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Substandard Housing and the Cost of Providing Housing-Related Services

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SUBSTANDARD HOUSING AND THE COST OF PROVIDING HOUSING-RELATED SERVICES

The Boston Urban Observatory

JUNE, 1973

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SUBSTANDARD HOUSING AND THE COST OF PROVIDING HOUSING-RELATED SERVICES

THE BOSTON URBAN OBSERVATORY
June, 1973

Prepared by
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The research and studies forming the basis for this report were conducted pursuant to a contract between the Department of Housing and Urban Development and the National League of Cities. The substance of such research is dedicated to the public. The authors and publisher are solely responsible for the accuracy of statements or interpretations contained herein.

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CONTENTS

Page

FIGURES AND TABLES

Page

Page

FOREWORD

Many of the studies sponsored by the Boston Urban Observatory clearly reflect the concern of municipal policy-makers for the concept of "neighborhood." Major segments of BUO reports on organized citizen participation, little city halls, housing inspectional services, citizen attitudes, and local bus services were devoted to neighborhood analysis and the implications of policy for this critical level of urban perspective.

Although neighborhood dynamics have been a principal interest of political scientists, sociologists, planners and engineers for some time, only recently have economists begun to focus on this level of urban life. The report which follows, the effort of a team of economists from the University of Massachusetts at Boston, represents a major contribution to the expanding literature in the determinants of neighborhood expenditure patterns, and its findings should be immediately useful to policy-makers in major agencies of the City of Boston.

Equally important, however, and particularly valuable for the long term is the display of detailed information by neighborhoods which can assist departmental administrators in making basic decisions about the allocation of expenditure and manpower resources.

Joseph S. Slavet, Director
Boston Urban Observatory

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Closer to "home" we are indebted to our colleague, Mary Huff Stevenson, for in-depth and detailed comments on the entire report. Without our two able, resourceful and conscientious research assistants, Marshall Mansfield and Lawrence Selfridge, we would still be compiling data. Helen St. Germain worked under tremendous time pressures in typing an earlier draft of this manuscript, and we are grateful to her for her efforts and good cheer during the ordeal.

The staff of the Boston Urban Observatory provided invaluable editorial, staff and budgeting assistance. In particular, we are indebted to Natalie

Ammarell, Kay Brayden, and Deirdre Kimball for their help. Elizabeth Knutson prepared the manuscript for final publication and without her, everything else would be wasted.

Finally, Joseph Slavet, Director of the Boston Urban Observatory, was on the scene from start to finish. This study could not have been completed without his guidance and encouragement.

If, despite all of this assistance, any errors remain, they are solely the responsibility of the authors.

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Boston

CHAPTER I

INTRODUCTION

A. Background and Purpose

Designed as a comparative undertaking by the National League of Cities (NLC), this study is officially entitled "National Research Agenda Project No. 5: Substandard Housing and the Cost of Providing Housing-Related Services." A similar study was carried out by the urban observatories in Denver and Nashville. According to the study scope of services, the NLC was interested in the cost of "a wide variety of local government activities ... required to support and service urban housing," and how these costs "are affected by housing quality, housing location, age and type of structures. ..." It was also suggested that attention "be given to examining variations in the type and level of services provided on the basis of such factors as housing ownership ... and according to the demographic characteristics of the occupants. In addition, consideration will be given to identifying, insofar as possible, special costs related to substandard housing and to estimating their magnitude."

More specifically, the following tasks were identified in the scope of study services:

1. Develop indicators of standardness and substandardness ...
2. Identify typical housing areas of essentially uniform characteristics ...
3. Determine the cost of providing housing-related services ...
4. Develop current and five-year projections of the cost of providing housing-related services if all housing were standard.

Implicit in the title of the study, and explicitly stated above in item 4, was the assumption that the cost of housing-related services was directly related to the quality of housing. In the earlier phases of our investigation we were able to discover little theoretical rationale for this assumed relationship. Our empirical findings support this contention. As a result, the study had to be slightly redirected.

B. Scope

A "standard" public-finance inquiry of the determinants of expenditure patterns was undertaken as part of this study. The literature in this field, far too extensive to cite,[1] includes numerous cross-sectional studies for states and for standard metropolitan statistical areas (SMSA's). We undertook a cross-sectional study based upon intra-city data for the City of Boston for services for which we could obtain data, even if they were not strictly speaking housing-related. Using standard statistical techniques, we attempted to ascertain the extent to which variations in service expenditures "among neighborhoods" within Boston could be explained by various socio-economic and geographic variables. We believe this makes the study particularly unique. To our knowledge no intra-city study of this nature has been conducted for as many services with as many observations. In this sense, the study is not "standard."

Clearly the most difficult (and time-consuming) aspect of the study was the development of reliable measures of expenditures for neighborhoods within the City. In some areas we believe we were successful; in other areas, not so successful. The results are reported for all services for which we were able to make estimates.

To fulfill the charge of the NLC with respect to substandard housing several steps were taken. First, alternative measures of substandardness were developed. Second, we attempted to measure the effect of substandardness on service expenditures even though only weak theoretical links were identified. These results are reported in all cases. Finally, wherever possible, attention was directed to the relationship between the quality of housing and population characteristics and to the policy implications of the substandard housing variables.

C. <u>Outline of Study</u>

Given our charge and our intention to stress "the quality of housing" influence, in Chapter II we present an analysis of alternative definitions of substandard housing and relate these definitions to important socio-economic variables. In Chapter III the underlying data and methodology are described (greater detail is given in Appendices A and B). Chapter IV presents a summary of expenditure allocations and reviews the expenditure patterns by neighborhoods. Chapter V brings together all of the data as we examine the determinants of the expenditure patterns. In Chapter VI the conclusions are reviewed and analyzed in terms of their policy implications.

This report can be read sequentially (Chapters II-VI, with an occasional side-trip to an Appendix if more details are desired) by readers slightly familiar with census data. (Readers not at all familiar with census concepts might read Chapter III before Chapter II.) Policy makers in municipal agencies can skip (or scan) Chapters III and V. But in doing so, they run the risk of not knowing the assumptions underlying our expenditure allocations and the basis of our policy recommendations. Experienced researchers, particularly those familiar with regression analysis, may wish to skip the descriptive material of Chapter IV.

Finally it should be noted that the scope of the study was limited by the availability of data. We have already acknowledged the many City officials who gave of their time and therefore contributed immeasurably to this study. Due to the pressures of day-to-day business, the Highway Division of the Public Works Department could not supply any of the required data. Consequently, despite our charge, nothing is reported on the construction, cleaning, maintenance and lighting of streets.

FOOTNOTES TO CHAPTER I

1. For an excellent bibliography on inter-city studies see the references in John C. Weicher, "Determinants of Central City Expenditures: Some Over-looked Factors and Problems," National Tax Journal, December, 1970, pp. 379-395.

CHAPTER II

THE QUALITY OF HOUSING IN THE CITY OF BOSTON

The primary purpose of this chapter is to describe the quality of the housing stock in the City of Boston. All the housing data presented and analyzed are taken from the 1970 U.S. Census of Housing. Section A presents a profile of the housing stock in Boston according to occupancy status. Section B discusses the definitions of substandard housing employed in this study. Section C presents and analyzes the estimates of the substandard housing stock. Section D attempts to make comparisons of the stock of substandard housing with socio-economic characteristics according to neighborhoods.

A. Housing Stock According to Occupancy Status

Table II-1 presents a profile of the housing stock in the City of Boston according to occupancy status in 1970. There are 232,424 housing units in Boston of which 93.6% are occupied and 6.4% are vacant (year-round). Of the occupied units, 27.2% are owner-occupied and 72.8% are renter-occupied. Additionally, 14.6% of the occupied units are black-occupied and 1.6% of the occupied units are occupied by persons of Spanish-American background. Of the black-occupied units, 17.5% are owner-occupied and 82.5% are renter-occupied. Thus owner-occupancy by blacks is significantly lower than that of whites. Conversely, renter-occupancy by blacks is significantly higher than that of whites.[1]

When one looks at occupancy status according to neighborhoods (Table II-1), one finds that vacancy rates range from a low of 1.6% in West Roxbury to a high of 15.1% in the South End. Only two neighborhoods have vacancy rates over 10% -- the South End and Roxbury. On the other hand, only three neighborhoods have vacancy rates under 3% -- West Roxbury, Roslindale and Hyde Park.

With respect to occupancy according to owner and renter status,

TABLE II-1

HOUSING STOCK IN THE CITY OF BOSTON IN 1970 ACCORDING TO OCCUPANCY STATUS

	Occupied and Vacant Housing Units	Percent Vacant	Percent Occupied	Percent of Occupied Units which are Owner-Occupied	Percent of Occupied Units which are Renter-Occupied	Percent of Occupied Units which are Black-Occupied	Percent of Occupied Units which are Spanish-American Occupied	Percent of Black Occupied Units which are Owner-Occupied	Percent of Black Occupied Units which are Renter-Occupied
City of Boston	232,424	6.4%	93.6%	27.2%	72.8%	14.6%	1.6%	17.5%	82.5%
Brighton-Allston	25,344	3.1	96.9	19.3	80.7	1.3	2.1	11.8	88.1
Back Bay	23,123	7.8	92.2	3.0	97.0	6.2	1.5	4.1	95.9
West End	8,586	8.4	91.6	7.9	92.1	1.4	0.5	2.7	97.3
North End	4,739	5.8	94.2	13.3	86.7	0.1	0.0	33.3	66.7
Charlestown	5,145	5.9	94.1	32.4	67.6	0.3	0.0	7.7	92.3
East Boston	13,707	6.2	93.8	30.7	69.3	0.7	0.0	3.4	96.6
South Boston	14,226	6.1	93.9	25.8	74.2	0.7	0.3	5.3	94.7
South End	11,865	15.1	84.9	11.4	88.6	30.3	3.2	7.5	92.5
Roxbury	23,310	11.3	88.7	15.4	84.6	62.7	3.7	15.1	84.9
North Dorchester	32,519	7.9	92.1	27.5	72.5	30.9	2.3	21.9	78.1
South Dorchester	24,595	4.4	95.6	38.1	61.9	17.2	1.1	28.5	71.5
Roslindale	12,287	2.0	98.0	50.5	49.5	0.7	0.3	5.7	94.3
Jamaica Plain	11,216	4.0	96.0	31.4	68.6	2.5	5.0	23.5	76.5
West Roxbury	9,882	1.6	98.4	66.0	34.0	0.2	0.0	18.2	81.8
Hyde Park	11,880	2.2	97.8	54.6	45.4	10.1	3.6	16.1	83.9

owner-occupancy rates range from a low of 3% in Back Bay to a high of 66% in West Roxbury. Only three neighborhoods -- West Roxbury, Hyde Park and Roslindale -- have owner-occupancy rates above 50%, while six neighborhoods have owner-occupancy rates below 20%: Back Bay, the West End, the South End, the North End, Roxbury and Allston-Brighton.

B. The Definition of Substandard Housing

The definitions of substandard housing employed in this study were determined solely by the available data on housing characteristics in the 1970 Census of Housing. Three alternative definitions of substandard housing are used in this study:

1. A substandard housing unit is a unit which does not have all plumbing facilities (SUB1).

2. A substandard housing unit is a unit which does not have all plumbing facilities and adequate heating (SUB2).[2]

3. A substandard housing unit is a unit which does not have all plumbing facilities, adequate heating, and both direct access and complete kitchen facilities (SUB3).

Clearly, the first definition (SUB1) of a substandard housing unit is the most restrictive while the third definition (SUB3) is the least restrictive. Thus estimates of the stock of substandard housing will be lowest when SUB1 is employed and highest when SUB3 is employed. The purpose of employing alternative definitions of substandard housing is to determine to what degree the estimates of substandard housing are affected by the particular definition of substandard housing which is utilized.

Clearly one might argue that the definitions of substandard housing used in this study are inadequate. Under the definitions employed in this study, a housing unit missing some or all plumbing facilities is classified as substandard.[3] Such a housing unit cannot necessarily be considered as uninhabitable or a threat to the health of the family which occupies it.

However, if one assumes that plumbing facilities serve as a proxy for the overall condition of the housing unit, then the definitions of substandard housing employed in this study are meaningful. Housing units lacking some or all plumbing facilities are also more likely to have inadequate electrical wiring, defects in the ceiling and floors, etc. The assumption that plumbing facilities serve as a proxy for the overall condition of a housing unit becomes more tenable the greater the difference between the market price for housing units with all plumbing facilities and housing units missing some or all plumbing facilities. In other words, the greater the difference in overall condition of the housing units classified as standard as compared to those classified as substandard, the greater is the expected difference between their market price.

Table II-2 presents average monthly contract rent by neighborhood for housing units with all plumbing facilities and for housing units lacking some or all plumbing facilities. Average monthly contract rent for housing units with all plumbing facilities is 31% to 150% higher (depending upon the neighborhood) than average monthly contract rent for housing units lacking some or all plumbing facilities. The average difference is 64%. This rather large margin suggests that plumbing facilities may in fact be a good proxy for evaluating the overall condition of the housing unit.[4]

C. The Stock of Substandard Housing

Table II-3 presents estimates of the stock of substandard housing in 1970 in the City of Boston. Data in this table are for occupied and vacant housing units combined. Using definition SUB1, 5.6% of the housing units in Boston were substandard. Using definition SUB2, 16.3% were substandard and using definition SUB3, 17.3% were substandard. Using SUB2 rather than SUB1 results in an estimate of the substandard housing stock which is almost

TABLE II-2

AVERAGE MONTHLY CONTRACT RENT

Neighborhood	(1) