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RESIDENTIAL LOCATION OF THE SERVICE-DEPENDENT POOR*

by

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ABSTRACT. The reliance of poor, nonworking households on human services such as health care, nutritional supplements, and social services suggests that their residential location decisions may be linked to the location of facilities providing such services. In turn, service facilities designed to supply in-kind benefits to the nonworking population have incentives to locate in areas most accessible to potential users. This paper develops a theoretical model of the residential location of poor, nonworking households and their support services, and reports on an empirical test of this model for Philadelphia, Pennsylvania. Results indicate that the pattern of human service facilities affects and is affected by the location of poor, nonworking households, and that both households and facilities are concentrated in Philadelphia's oldest and most deteriorated inner-city neighborhoods. These findings present a challenge to public policymakers responsible for the delivery of human services and the revitalization of the urban core.

INTRODUCTION

Explanations of why the poor concentrate in the urban core have been highly prominent in the urban literature. Alternative theories are conceptually wide ranging and founded on distinct research traditions.

There are, for example, explanations based on strict microeconomic theories of consumer behavior, sociological theories stressing the role of ethnic segregation, and anthropological perspectives that regard the so-called culture of poverty as a binding force in the cohesion and clustering of the poor in restricted core areas. Despite this considerable attention, however, urban analysts for the most part have not looked beyond the ethnicity and level of cash income among the central city poor to other population characteristics that could affect locational patterns. Similarly, policy responses to urban problems have seldom recognized differences within the low-income population in proposals and programs for the urban core.

One important distinction to be made among the central city poor is between the working poor and the large and growing population of more or less permanently nonworking poor which includes the elderly, the mentally and physically disabled, and the chronically unemployed. For purposes of geographical analysis and policy-oriented research, it is useful to consider members of this nonworking group as service dependent, due to their reliance on both cash income and human services provided by government and voluntary sectors. Services targeted to the nonworking poor include physical and mental health support, vocational rehabilitation, day care, meals-on-wheels, etc. Service dependency stands in contrast to the reliance of the working poor on earnings from employment, suggesting that different reasons may underlie the common location of working and service-dependent poor in deteriorated urban areas. For those who are service dependent, the work place does not necessarily affect residential

location choice; rather, the location of a different type of income source--namely, service facilities--may play a critical role in where they choose to live.

The present analysis considers the locational behavior of service dependents and human service facilities, in the context of a declining central city environment. The purpose of the analysis is to gain a better understanding of how certain differences among the urban poor may affect their choice of residential location. More specifically, the analysis seeks to provide a theoretical framework for structuring the location problem of the service-dependent population, and presents several tests of that framework in an empirical study of Philadelphia, Pennsylvania.

THEORETICAL BACKGROUND

Microeconomic or "trade-off" models of the residential location of urban populations, such as developed by Alonso, Muth, and Mills, have typically considered the locational decisions of labor force households.[1] Such models can, however, be extended to include the case of nonworking, service-dependent groups.[2] Within the framework of the basic trade-off model, groups such as the handicapped, aged, or unemployed are considered rooted to the site of human service delivery rather than to a work place.[3] Most human services are provided at public facilities which tend to cluster in Central Business Districts (CBDs), or CBD fringe zones.[4] Service facilities can thus be viewed as place-specific sources

of real income and support, which, like an employment location, involve transportation expenditures in the collection of benefits (wages or in-kind services). Aside from this substitution of a service facility site for a work place, the basic trade-off model can remain intact. In selecting their optimal residential location, service-dependent households are assumed to trade off housing costs, which on a per-unit basis decline with distance from the CBD, and transportation-to-services costs which increase with distance from the CBD. The point U_{SD} represents an optimal location choice for a service-dependent household, resulting from such a trade-off of housing and travel costs (Fig. 1).

Many service dependents--particularly the elderly and disabled--have physical or mental/perceptual handicaps which increase the effective cost of traveling to service facilities. Because of their relatively high transportation cost schedules, service dependents can be expected to reside close to clusters of human service facilities. In addition, transportation problems of the service-dependent population imply that service-dependent households could be concentrated more closely about the urban core than labor-force groups of equivalent cash income who are employed in the CBD (Fig. 2). Such a pattern of residential segregation of the labor force from the nonworking poor would be reinforced by the introduction into the model of several income classes, or suburban employment for some portion of the urban labor force.[5]

Although the trade-off model of household location provides insight into the nature of location choices made by service-dependent households

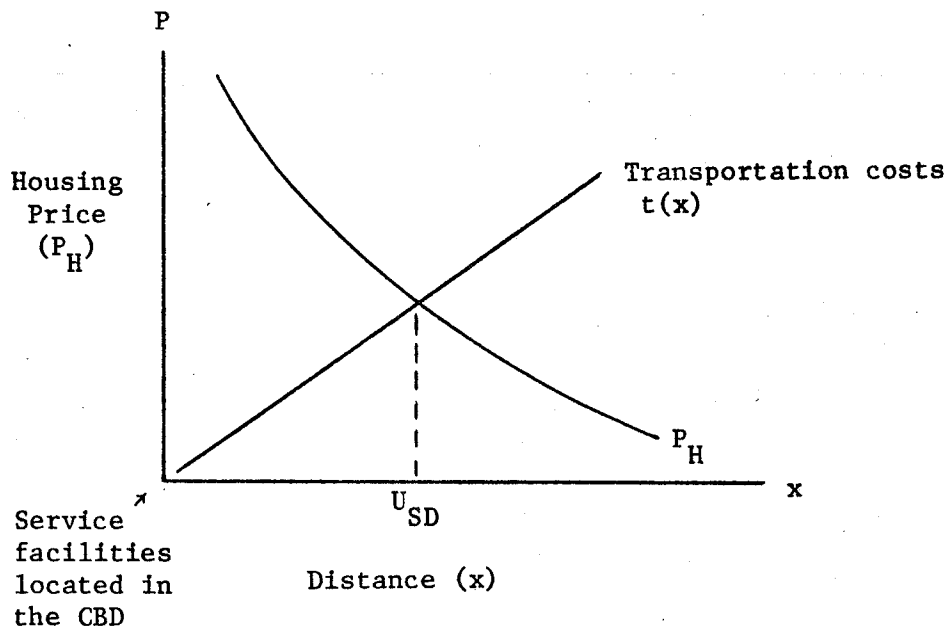


FIGURE 1

SERVICE-DEPENDENT LOCATION AS A FUNCTION
OF HOUSING AND TRANSPORTATION COSTS

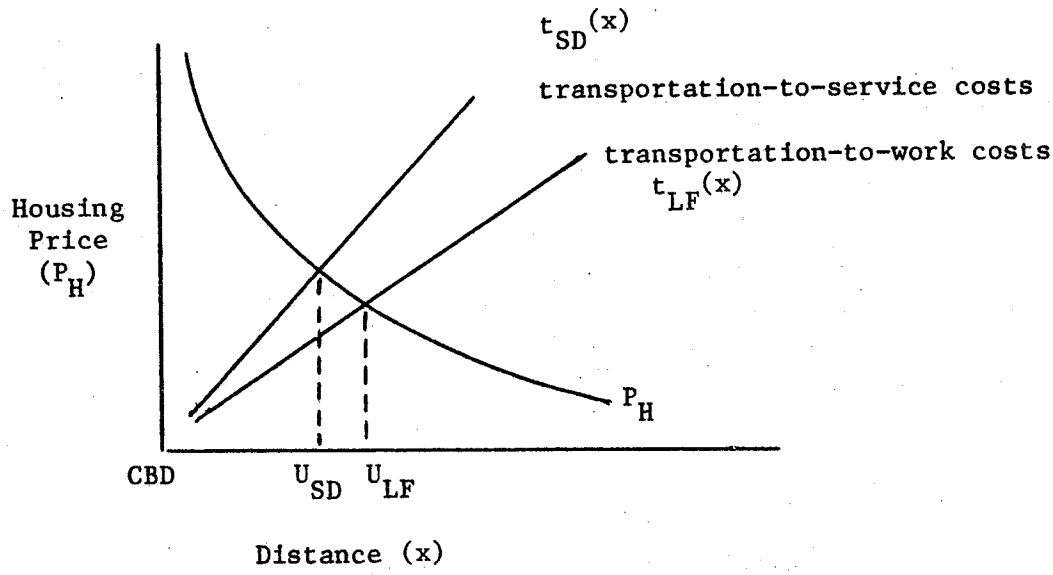


FIGURE 2

RELATIVE LOCATION OF LABOR FORCE AND SERVICE-DEPENDENT HOUSEHOLDS IN A MONOCENTRIC CITY

by bringing out the importance of housing and transportation costs in locational decision making, additional factors typically affect the household's decision regarding where to live.[6] For example, the nature of the housing supply may be an important consideration in location choice. The durability of the housing stock constrains the supply and location of subsequent housing, and implies a dwelling stock that is heterogeneous in terms of age, structural characteristics, condition, and, ultimately, price. This heterogeneity means that the price gradient for housing units, as they have been built out over time, may be bumpy instead of smooth and downward sloping. In addition, stocks of rental and owner-occupied housing units may be located in different sections of the city, preventing owners or renters from maintaining a full range of choice in selecting a residential location. For the service-dependent population, such supply constraints and characteristics imply a highly constricted and irregular geography of housing opportunities, confined by the distribution of rental versus owner-occupied units, as well as by the growth of new, more costly, and lower-density housing located outside core areas.

In addition to the heterogeneous nature of the housing stock, socio-economic and demographic characteristics of neighborhoods within an urban area may be key determinants of the residential location of service-dependent (as well as labor-force) households. Indeed, the importance of such "social choice" factors provides the basis for most ecological theories of urban spatial structure.[7] From this perspective, a

residential distribution is essentially the spatial expression of differences in the needs and values held by population groups bound together by some strong communality of interest or background. In practice, such proxy measures of social ties as race, life cycle stage, ethnicity, socioeconomic status, and life style preferences are typically important determinants of household location.[8] Such factors can be expected to influence the location choices of service-dependent households, along with housing and journey-to-human-services costs.

Service Facility Location

The trade-off model of household location clarifies the observation that the location of service-dependent households is linked to the distribution of facilities which provide human services. Given this tie between households and facilities, an understanding of the locational process of these service facilities is critical to explaining the locational patterns of the nonworking poor. In general, service facilities are most clearly conceived of as public facilities which provide some type of public/merit good or service. Foremost among the goals and objectives in the provision of such goods and services is the maximization of aggregate social welfare which, from a spatial perspective, is often a function of the net accessibility of facilities to service consumers.[9] Particularly for facilities designed to provide services to relatively immobile segments of the service-dependent population, such as the elderly and handicapped, maximization of client access to the service site would appear to be a principal consideration in the location of human service facilities.

A provider's search for an optimal facility site is, of course, limited by budget constraints which restrict expenditures on capital infrastructure, administration and staffing, and facility maintenance. In addition, many human service facilities are considered by local community residents to be "noxious" facilities, which, together with their "different" clientele, pose threats to property values or increase neighborhood instability. Although such effects of individual facilities have not been demonstrated empirically, the fear of spillover effects like property value decline, can generate community opposition to facility siting and client presence.[10] Such opposition, which may become translated into increased planning, administration, or legal expenditures required to site an unwanted facility, is most properly considered a conflict cost of facility siting and service provision, which adds to the total service provision bill.

Typically, the ability to oppose facility and client presence is strongly associated with community income.[11] Middle- and upper-income neighborhoods tend to be most successful in exclusionary efforts by posing such strong opposition that conflict costs become prohibitively high. The repulsion of facilities and clients from better neighborhoods, as well as the severe resource limitations of services and service-dependent households, suggests that both service clients and facilities may be constrained to low-income zones, or to those areas actively undergoing property value decline and housing stock depletion.

