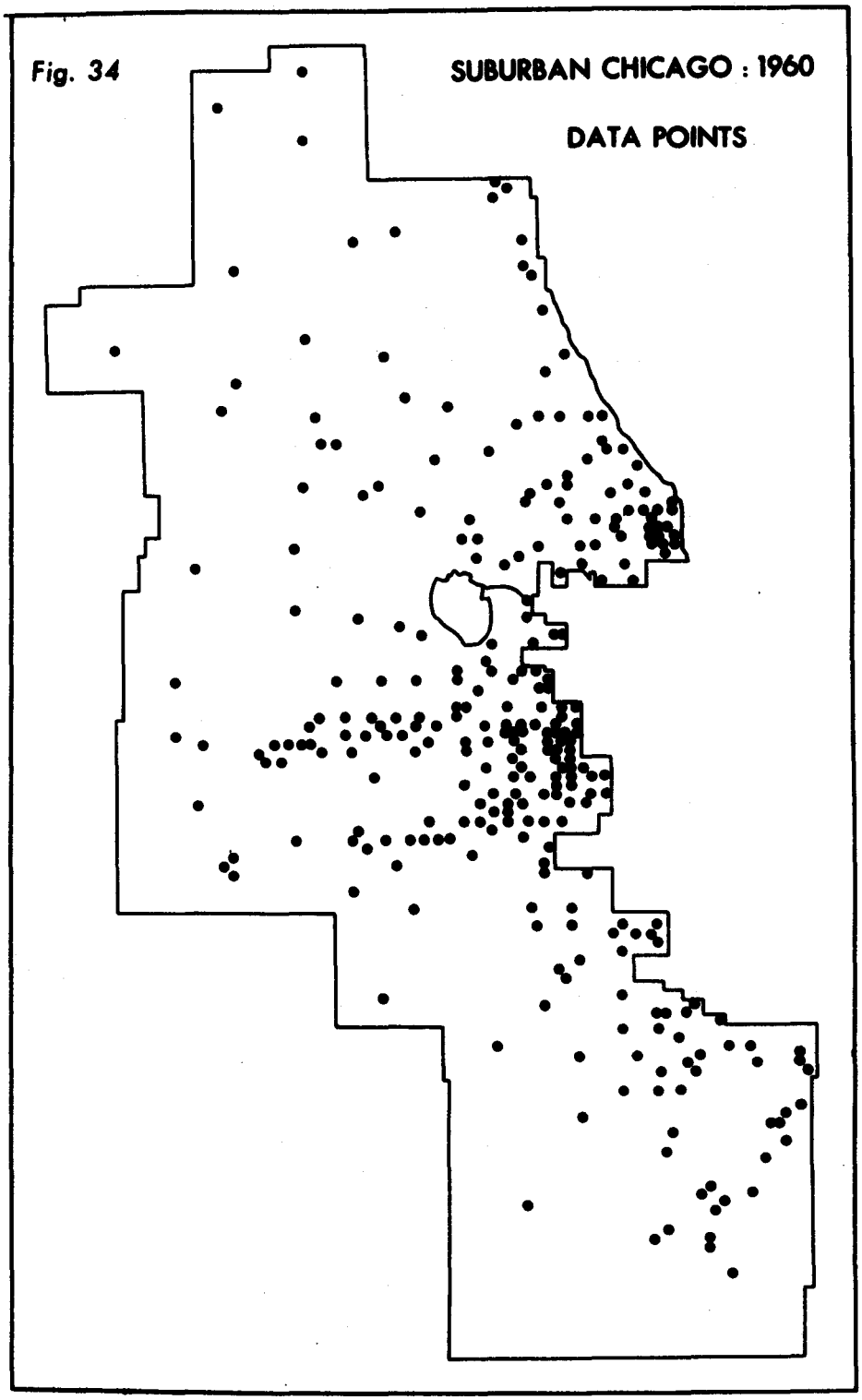
Fig. 34
SUBURBAN CHICAGO : 1960
DATA POINTS

APPENDIX 3

A METHOD TO OVERCOME THE PROBLEM OF MISSING DATA IN THE CASE OF MEDIAN INCOME

One simple way to overcome this problem is to remove the observation with missing data from the analyses. This results in considerable loss of information, however; for 1950, 168 tracts would have been removed and for 1960, 58 tracts.

A more satisfactory procedure is as follows. It is intuitively reasonable that, in general, the socio-economic conditions in tracts immediately adjacent to those with missing data, are more similar than in tracts which are increasingly distant. This follows from the situation that, in many urban areas, persons of similar socio-economic status tend to group together in residential neighbourhoods. This has been demonstrated by research in urban ecology. It would be possible, then, to replace the missing data by a figure which is representative of adjacent tracts, i.e., from the neighbourhood.

Confirmation of the rationale for this argument is presented in Tables 41 and 42. The near neighbours for every tract, together with the median income for the tract and each near neighbour are calculated. The mean and standard deviation of the difference between the income of a tract and its first near neighbour for all first near neighbours, between a tract and its second near neighbour for all second near neighbours and so on, is calculated and tabled. The number of observations for each rank of near neighbour systematically declines with distance. Since it is possible to have as many near neighbours as there are observations, it is desirable to limit the number of near neighbours, e.g., an area with a radius of one mile might be an operational definition of neighbourhood.

The method used here as a limit is to sum the population of near neighbours tracts as they were sorted and ranked on the basis of proximity. Once the sum reached 25,000 (an arbitrary choice), only those tracts which were closer than tracts already accepted as near neighbours, and the addition of whose population would not violate the 25,000 maximum, were added. Thus, a continual sorting, acceptance and rejection occurs until the final list of near neighbours is a list of tracts ranked by distance and whose population sum approximates 25,000. The mean median income is also calculated for each set of near neighbours.

The tables show that as distance increases, i.e., as the rank of the near neighbours increases, the mean difference of income for all near neighbours of a given rank increases. It begins

to decline only as the number of observations substantially falls to less than a third of the original number of observations.

This is interpreted as showing that there is an increasing difference between tracts and adjacent tracts as distance increases. Thus, to use a figure representative of adjacent tracts as a replacement for missing data seems reasonable.

TABLE 41

Income Differences Between Adjacent Tracts - 1960

Near Neighbour	Mean	Standard Deviation	Number of Observations
1	920.85	1192.86	1120
2	1010.53	1244.17	1112
3	1021.61	1150.87	1030
4	1097.06	1279.63	838
5	1107.97	1250.25	561
6	947.96	1292.56	375

TABLE 42

Income Differences Between Adjacent Tracts - 1950

Near Neighbour	Mean	Standard Deviation	Number of Observations
1	525.21	622.64	777
2	550.87	717.21	763
3	590.56	732.51	692
4	621.43	750.66	567
5	642.98	820.31	375
6	562.32	625.21	245

APPENDIX 4

CONTIGUITY AND RESIDUALS FROM REGRESSION[1]

To use the standard procedure for contiguity analysis requires the construction of contiguity matrices, with each tract which is adjacent to any given tract being listed alongside of the given tract. Commonly, two definitions of adjacency are used -- a common edge definition and a common vertex definition.[2] Thus, two contiguity matrices are often created. For over 1000 observations for each of two time periods, this is a laborious task. This is especially true when the real names of census tracts, used on the base map, must be converted into sequential identification numbers to correspond with the set of residual values.

One way in which this problem might be overcome is to define adjacency in different terms. Thus, adjacency could be defined as any observation within a specified distance of a given tract. If this is done a list of near neighbours can be quickly calculated since each tract has x and y locational co-ordinates.[3] Thus, the "contiguous" tracts are obtained. In a spatial sense, however, some tracts are now "contiguous" which may have one or two other tracts intervening between the source tract and themselves.[4] They represent second and even third "orders" of contiguity. This raises serious doubts about the validity of using the contiguity ratio as normally defined, e.g., as in the program, VALRAT, written by Anderson to test for randomness in a spatial pattern.[5]

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[1]I am grateful to my colleagues at the University of Iowa for their helpful comments on this problem, particularly David Reynolds, Peter Taylor and Clark Archer.

[2]M. F. DACEY, "A Review of Measures of Contiguity for Two and K-Color Maps," in B.J.L. BERRY and D. MARBLE (eds.), Spatial Analysis: A Reader in Statistical Geography, (Englewood Cliffs, Prentice Hall, 1968), pp. 479-495.

[3]The grid system used in this study is the Standard Location Area co-ordinates provided by the Census Bureau. This is only available for 1960 and the conversion to the 1950 base map is a difficult and arduous task.

[4]By source tract is meant the tract from which the adjacency linkages are being determined.

[5]D. ANDERSON, "VALRAT," in D.F. MARBLE (ed.), Some Computer Programs for Geographic Research, (Department of Geography, Northwestern University, Special Publication, no. 1, August, 1967), pp. 107-110.

One possibility is to develop another more appropriate ratio and, therefore, a new program. Or, the approach used here can be followed. This uses the concept of adjacency (or contiguity) based on a distance limit, which can obviously be allowed to vary by selected increments. In some respects, this is more satisfactory than the contiguity definitions using the common edge and common vertex procedures. For example, where the areal units are very large in some parts of a study but small in another section, then, under the old definitions, tracts would be brought in as contiguous at varying distances from the source tract -- this is a common situation with census tracts in metropolitan areas. Thus, the values of tracts at varying distance are adjudged to have an effect on the value in the source tract. But conditions may vary considerably in short distances. The use of this procedure gives greater flexibility and the effects of the changes in distance can actually be observed. It is also much more efficient for large numbers of observations.

The procedure is as follows: The residuals are obtained from the regression analysis for each observation. The number of near neighbours is calculated and is limited by specified distances, e.g., 0.5 miles, 1.0 miles (these are arbitrary choices). The mean of the residuals for each set of near neighbours is calculated. A correlation analysis is then performed on the residuals for each tract and the mean residual of its near neighbours.

One difficulty here is that the number of near neighbours varies for each observation. In some cases, where the census tracts are very large, e.g., in sparsely populated suburban areas, there are no near neighbours if 0.5 miles and 1.0 miles are used as limits. These tracts are removed from the correlation analysis. The effect of the varying number of near neighbours can be assessed by creating, in this case, two subsets of tracts -- (a) those census tracts which have 3 or less near neighbours and (b) those which have 4 or more near neighbours. The mean residual values of the near neighbours are again calculated for each of the subsets and correlated with the original tract residuals. Clearly, the number of subsets could be a variable -- two categories are rather gross.

The end product then is a number of correlation coefficients measuring the association between the residuals of all census tracts and all near neighbours within a specified distance, between the residuals of tracts which have 3 or less near neighbours and the mean residual of those near neighbors, and between the residuals of tracts which have 4 or more near neighbours and the mean residuals of those near neighbours. There are as many sets of correlation coefficients as there are dis-

tance limits specified.

The interpretation is that high correlation coefficients are an indication of order in the residuals, while low coefficients indicate that there is little association amongst the residual values.[6] If the latter is the case, the set of independent variables in the regression model is a satisfactory one.

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[6]There will always be correlations among the residuals and therefore very low correlation coefficients should not be expected.
N.R. DRAPER and H. SMITH, Applied Regression Analysis, (New York, J. Wiley & Sons, Inc., 1966), Chapter 3, pp. 93-94.

APPENDIX 5

THE NUMBER OF OBSERVATIONS FOR THE 1950-1960 ANALYSIS

As mentioned in Chapter 5, it is not possible to completely compare the suburban areas so these data are only for the central city. Even here, however, a number of tracts are no longer included. Because of boundary changes, this group of tracts is not directly comparable. The special report cited in Chapter 2, footnote 12 on comparability, is of limited value.

Proportions are provided whereby tracts which have been split from 1950 to 1960 can be compared. To use these proportions would require that the assumption be made that all housing variables were spatially distributed between the split tracts in the same manner as the number of dwelling units (it is for total number of dwelling units that the proportions are available). This assumption is not made. Given the arrangement of the data on the data tapes, it is extremely complicated to deal with 1960 tracts which are combinations of 1950 tracts. These reasons account for the smaller number of observations for the 1950-1960 analysis.

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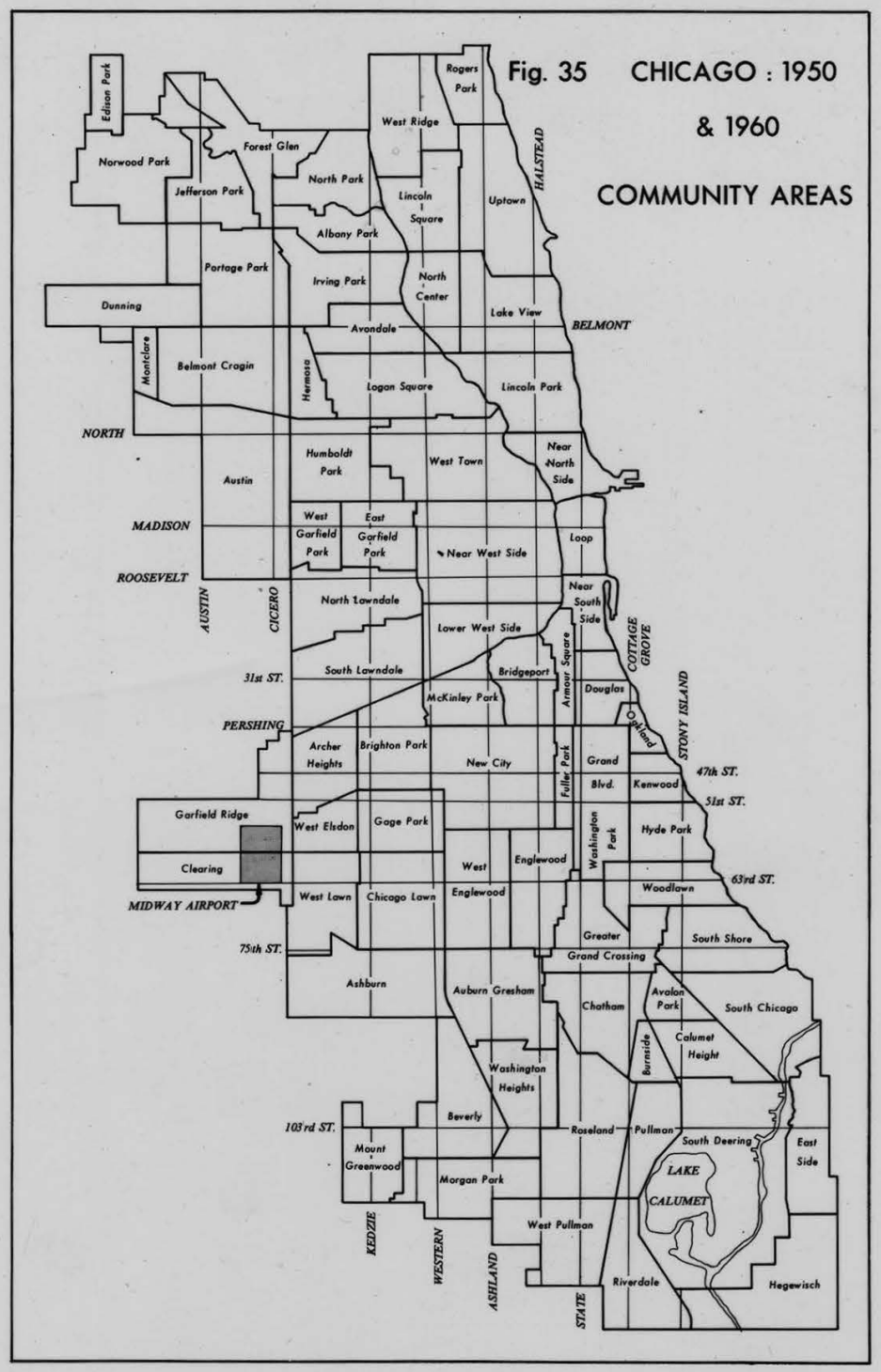
Fig. 35 CHICAGO : 1950 & 1960
COMMUNITY AREAS
Edison Park
Norwood Park
Jefferson Park
Forest Glen
North Park
Rogers Park
West Ridge
Lincoln Square
Uptown
HALSTEAD
Albany Park
Portage Park
Irving Park
North Center
Dunning
Lake View
Avondale
BELMONT
Montclare
Belmont Cragin
Hermosa
Logan Square
Lincoln Park
NORTH
Humboldt Park
West Town
Near North Side
Austin
West Garfield Park
East Garfield Park
Near West Side
Loop
MADISON
ROOSEVELT
AUSTIN
CICERO
North Lawndale
Near South Side
Lower West Side
COTTAGE GROVE
STONY ISLAND
31st ST.
South Lawndale
Bridgeport
Armour Square
Douglas
McKinley Park
PERSHING
Oakland
Archer Heights
Brighton Park
New City
Fuller Park
Grand Blvd.
Kenwood
47th ST.
51st ST.
Garfield Ridge
West Elsdon
Gage Park
Hyde Park
Washington Park
Clearing
West Englewood
Englewood
63rd ST.
Woodlawn
MIDWAY AIRPORT
West Lawn
Chicago Lawn
Greater Grand Crossing
South Shore
75th ST.
Ashburn
Auburn Gresham
Chatham
Avalon Park
South Chicago
Calumet Height
Burnside
Washington Heights
Beverly
103rd ST.
Roseland
Pullman
South Deering
East Side
Mount Greenwood
Morgan Park
LAKE CALUMET
West Pullman
KEDZIE
WESTERN
ASHLAND
STATE
Riverdale
Hegewisch

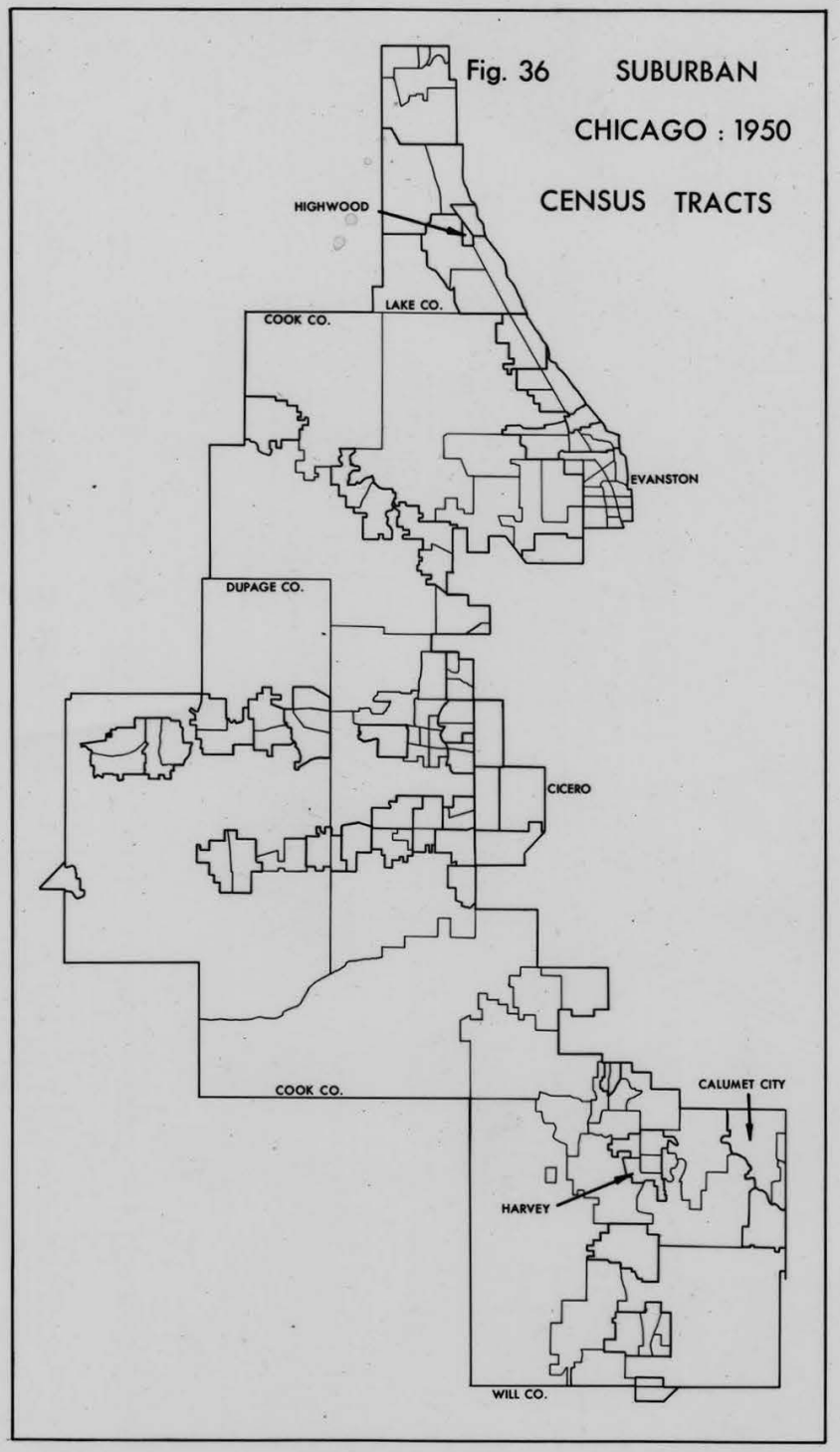
Fig. 36 SUBURBAN
CHICAGO : 1950
CENSUS TRACTS
HIGHWOOD
LAKE CO.
COOK CO.
EVANSTON
DUPAGE CO.
CICERO
COOK CO.
CALUMET CITY
HARVEY
WILL CO.

Fig. 37

SUBURBAN CHICAGO : 1960

MUNICIPALITIES