Service Dependents and the Central City Housing Market

The interdependency between the location of service-dependent households and human service facilities, and their controversial character within a community context, have ramifications for the urban housing market which, in turn, feed back into the location choices of households and facilities. The mutual attraction of service clients and providers increases the likelihood that clients and facilities will concentrate in certain districts of the city, increasing the segregation between the nonworking poor and the labor-force population. At some level of concentration, a community may become saturated by services and client populations, and evolve into a service-dependent or service-sector ghetto.

Although little empirical research exists to clarify the relationships between central city housing prices and the location of service-dependent households or service facilities, it is likely that local housing prices are influenced by service saturation, as well as by traditional determinants of housing price such as the characteristics and condition of housing units, neighborhood amenities and urban services, community social fabric, and access to employment and sociocultural opportunities.[12] This negative capitalization of community spillover effects of service saturation into housing prices may, in turn, increase the acceptability of the neighborhood to additional service-dependent households and support facilities.

A SIMULTANEOUS MODEL OF SERVICE-DEPENDENT HOUSEHOLD LOCATION

Theoretical considerations regarding the factors which affect the residential location of service-dependent groups, and the distribution of

human service facilities suggests that the location choices of households and facilities are interdependent. In addition, their locational decisions may both affect and be affected by the distribution of urban housing prices. These relationships can be formalized within the framework of a simultaneous equation model. Endogenous and exogenous variables are structurally related as shown in equations (1)-(3). The partial derivatives indicate the expected direction of relationships among endogenous variables.

$$y_1 = f(y_2^*, y_3, x_i); \quad \partial y_1/\partial y_2^* > 0; \quad \partial y_1/\partial y_3 < 0 \tag{1}$$

$$y_2 = f(y_1^*, y_3, x_i); \quad \partial y_2/\partial y_1^* > 0; \quad \partial y_2/\partial y_3 < 0 \tag{2}$$

$$y_3 = f(y_1^*, y_2^*, z_i); \quad \partial y_3/\partial y_1^* < 0; \quad \partial y_3/\partial y_2^* < 0, \tag{3}$$

where endogenous variables are defined as:

y_1 = service-dependent population density

y_1^* = access (or exposure) to service dependents

y_2 = human service facility density

y_2^* = access (or exposure) to human service facilities

y_3 = residential property values

and exogenous variables in the system are:

x_i = sociodemographic indicators such as life cycle stage, race, occupational status, income, etc.

z_i = race, income, occupational status, neighborhood-amenity level, access to employment, housing conditions and characteristics

The model states that service dependents and their support facilities are attracted to each other, and to zones of low residential property values. The value of residential properties is, in turn, partly a function of the density of service-dependent households and service facilities. The model's exogenous variables represent other factors that affect the locational decisions of service-dependent households and service facilities, and that determine patterns of urban housing values. Unlike endogenous variables, the values of exogenous variables are assumed to be determined independently of other variables in the system of simultaneous equations. Exogenous factors affecting the location of service-dependent households are social choice indicators such as income, life cycle stage, race, and occupational status. Such variables may also determine the level of site costs (including conflict costs) faced by facility locators, and so they operate as exogenous variables affecting the distribution of human service facilities. Housing characteristics and conditions, neighborhood amenity levels, access to employment opportunities, and sociodemographic composition are the model's exogenous variables assumed to determine patterns of residential property values.

EMPIRICAL ANALYSIS

Sources of Data

Data for an empirical test of the theoretical simultaneous equation model are drawn from the 1970 Census of Population and Housing, 4th Count Series, for the central city of Philadelphia.[13] A potentially

service-dependent population defined from the census is composed of three groups:

1) the needy elderly: age 65 or over and below the poverty level;
2) the disabled: age 16 to 64, experiencing a disability that limits or prevents work and which has lasted six months or longer; and
3) needy females with dependents: female household heads with dependent children under 18, below 75 percent of the poverty level.

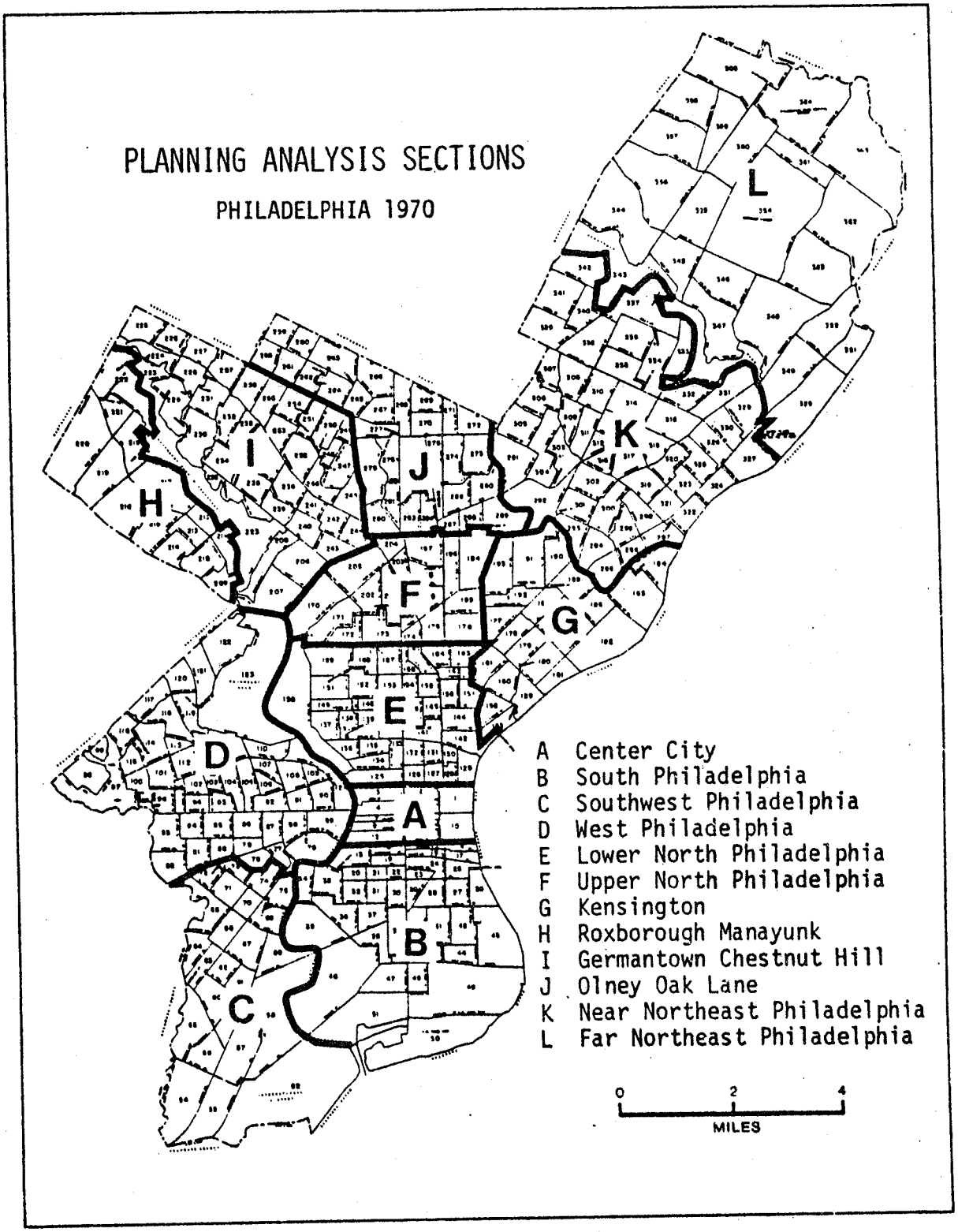
A fourth group is:

4) service dependents: an aggregate of groups (1) through (3).

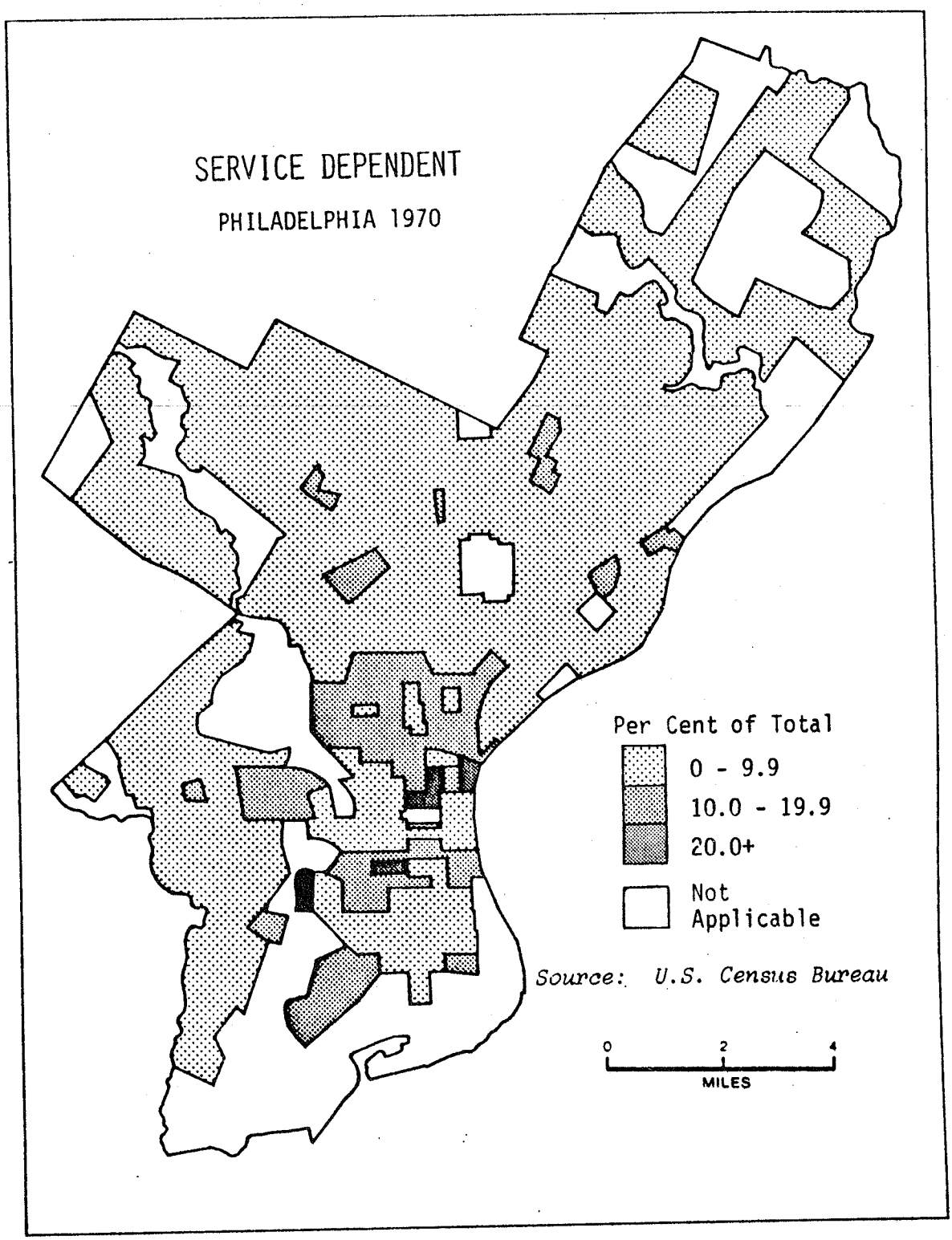
Facility data, derived from Regional Science Research Institute files, refer to the census tract location of service facilities targeted to the elderly, low-income, and handicapped population in the central city of Philadelphia.[14] These facilities provide: (1) health and mental health services, (2) special education services, (3) community and social services, (4) housing assistance services, (5) consultation and referral services, and (6) information services.

Mapping Exercise

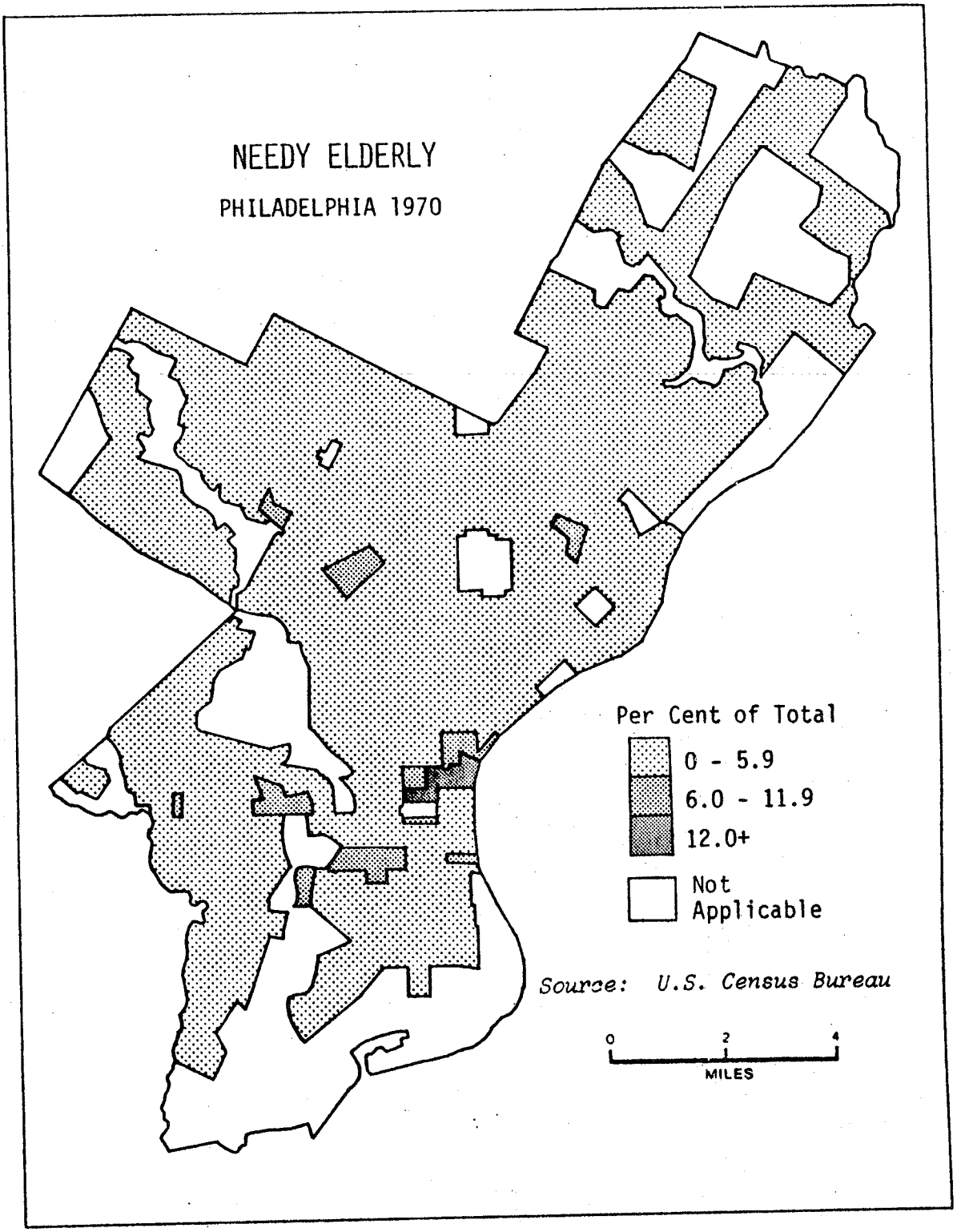
Preliminary mapping of service-dependent population patterns, service facility sites, and residential property values in Philadelphia suggest the plausibility of the simultaneous equation model. Distributional maps of potentially service-dependent residents indicate concentration of service dependents in the CBD-fringe areas of Philadelphia (Maps 2-5). The majority of service dependents reside in the poorest, most degraded areas of the city, including the ghetto areas of Lower North Philadelphia and West Philadelphia (Map 1 identifies major neighborhoods of the city).


PLANNING ANALYSIS SECTIONS
PHILADELPHIA 1970
A Center City
B South Philadelphia
C Southwest Philadelphia
D West Philadelphia
E Lower North Philadelphia
F Upper North Philadelphia
G Kensington
H Roxborough Manayunk
I Germantown Chestnut Hill
J Olney Oak Lane
K Near Northeast Philadelphia
L Far Northeast Philadelphia
0 2 4
MILES

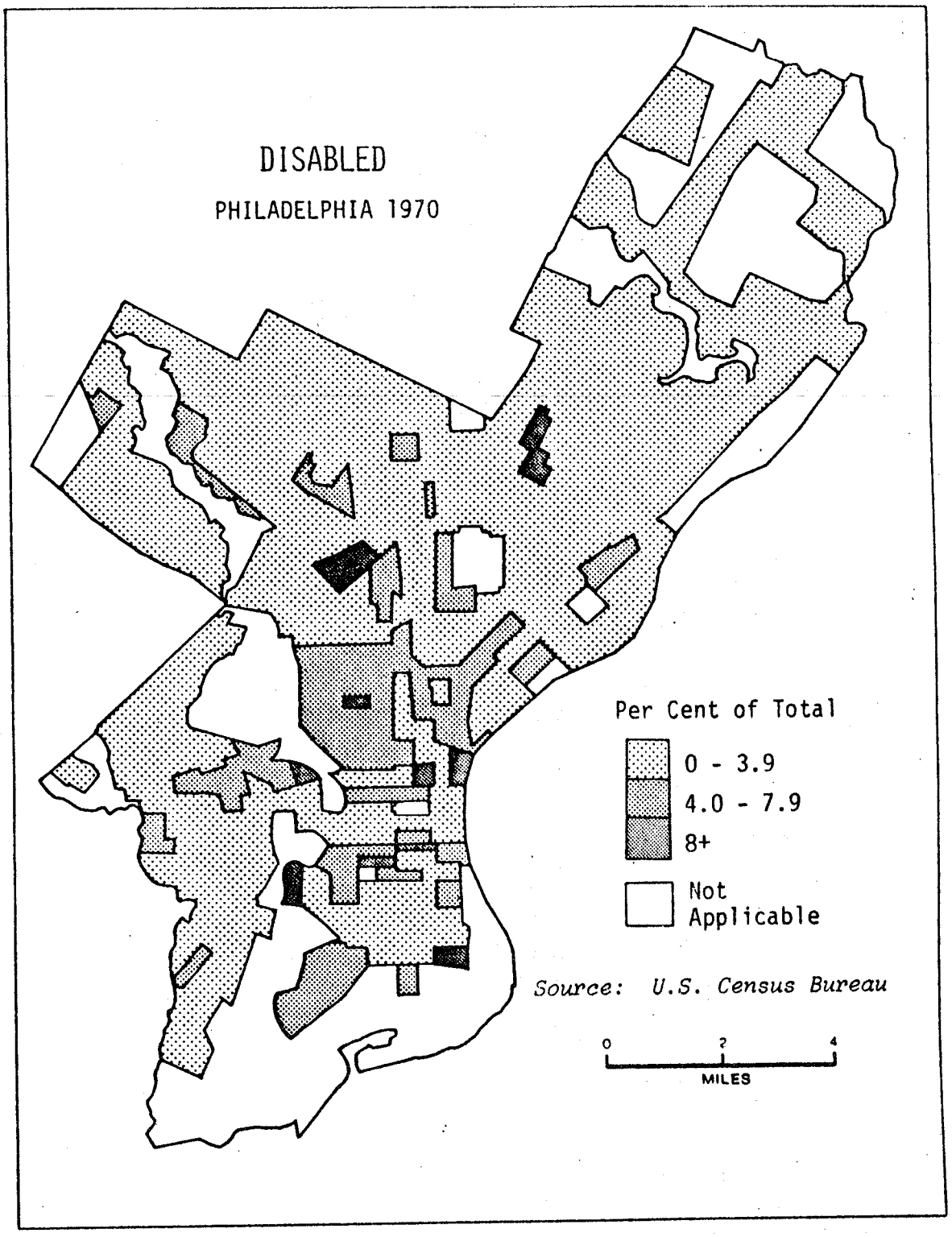
Map 1


SERVICE DEPENDENT
PHILADELPHIA 1970
Per Cent of Total
0 - 9.9
10.0 - 19.9
20.0+
Not Applicable
Source: U.S. Census Bureau
0
2
4
MILES

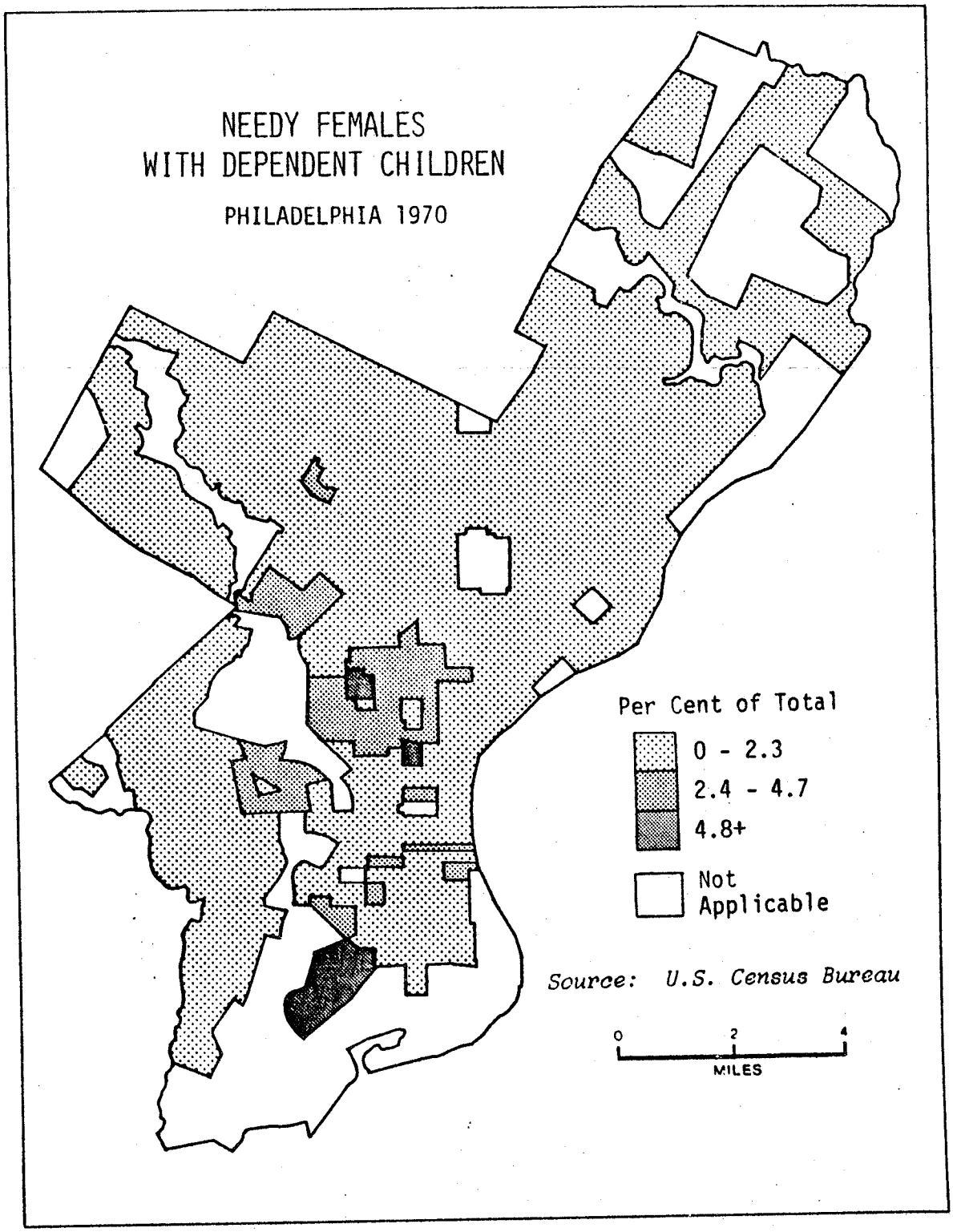
Map 2


NEEDY ELDERLY
PHILADELPHIA 1970
Per Cent of Total
0 - 5.9
6.0 - 11.9
12.0+
Not Applicable
Source: U.S. Census Bureau
0
2
4
MILES

Map 3


DISABLED
PHILADELPHIA 1970
Per Cent of Total
0 - 3.9
4.0 - 7.9
8+
Not Applicable
Source: U.S. Census Bureau
0
2
4
MILES

Map 4


NEEDY FEMALES
WITH DEPENDENT CHILDREN
PHILADELPHIA 1970
Per Cent of Total
0 - 2.3
2.4 - 4.7
4.8+
Not Applicable
Source: U.S. Census Bureau
0
2
4
MILES

Map 5

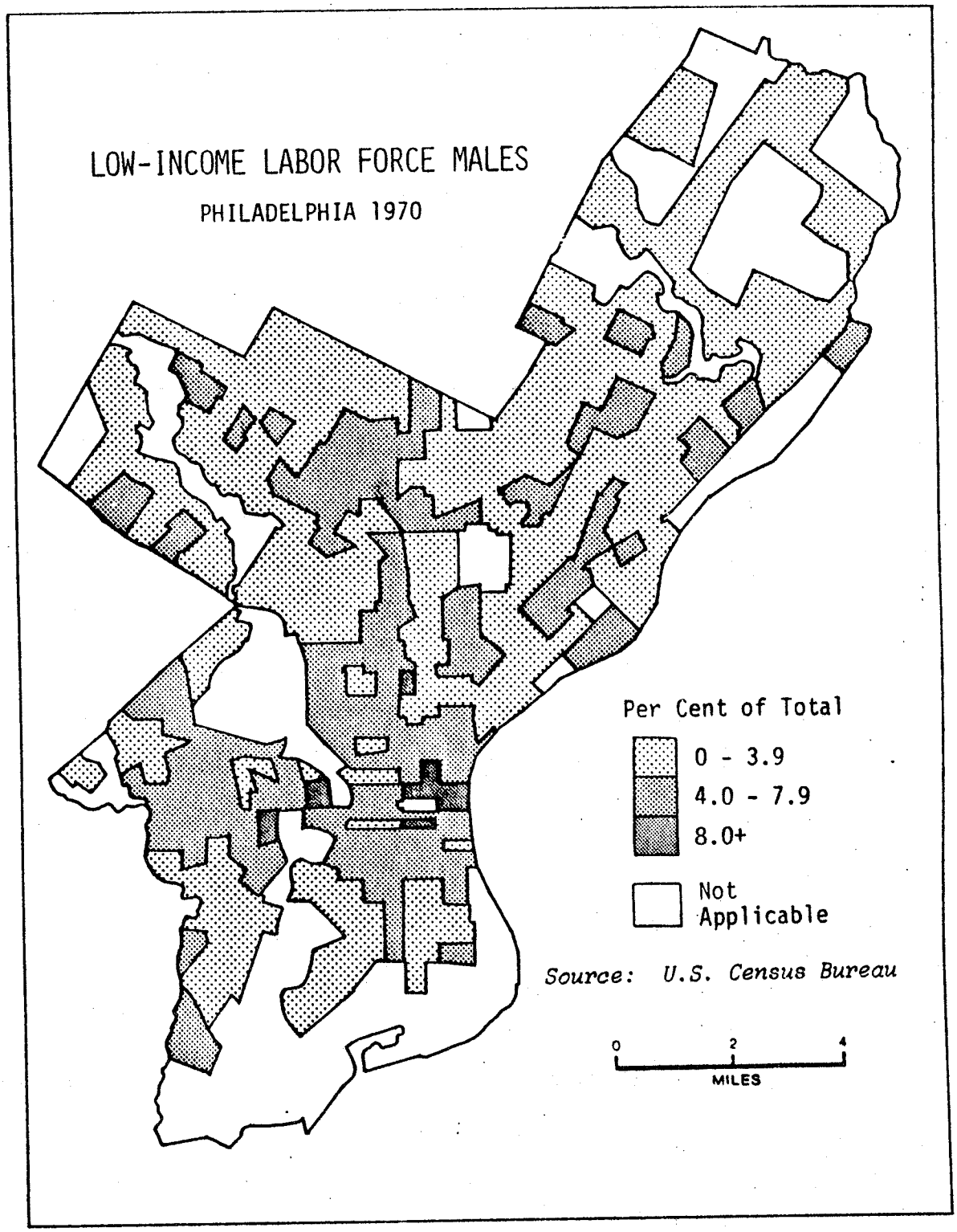
In contrast, low-income households headed by a working male are more evenly distributed throughout the central city (Map 6).[15]

With only minor exceptions, concentrations of needy elderly, disabled, and needy female household heads occur in areas designated as "low-income neighborhoods" by the Bureau of Census.[16] These neighborhoods are poor and heavily minority, as compared with the city as a whole (Table 1). In addition, their residents are typically less educated, hold blue-collar jobs, and are more residentially mobile than the general population of the city, and are more likely to be unemployed (Table 2).[17]

Examination of the pattern of service facilities indicates that human services tend to cluster in central locations (Map 7). Highest concentrations are in Lower and Upper North Philadelphia, South Philadelphia, West Philadelphia, and, to a lesser extent, Germantown. In contrast to these areas, many neighborhoods such as Northeast Philadelphia in general, Southwest Philadelphia, Roxborough, and Manayunk, have remarkably few service facilities within their bounds.

The tendency for service providers to target their provision of services to Philadelphia's nonworking poor leads to a covariation in the pattern of service-dependent households and human services facilities (Map 8). In addition, low rents and low property values appear to be characteristic in areas where the concentration of facilities and service-dependent households is high (Maps 9-10).

Decline in the value of residential property during the 1960s was widespread, and extends beyond the areas where the majority of service


LOW-INCOME LABOR FORCE MALES
PHILADELPHIA 1970
Per Cent of Total
0 - 3.9
4.0 - 7.9
8.0+
Not Applicable
Source: U.S. Census Bureau
0
2
4
MILES

Map 6

TABLE 1

NATURE OF HEAVILY SERVICE-DEPENDENT AREAS

PHILADELPHIA, 1970

	Percent of All Income Levels			Percent Below Poverty Level		
	Total	Black	Spanish Language	Total	Black	Spanish Language
Philadelphia City	100	33.4	2.4	15.4	25.4	29.5
Non-low-income areas	100	21.4	1.3	9.4	14.3	14.0
Low-income areas	100	68.6	5.4	32.5	35.4	40.4
Percent of total Philadelphia population in low-income areas	100	52.7	58.7	54.5	73.3	80.4

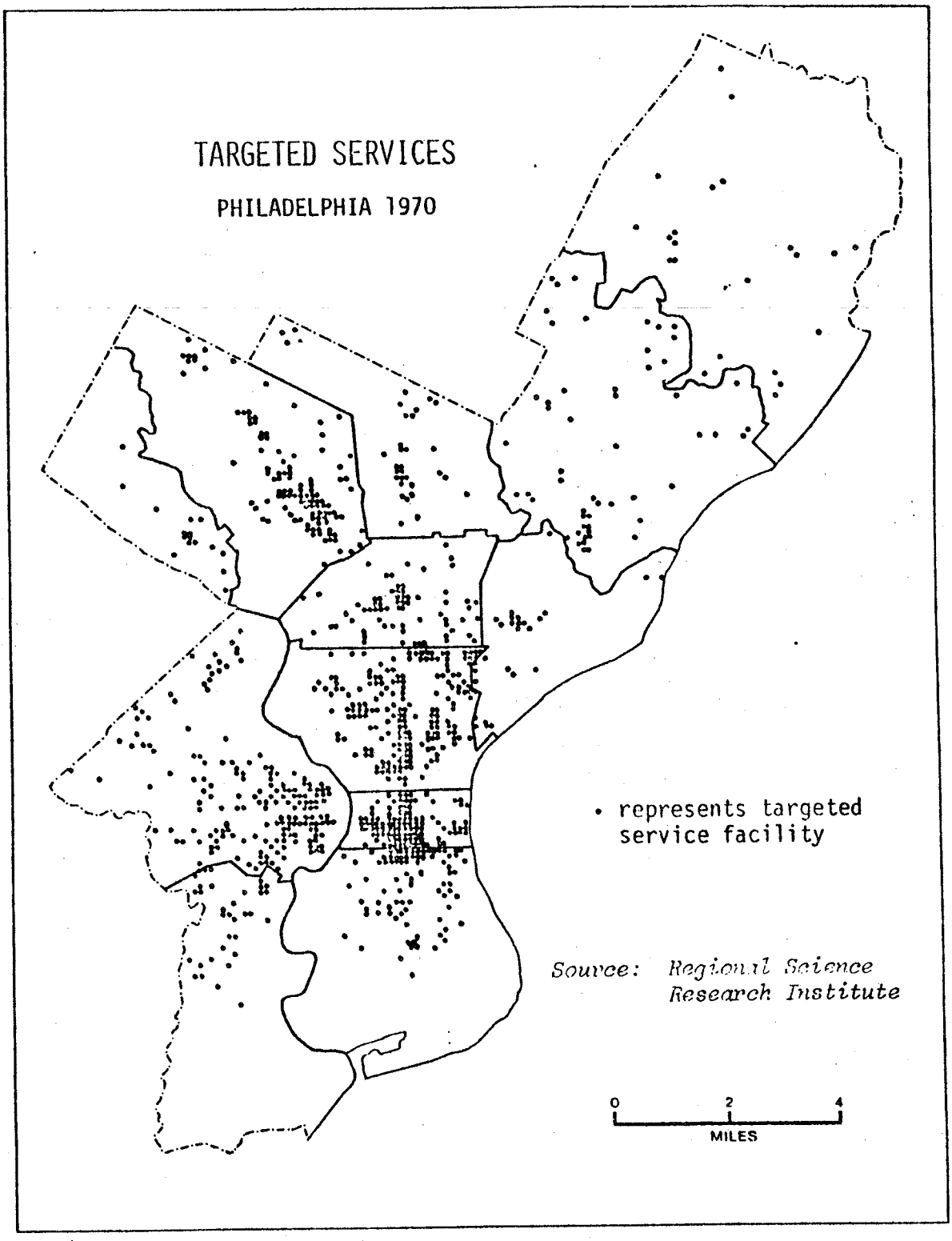
SOURCE: Philadelphia City Planning Commission, Population, Socioeconomic, and Housing Characteristics 1960 and 1970 for Philadelphia Census Tracts (1972).

TABLE 2

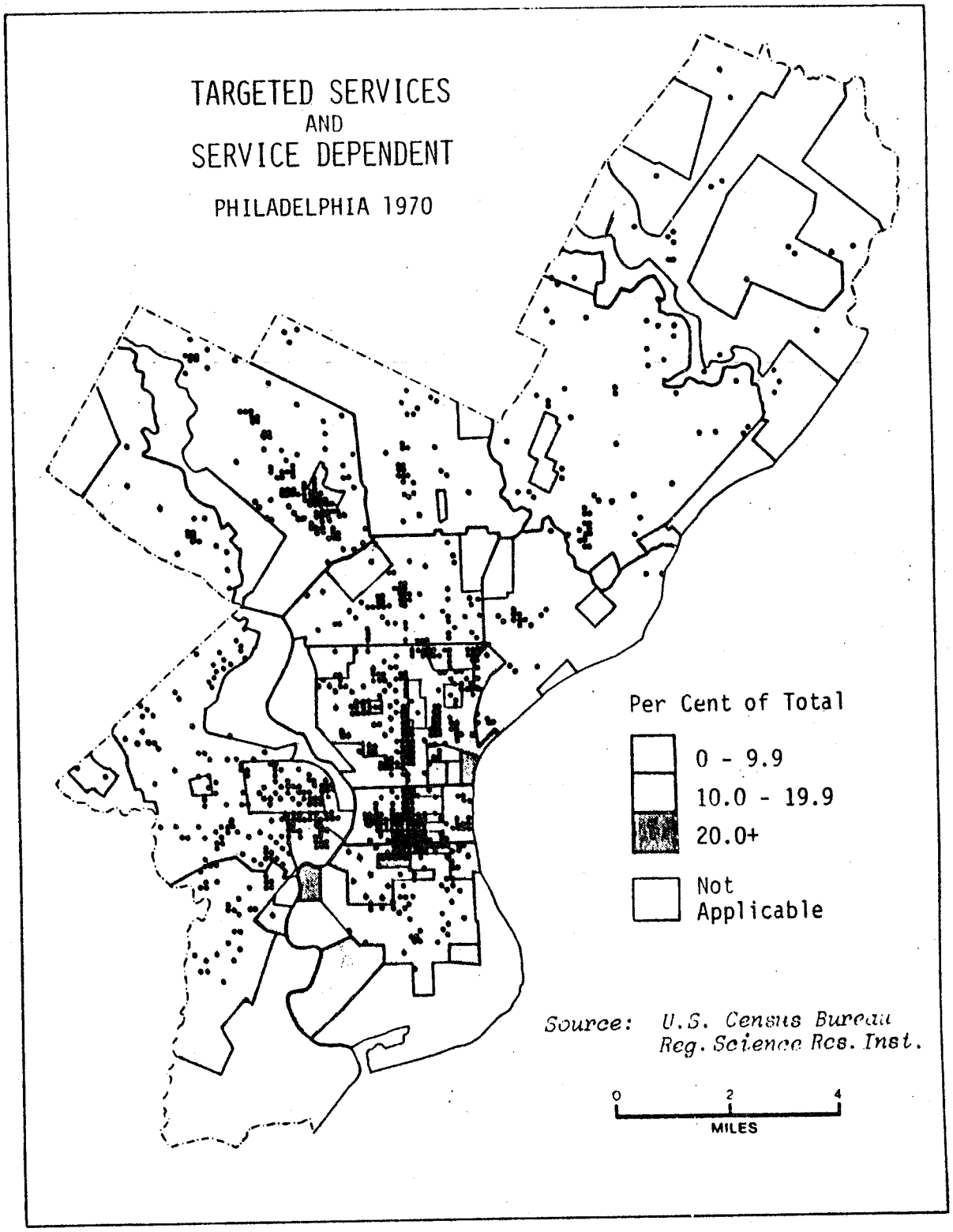
CHARACTERISTICS OF THE "LOW-INCOME NEIGHBORHOOD" OF LOWER NORTH PHILADELPHIA AND PHILADELPHIA, 1970

	Lower North Philadelphia	Philadelphia City
Percent:		
nonwhite	76.0	34.4
65 and over	9.3	11.7
under 20	42.6	34.4
primary individuals	30.6	25.8
female-headed households	25.3	14.1
below poverty	29.4	11.2
white collar	22.5	47.5
unemployed	8.3	4.6
foreign stock or foreign born	7.2	23.1
Median school years completed	9.4	10.9
Percent:		
nonmovers	54.7	61.3
owner-occupied housing units	33.5	59.7
vacant housing units	12.0	4.6
multiple housing units	48.3	33.5
crowded	12.9	6.3
Median value of owner-occupied units	$6,100	$10,600
Median contract monthly rent	$66.00	$76.00

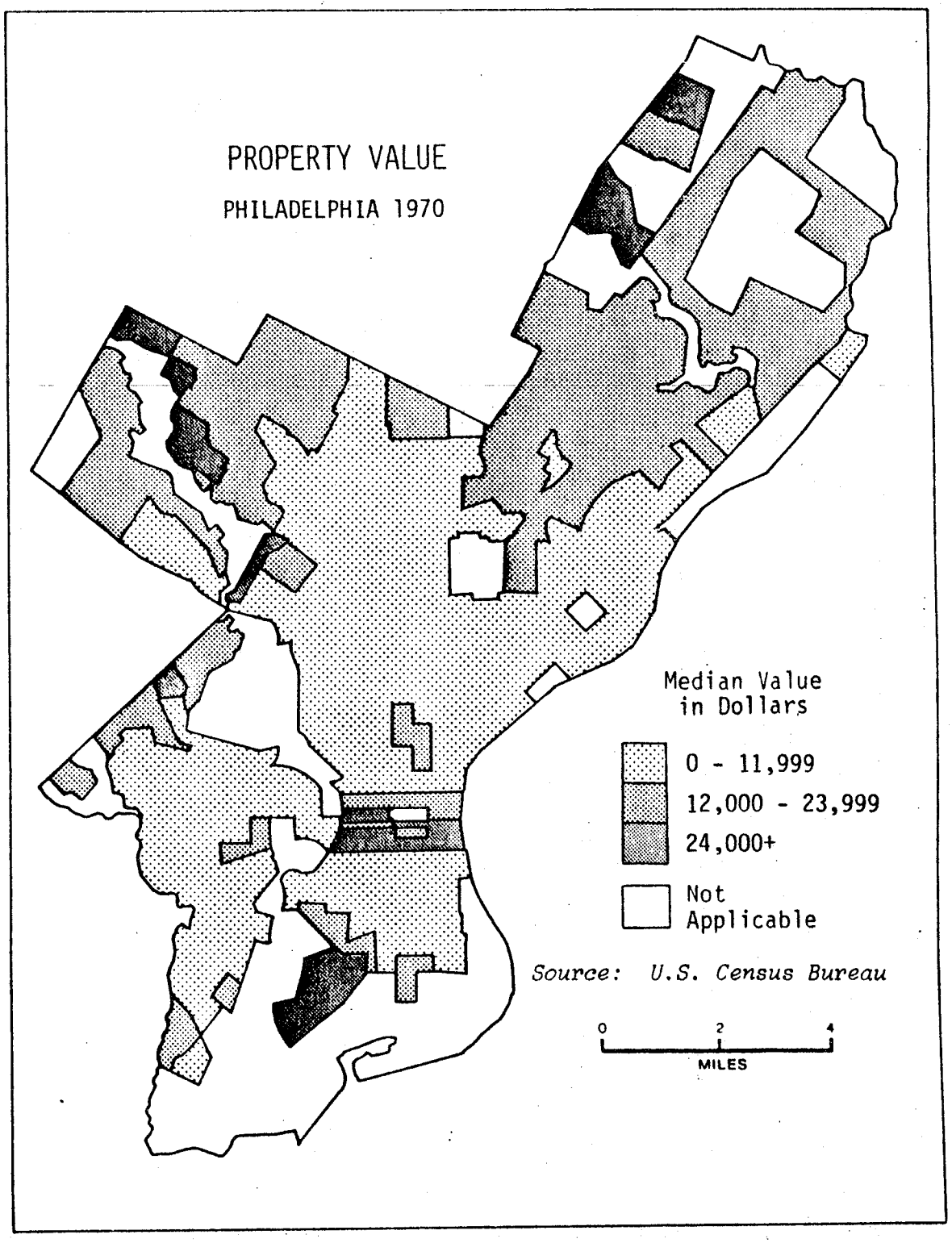
SOURCE: Philadelphia City Planning Commission, Population, Socio-economic, and Housing Characteristics 1960 and 1970 for the Philadelphia Census Tracts (1972).


TARGETED SERVICES
PHILADELPHIA 1970
• represents targeted service facility
Source: Regional Science Research Institute
0
2
4
MILES

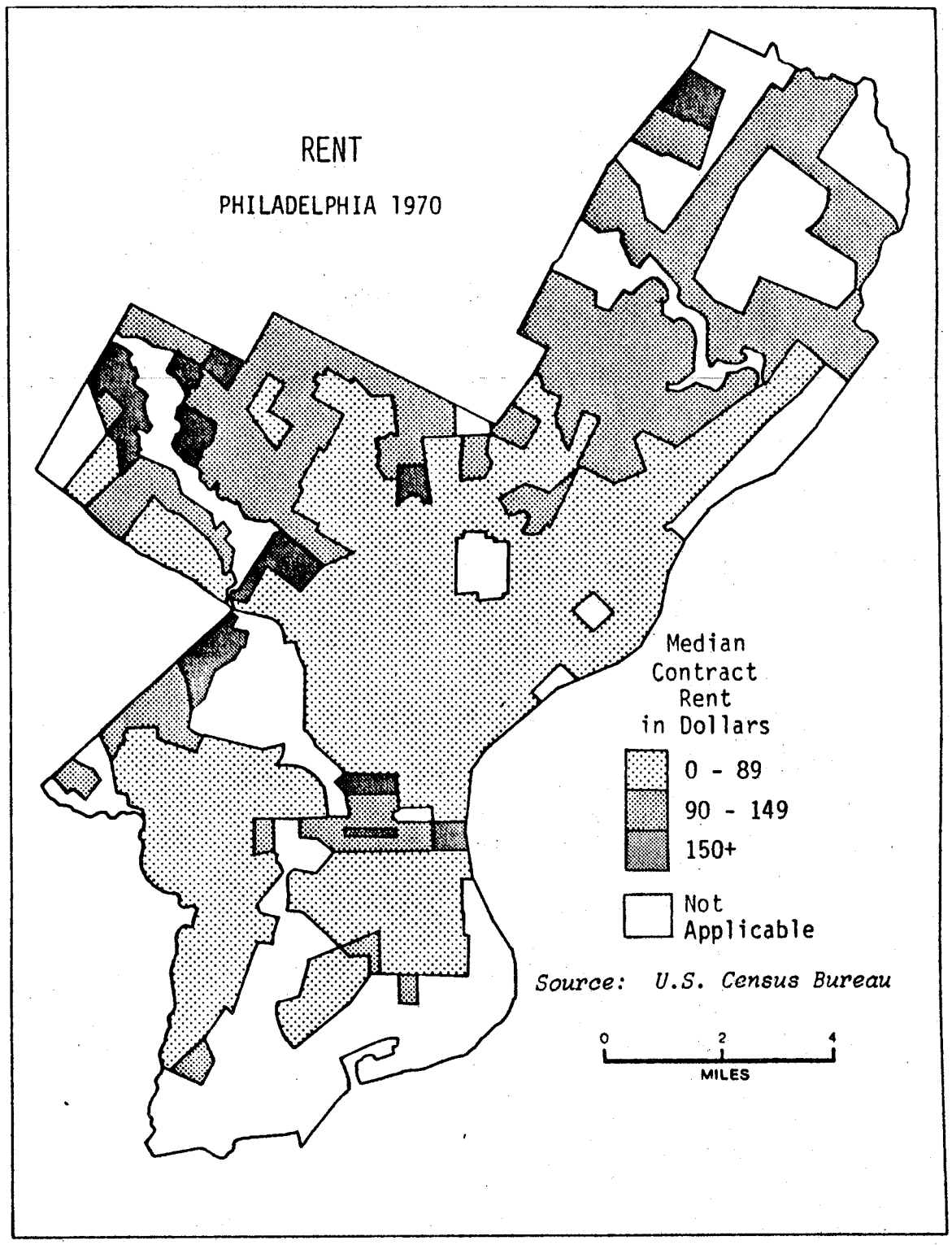
Map 7


TARGETED SERVICES
AND
SERVICE DEPENDENT
PHILADELPHIA 1970
Per Cent of Total
0 - 9.9
10.0 - 19.9
20.0+
Not Applicable
Source: U.S. Census Bureau
Reg. Science Res. Inst.
0
2
4
MILES

Map 8


PROPERTY VALUE
PHILADELPHIA 1970
Median Value in Dollars
0 - 11,999
12,000 - 23,999
24,000+
Not Applicable
Source: U.S. Census Bureau
0
2
4
MILES

Map 9

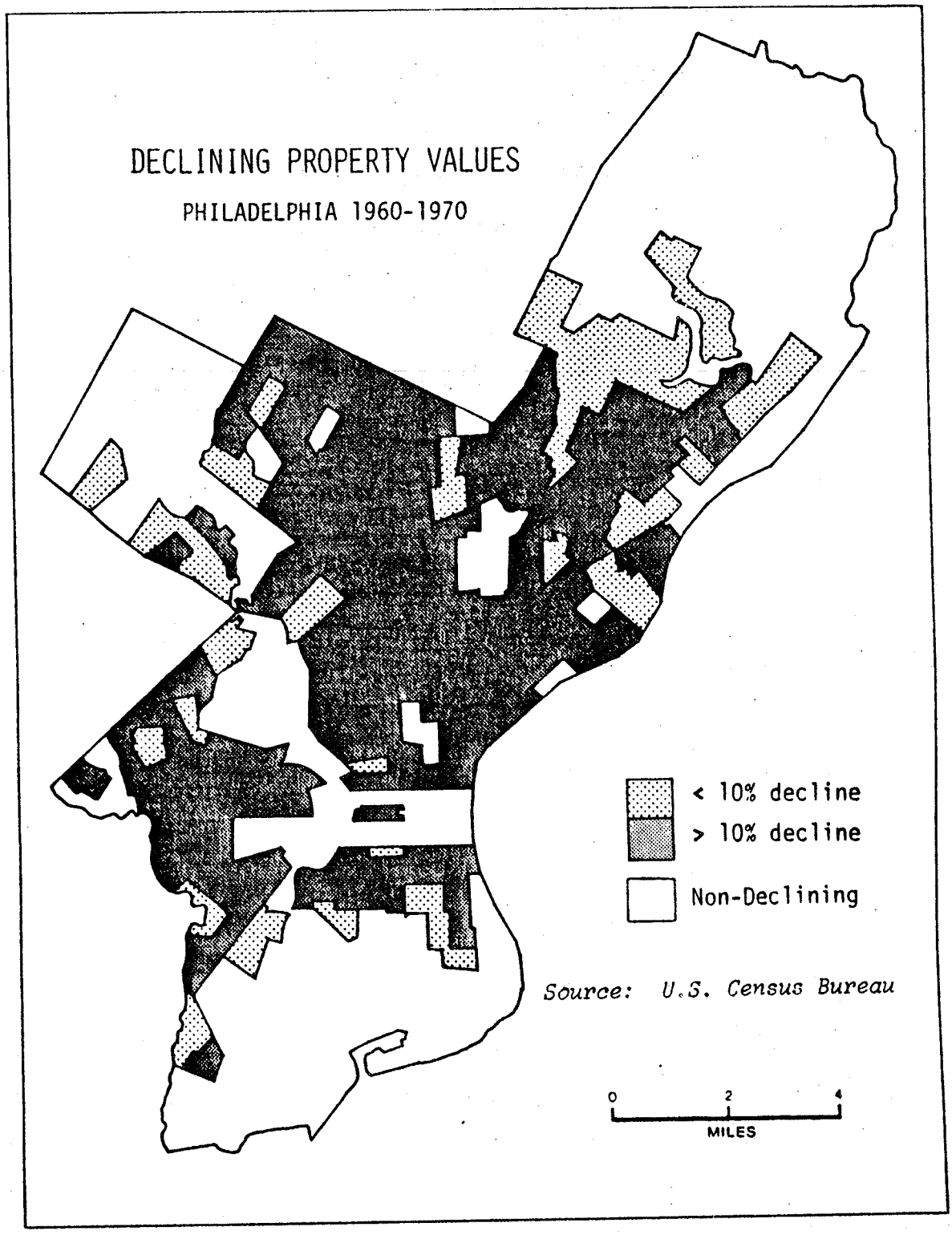

RENT
PHILADELPHIA 1970
Median
Contract
Rent
in Dollars
0 - 89
90 - 149
150+
Not
Applicable
Source: U.S. Census Bureau
0
2
4
MILES

Map 10

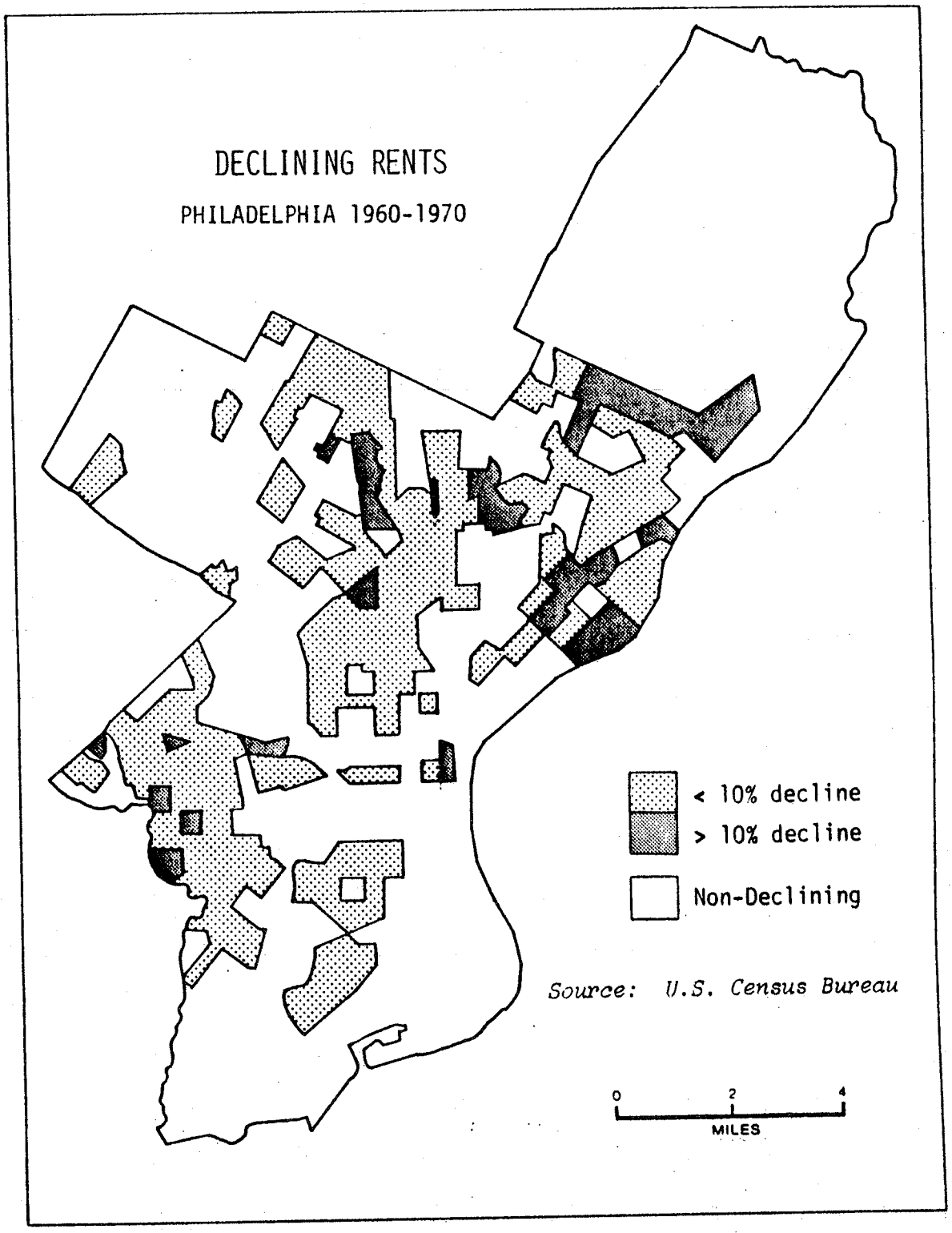
dependents reside. Nonetheless, some of the highest rates of decline between 1960 and 1970 were experienced in heavily service-dependent areas (Map 11).[18] For example, property value decline in service-dependent areas ranged from 5 percent to 48 percent, compared to a city-wide figure of 6 percent decline. Similarly, declines in contract rent experienced in neighborhoods with many service-dependent households were higher than the city average, with the largest declines in rent occurring along the fringe of Philadelphia's heavily service-dependent and minority ghetto areas. This pattern of decline with respect to service-dependent and ghetto areas suggests that rents in such areas have either stabilized or bottomed out, with active decline either following or leading the path of ghetto expansion (Map 12).

Regression Analysis

The simultaneous equation model introduced to structure the theoretical relationships among the location of service-dependent households, service facility sites, and patterns of residential property values, was estimated empirically using multiple regression analysis. Theoretically, such a model calls for a two- (or three-) stage least-squares approach to parameter estimation to prevent simultaneous-equation bias from distorting the model's coefficients. In the present case, however, estimates from two-stage methods were generally poor due to the inadequacy of instrumental variables contained in the data base.[19] On the other hand, ordinary least squares (OLS) estimates followed theoretical expectations rather closely, and since they appear to provide a plausible picture of variable relationships, OLS results are presented here.


DECLINING PROPERTY VALUES
PHILADELPHIA 1960-1970
< 10% decline
> 10% decline
Non-Declining
Source: U.S. Census Bureau
0
2
4
MILES

Map 11


DECLINING RENTS
PHILADELPHIA 1960-1970
< 10% decline
> 10% decline
Non-Declining
Source: U.S. Census Bureau
0
2
4
MILES

Map 12

In addition to testing relationships represented by the simultaneous equation model, the density of poor working males was added to equations as a control variable. This variable was included to indicate the relative impact of service-dependent versus low-income labor-force groups on location of service facilities, property values, and the location of other service-dependent groups.

Severe multicollinearity problems plagued the analysis, particularly with respect to socioeconomic status and property-value variables. Service-dependent variables, and access to service dependents/facilities variables were highly correlated with income, occupational status, property value, and rent.[20] As expected, these latter variables were strongly intercorrelated. Interestingly enough, the working-poor variable was not strongly associated with service-dependent, facility, socioeconomic status, or property-value variables.

Due to collinearity problems several socioeconomic status-type variables were tested for predictive power in service-dependent and facility-density equations. Income generally fared the best. When other socioeconomic status variables were included in the equations, other variables took on the role of an income variable. For instance, access measures which correlated highly with income behaved like an income variable when used in equations with property value, rent, and occupational status. In some cases, the same behavior occurred with the race variable as well.

Another approach taken to deal with collinearity problems involving access variables was to use facility and service-dependent density

variables instead of geographical access per se. These variables were correlated with access measures, but had weaker associations with certain socioeconomic status variables. In addition, the facility-density and service-dependent variables were only weakly correlated with each other, as opposed to the access to facilities and access to service-dependent variables which had a simple correlation coefficient of 0.9. Variables used are given in (Table 3).

Model Results

With some exceptions, the model performed as expected. Most variables were statistically significant at the 5 percent level, and the explanatory power of the model's equations was moderately high ($.32 \leq R^2 \leq .68$). In addition, the equations suggest some further behavioral mechanisms that may be involved in service-dependent location choice, the siting of human service facilities, and the dynamics of the central city housing market.

Service-dependent equations (Table 4). Results of these equations followed prior expectations rather closely. Aggregate service-dependent population density appears to be strongly and significantly influenced by the facility distribution. Typically, socioeconomic status-type variables were the strongest explanatory variables, particularly income. The race variable was also significant, especially in equations lacking an income measure. On the basis of these equations, service dependents would be expected to locate in low-cost urban neighborhoods that have high proportions of elderly, nonwhite, and low-income residents and that are close to human service facilities.

TABLE 3

VARIABLE DEFINITIONS

FACILITIES	= Number of targeted human-service facilities per 1,000 population in census tract i.
SERVICE DEPENDENTS	= percent population in tract i that is likely to be service dependent.
NEEDY ELDERLY	= percent population in tract i that is 65 years of age or more, and below poverty level.
DISABLED	= percent population in tract i that has a disability which limits or prevents work, and has lasted 6 months or longer.
NEEDY FEMALE	= percent population in tract i that are female household heads with minor dependents, and below 75 percent of the poverty level.
AGE	= median age of population in tract i.
RACE	= percent population in tract i that is white.
OCCUPATION	= percent population in tract i that is white collar.
INCOME	= median personal income in tract i.
PROPERTY VALUE	= median value of owner-occupied housing units in tract.
RENT	= median monthly contract rent of renter-occupied housing units in tract i.
WORKING POOR	= percent population in tract i that are male labor-force participants, and below poverty level.
ACCESS TO SERVICE DEPENDENTS	= accessibility of tract j facilities to service dependents in all other tracts i.

TABLE 4

SELECTED REGRESSION RESULTS: SERVICE-DEPENDENT EQUATIONS

Independent Variables	Dependent Variable				
	Percent Service-Dependent Population	Percent Needy Elderly Population	Percent Disabled Population		Percent Needy Female Population
Facilities	.29*[a] (0.00005/0.00001)[b]	-.02 (-0.000002/0.0)	.18* (0.00001/0.00001)	.18* (0.00001/0.00001)	.27* (0.00001/0.0)
Age	.24* (0.0012/0.0002)	.57* (0.0015/0.0001)	.07 (0.0002/0.0002)	.05 (0.0001/0.0002)	-.38* (0.0005/0.0001)
Race	-.25* (-0.021/0.005)	-.03 (-0.001/0.002)	-.15* (-0.006/0.00001)	-.15* (-0.006/0.003)	-.22* (-0.004/0.001)
Occupation			.29* (-0.0004/0.0001)		
Income	-.60* (-0.000009/0.0)	-.40* (-0.000003/0.0)		-.19* (-0.00002/0.0)	-.21* (-0.00001/0.0)
Needy elderly			.14* (0.14/0.06)	.17* (0.18/0.08)	.24* (0.12/0.03)
Disabled		.10* (0.097/0.04)			.20* (0.1/0.02)
Needy female		.22* (0.43/0.10)	.23* (0.46/0.14)	.33* (0.65/0.14)	

TABLE 4--Continued

Independent Variables	Dependent Variable				
	Percent Service-Dependent Population	Percent Needy Elderly Population	Percent Disabled Population		Percent Needy Female Population
Working poor	.07 (0.153/0.104)	.17* (0.19/0.05)		-.18* (-0.21/0.07)	.10* (0.06/0.03)
R^2	.51	.61	.34	.32	.59

[a]Standardized regression coefficient (beta). Asterisk indicates coefficient is significant at alpha = .05.

[b](Estimated regression coefficient (b)/standard error of estimate.)

Differences emerge when the service-dependent group is disaggregated into needy elderly, disabled, and needy female components. Life-cycle stage is a much stronger determinant of needy elderly location than for any other service-dependent group, while facility density is considerably less important, although significant in some cases. This is most likely due to the fact that many of the elderly poor are homeowners of long tenure, who purchased central city homes during their working years, and are highly immobile at this juncture of the life cycle, due to age, social ties, and economic constraints. In addition to the importance of life-cycle stage and neighborhood income, there is recognizable covariation among needy elderly and needy female groups and, to a lesser extent, between needy elderly, disabled, and working poor groups.

Life-cycle stage is not a significant predictor of disabled population location, as it is for the needy elderly. Facility density is more important, along with socioeconomic status measures. Occupational status in particular had large coefficients, confirming other research showing that disability predominates in blue-collar/service-sector households and neighborhoods.[21] The working poor and other service-dependent groups, particularly the needy female group, are also significant predictors of the location of households with disabled members.

The explanatory variables used in the disabled-population equations were only marginally successful in explaining disabled densities. This is most likely due to problems in defining the disabled-population group from the census, there being no way to restrict the population with respect to income or head-of-household status. Thus, included in the

disabled group are both the disabled who are not poor as defined by the standard poverty threshold, and disabled spouses of labor force participants whose location, in all probability, is not autonomously determined.

Facility density, race, and socioeconomic status (particularly income and occupational status) were best predictors for the needy female group. Age is seemingly less important and has a different sign than for other service-dependent groups. This implies that although needy females tend to be attracted to areas where households are in early life-cycle stages (as expected due to their own early stage), socioeconomic status and facility factors bias their location toward areas where the needy elderly and disabled reside, holding all else constant. The working poor distribution is also significant in explaining needy female location, but to a lesser extent than the other service-dependent groups.

Human service facility equations (Table 5). With one exception, facility equations also supported prior theory. In conjunction with socioeconomic status variables, access to service dependents (particularly the needy female group) were significant factors in explaining the distribution of human services. The distribution of working poor, on the other hand, had little if any connection with patterns of facilities.

Unexpectedly, race was by far the strongest determinant of facility density. When all else is held constant, facilities concentrate in predominantly white areas. The race variable is not highly correlated with either income or property value variables, suggesting that in the central city of Philadelphia, low-rent areas can as easily be white as black.

TABLE 5

SELECTED REGRESSION RESULTS: HUMAN SERVICE FACILITIES

Independent Variables	Dependent Variable Human Service Facilities per 1,000 Population		
Access to service-dependents	.24*[a] (397.1/69.9)[b]		
Age	-.04 (-1.4/1.5)	-.10* (-3.6/1.5)	.04 (1.4/1.9)
Race	.72* (346.5/22.4)	.74* (355.3/23.1)	.74* (355.1/22.5)
Income	0.0	.08 (0.01/0.01)	.07 (0.01/0.01)
Needy elderly			-.03 (-320.5/783)
Disabled			.12* (1506.2/575.6)
Needy female			.31* (7567.4/1420.5)
Working poor		.08* (1939.2/348.8)	.07 (1039.2/685)
Service dependent		.30* (1120.2/672.6)	
R^2	.47	.50	.53

[a]Standardized regression coefficient (beta). Asterisk indicates coefficient is significant at alpha = .05.

[b](Estimated regression coefficient (b)/standard error of estimate.)

This, in turn, suggests that facility providers and their service-delivery staff are sensitive to their capital costs but are more affected by the racial composition in areas surrounding potential facility sites. A variety of factors may lie behind this racial sensitivity in location choice; it is plausible, for example, that providers: (1) are unwilling to work directly in a heavily minority or ghetto environment; (2) are using a triage-type siting process whereby services are targeted to poor white areas that providers consider more "redeemable," as opposed to hard-core ghetto areas where service provision may result in little discernible impact; and/or (3) are following a locational "creaming" strategy, aimed at agency survival and provider self-agrandizement. In this latter case, providers would locate in areas where service delivery outcomes may be most "successful," to create a favorable image within the larger bureaucratic community. In light of such objectives, ghetto areas may be unattractive as facility sites.

Residential land-value equations (Table 6). Only a partial testing of equation (3) was attempted. Not all exogenous variables contained in the structural submodel were available or useful. For example, census data on such housing attributes as age and condition are very insensitive in older cities like Philadelphia, and, in fact, previous research has shown the Philadelphia housing stock to be quite homogeneous in character.[22] Also, since neighborhood-amenity variables are not available at the census-tract level, ecological correlates of high- and low-amenity areas were used as surrogates. Finally, access to employment opportunities was not included. Because the central city of Philadelphia is only

TABLE 6

SELECTED REGRESSION RESULTS: HOUSING VALUE EQUATIONS

Independent Variables	Dependent Variables: Median Value of Owner-Occupied Dwelling Units		Dependent Variables: Median Contract Rent of Rental Units	
Facilities	-.15*[a] (-3.7/1.6)[b]	-.25* (-6.0/1.3)	-.13* (-0.01/0.004)	-.21* (-0.02/0.004)
Age	.20* (157.4/44.2)	.14* (110.8/42.1)	.24* (0.85/0.16)	.21* (0.7/0.2)
Race	.04 (520.3/876.5)	.05 (570.4/677.2)	0.0	0.0
Occupation		.75* (278/18.3)		.69* (1.14/0.07)
Income	.22* (0.5/0.2)		.26* (0.003/0.001)	
Service dependent	-.31* (-47581/10477.8)		-.39* (-270.5/39.8)	
Needy elderly		-.20* (-60759.5/15330.6)		-.30* (-407.7/59.4)
Disabled		-.04 (-11276/13360)		-.07* (-89.8/51.6)
Needy female		.22* (128240.5/33414.5)		.13* (344.6/126.5)
Working poor	.03 (10140.8/19364.8)		-.02 (-28.8/76.0)	
R^2	.30	.59	.45	.68

Footnote to Table 6:

[a]Standardized regression coefficient (beta). Asterisk indicates coefficient is significant at alpha = .05.

[b](Estimated regression coefficient (b)/standard error of estimate.)

one segment of the Philadelphia metropolitan labor shed, access variables confined to distances and jobs located solely within the central city would have been misleading.[23]

Despite these omitted variables, the remaining independent variables explained up to two-thirds of the variation in residential land values, whether measured by median monthly contract rent or median value of owner-occupied housing. The strongest predictor of both rent and value was occupational status, with service dependents, life-cycle stage, and facility density significant but weaker predictors.

Contrary to expectations, high land values were positively associated with the density of needy females. This result has no adequate explanation, and data on a more disaggregated level are necessary to clarify the relationship. Notably, the distribution of working poor had no impact on values, and race likewise proved to be totally insignificant.

The working poor. Behavior of the working poor variable is noteworthy, as results show that the distribution of working poor males is generally less influential as a determinant of specific service-dependent location patterns than are other service-dependent groups. For example, among population groups considered, needy elderly densities are best predictors of needy female distributions, and needy females are best predictors for both disabled and needy elderly patterns. This speaks to the differential location patterns of labor force and service-dependent income sources (e.g., workplaces versus facilities); it also suggests that forces for the ghettoization of nonworking, service-dependent people may be stronger than for poor working people.

In addition, the working poor had no influence on the distribution of residential property values of human service facilities, while service dependents did. These results indicate that service providers, although influenced by factors other than need, are affected by the location of those groups for whom services are intended. Results also suggest that nonlabor-force status is indeed a factor in the behavior of the housing market. Specific forms of poverty, rather than poverty in general, may affect the trends in central-city housing values.

Summary and Conclusions

This essay has focused on the reliance of poor, nonworking households on human services such as health care, nutritional supplements, and social services. Their dependency on human services suggests that residential location decisions of the nonworking poor may be linked to the location of facilities which supply such services. In turn, service facilities designed to provide benefits and support to the nonworking poor have a variety of incentives to locate in close proximity to potential service clients. These observations comprise the basis for a theoretical simultaneous equation model of the residential location of poor, nonworking households and their support services, and the relationships of their locational decisions to the central-city housing market. Results of the empirical test of this model for Philadelphia, Pennsylvania, while representing only an initial analysis, are nonetheless suggestive of the existence and strength of locational interdependency between service-

dependent households and human service facilities. Specifically, the results suggest that the pattern of human service facilities affects and is affected by the location of service-dependent households, and that both service-dependent households and facilities are highly concentrated in Philadelphia's oldest and most deteriorated inner-city neighborhoods.

These research findings have a variety of implications for the study of urban spatial structure and behavioral models of location choice. First, the analysis supports the assertion that we need to look beyond the cash income levels and ethnicity of urban population groups, in unraveling the constraints and opportunities that affect the distribution of subgroups of the population, particularly the nonworking poor. As services grow in their importance to the quality of urban life, it seems a worthwhile endeavor to generalize the basic trade-off framework of residential location choice to include other sources of income such as human services, other sorts of public services, and perhaps productive nonmarket activities. This inclusion implies a break from the traditional reliance on universal utility functions applied to all segments of the urban population, and an increasing use of a disaggregated approach to household utility which can serve to differentiate populations with significantly different objectives and constraints. Such a disaggregated approach is not only appropriate

for the analysis of residential location choice among working versus nonworking people, but is also suited to the study of employed residents of metropolitan areas who may have different preference structures and respond in a variety of ways to changing market conditions.

Secondly, the focus on place-specific services as a determinant of population location must be joined with renewed attention to the locational behavior of facilities which provide those services. As the present analysis suggests, many human services may be locationally sensitive and mobile, due to limited and uncertain commitments for service funding from the public purse, as well as the tendency of services to generate community controversy and opposition. Future research on the determinants of facility patterns should therefore consider an entire range of budgetary, bureaucratic, and community factors that, in addition to client access, may enter into the siting calculus of human service providers.[24] Moreover, since the relative saliency of such factors may vary considerably between types of human services--e.g., centers for the retarded versus senior citizens services--general models of public facility location must be used with caution or adapted to the requirements of the particular service under consideration.

Finally, the two-way linkage between the location choices of service-dependent households and public service facilities brought out here, provides further rationale for an emphasis on models of population location which stress interdependency between residential location and the location of income sources such as jobs or services.[25] Such models stand in

contrast to location models which treat the distribution of household demand for services or employment as exogenous (e.g., traditional public facility location theory or classical industrial location models), or assume the location of services or jobs as exogenous in the analysis of residential location choice (e.g., trade-off models). Further, the research suggests that a second type of locational interdependency requires consideration in the study of urban structure. In the case of the service-dependent population, this interdependency arises between community attitudes toward the nonworking poor, and the range of residential location choices open to these groups. More generally, models of location choice should explicitly consider the competition for personal or community space among groups which differ in terms of their values, needs, and preferences, and assess the implications of such competition for the spatial structure of cities.[26]

Implications for Public Policy

Apart from considerations of geographical theory, the research findings suggest the need for a reorientation of public policy as it affects the needy elderly, disabled, and unemployed poor. As this study brings out, the locational interdependency between service dependents and facilities may act as a catalyst to inequality in the provision of human services, and entrench existing trends toward a ghettoization of nonworking, dependent groups in the most deteriorated and impoverished sections of an urban area, particularly in declining central cities. Benefits received by service users stemming from close proximity to a wide mix

of human services may be canceled out by the environmental disamenities associated with such ghetto areas; rather than increasing the real incomes of service dependents, the targeting behavior of human services may instead reduce recipients' welfare by constraining them to zones of decaying housing stocks, inferior neighborhood services, and personal and property victimization common to declining central cities.

Both service inequality and ghettoization may further act to exacerbate urban decline or, at a minimum, serve to impede the revitalization of core areas by the private sector. The negative association between housing values and the density of service-dependent households and service facilities suggests that from the perspective of the nondependent population, high concentrations of dependents and their support facilities detract significantly from neighborhood attractiveness. Unless the chain of service-dependent household and facility agglomeration is interrupted, nondependent households may well be unwilling to acquire low-income properties and turn the tide of urban disinvestment.

These considerations suggest that deconcentration of service-dependent households and support facilities away from declining, inner-city areas may be an appropriate goal of public policymakers. Moreover, the locational interdependency of service-dependent households and facilities implies that the success of any efforts to deconcentrate the service-dependent poor will rely on a variety of supporting programs and policies. For example, deconcentration of service-dependent households necessitates not only the provision of adequately designed low-income housing and accessible transportation facilities in noncentral city areas, but also requires the location of human-service delivery facilities in those

areas. Conversely, development of a deconcentrated service-delivery system would be both wasteful and negligent if consumers are constrained to inner-city housing stocks by insufficient income and/or limited housing opportunities.

Deconcentration may have secondary effects that also need to be considered. Relocation of some portion of the service-dependent population and the service-delivery system away from inner-city areas creates both problems and opportunities for the management of the residual space. In the absence of an aggressive rehabilitation and renewal effort, such areas could experience increased deterioration or housing abandonment and become even less attractive and more hazardous than they are at present. This would be a severe spillover cost to be borne by remaining inner-city residents; in addition, such externalities would further reduce chances for area revitalization. Given sufficient rehabilitation or rebuilding programs, however, the space made available through deconcentration of the service-dependent population could be made more amenable to occupation by nonpoor households and increase the probability of neighborhood improvement.

Clearly, policies or plans designed to deconcentrate the service-dependent population and their ancillary facilities must be given a long time frame. This is partially for the benefit of service-dependent households themselves, many of whom are highly immobile and resistant to change due to age, disability, or social ties. But a long time reference is also appropriate from the perspective of the receiving, noncentral city communities which must work out problems of an adequate low-income

housing supply, equitable service-facility siting policies, and service coordination.

But, while the deconcentration of service-dependent populations may be a long-range goal of public policy, there are a variety of short-term policies that could alleviate current problems of the service-dependent poor and the problems of declining central cities plagued by financial crises. For example, formulas for revenue sharing and categorical grant-in-aid programs could be restructured to account for the magnitude of a city's service-dependent population, so that heavily service-dependent cities are not penalized unduly for their greater service responsibilities and reduced tax bases. In addition, programs designed to aid service-dependent people, such as the elderly and handicapped, in maintaining or improving their housing, easing transportation problems, or in obtaining appropriate human services may be essential to the immediate well-being of inner-city, service-dependent households.

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FOOTNOTES

1 W. Alonso, Location and Land Use (Cambridge, Mass.: Harvard University Press, 1964); R. Muth, Cities and Housing (Chicago: University of Chicago Press, 1969); E. Mills, Urban Economics (Glenview, Ill.: Scott, Foresman and Co., 1972).

2 A more extensive discussion of theoretical considerations regarding the location of service-dependent households and human service facilities is located in J. Wolch, "The Residential Location Behavior of Service-dependent Households," unpublished Ph.D. dissertation, Princeton University, 1978.

3 Some services, such as meals-on-wheels or home care are delivered to users' homes, and hence need not affect the user's choice of where to live. The present discussion is not concerned with such dispatch-type services.

4 J. Wolpert, "Service Facility Representation in Urban Communities," Proceedings of the Joint U.S.-Soviet Seminar on Urban Quality of Life" (Moscow, 1975).

5 Muth, op. cit., and others have shown analytically that low-income households can be expected to reside closer to the employment locus than households of higher income; suburban employment shifts the optimum location of suburban workers away from the CBD.

6 For a critique of trade-off models and their assumptions concerning the supply side of the urban housing market, see G. Ingram, J. Kain, and J. Ginn, The Detroit Prototype of the NBER Urban Simulation Model (New York: Columbia University Press, 1972); H. Richardson, "The New

Urban Economics: An Evaluation," Socio-Economic Planning Sciences, Vol. 10 (1976), pp. 137-47; or M. Ball and R. Kirwan, "Accessibility and Supply Constraints in the Urban Housing Market," Urban Studies, Vol. 14 (1977), pp. 11-32.

7 For a current summary of research in urban ecology, see B. J. L. Berry and J. Kasarda, Contemporary Urban Ecology (Macmillan, 1977).

8 See, for instance, B. Moriarty, "Socioeconomic Status and Residential Location Choice," Environment and Behavior, Vol. 6 (1974), pp. 448-69; or one of the several urban factorial ecology studies highlighting the tendency for households to locate in neighborhoods of similar socio-economic status, life-cycle stage, and ethnicity, such as R. Murdie, The Factorial Ecology of Metropolitan Toronto (University of Chicago Department of Geography Research Paper #116, 1969).

9 The use of time or cost-distance measures as proxies for social welfare is amply documented in the traditional literature on the location of public facilities. Such studies are clearly reviewed in A. White, "Locational Analysis for Public Facilities: Models, Patterns, and Processes," unpublished Ph.D. dissertation, University of Pennsylvania, 1976.

10 M. Dear, "Locational Analysis for Public Mental Facilities," unpublished Ph.D. dissertation, University of Pennsylvania, 1974.

11 J. Wolpert, "The Agglomeration of Public Service Facilities in Urban Areas," Research Proposal to the National Science Foundation, Princeton University, 1975, mimeo.

12 For a review of major empirical studies of housing demand employing traditional frameworks, see M. Ball, "Recent Empirical Work on the Determinants of Relative Housing Prices," Urban Studies, Vol. 10 (1973), pp. 213-233.

13 U.S. Bureau of Census, 4th Count Census of Population and Housing, 1970. Drawbacks to these data should be noted. Census data refer only to people likely to be service dependent, rather than those known to be so. It also lacks definitional precision (e.g., disabled people above poverty, and secondary wage earners who may be neither public dependents, below poverty level, or responsible for their location choice, cannot be excluded from the sample).

14 Facility numbers are recognized to be underreported (R. Coughlin, personal communication, 1978), and pertain to 1974 rather than 1970. Underreporting and the probability of serial correlation with a 1970 data set suggest that the 1974 data provide an adequate measure of the facility distribution in 1970, however. In addition, facility data contain no information on relative size or capacity of individual facilities necessary to signify adequately the importance of a facility's attractiveness to potential users.

15 Only males were considered, as much of the female "poverty" group are secondary wage earners whose family incomes are above the poverty level. Males were considered to have higher probability of being the chief income recipients and locational decision makers.

16 U.S. Bureau of Census, Census of Population Supplementary Report PC(51)94, 1970.

17 Statistics in Table 2 are derived from: Philadelphia City Planning

Commission, Population, Socioeconomic, and Housing Characteristics, 1960 and 1970, for the Philadelphia Census Tracts, 1972.

18 This is decline in real terms. 1970 values and rents have been deflated by the appropriate Consumer Price Index.

19 Tests for simultaneous-equation bias, such as the Wu test, could have been performed. Such tests are only meaningful given good instrumental variables, however, and tend to show no simultaneous-equation bias when instruments in the model are poor predictors of endogenous regressors, as is the case here.

20 Two accessibility variables--access to facilities and access to service dependents--were tested in the model. These variables, provided by the Delaware Valley Regional Planning Commission, apply to transit mode in 1970, and are defined as:

$y_1^* = A_{sj}$ = access of tract j service dependents to facilities in all other tracts; and

$y_2^* = A_{fj}$ = access of tract j facilities to service dependents in all other tracts, where access is defined as:

$$A_{sj(\text{or } fj)} = \sum_{i=1}^{n} s_i(\text{or } f_i)Z^{-1}$$

where Z = transit mode impedance between tracts i and j :

$Z = (k+1)*16 + 3.2*ET + RT + 1*UC$, and

ET = excess time (walk and wait)

RT = running time (in vehicle)

UC = user cost

K = number of transfers in path from i to j

S = number of service dependents

F = number of targeted human-service facilities.

21 K. Allan, "First Findings of the 1972 Survey of the Disabled: General Characteristics," Social Security Bulletin, Vol. 39 (1976), pp. 18-37.

22 C. Rapkin and W. Grigsby, Residential Renewal in the Urban Core (Philadelphia, Pa.: University of Pennsylvania Press, 1960).

23 Facility data were only available for the central city, thus constraining other parts of the analysis.

24 Such factors have been considered in the literature on conflict in the location of public facilities (see, for example, M. Austin, T. Smith, and J. Wolpert, "The Implementation of Controversial Facility-Complex Programs," Geographical Analysis, Vol. 2 (1970), pp. 315-29; A. Mumphrey, and J. Wolpert, "Equity Considerations and Concessions in the Siting of Public Facilities," Economic Geography, Vol. 44 (1973), pp. 109-21; or J. Seley, "Paradigms and Dimensions of Urban Conflict," unpublished Ph.D. dissertation, University of Pennsylvania, 1973). However, the findings of the conflict research have not been adequately generalized and reformulated within frameworks appropriate for broad empirical testing, or for incorporation with models of residential location choice.

25 For examples of location models which incorporate interdependency between the location of jobs and people, see D. Steinnes, "Causality and Intraurban Location," Journal of Urban Economics, Vol. 4 (1977), pp. 69-79; or J. Segal, "Intrametropolitan Migration: A Simultaneous

Model of Employment and Residential Location of White and Black Households," Journal of Urban Economics, Vol. 2 (1975), pp. 29-47.

26 Such models have been developed to consider the competition between white and black households, for example, J. Yinger, "Racial Prejudice and Racial Residential Segregation in an Urban Model," Journal of Urban Economics, Vol. 3 (1976), pp. 383-396; or S. Rose-Ackerman, "The Political Economy of a Racist Housing Market," Journal of Urban Economics, Vol. 4 (1977), pp. 150-169.

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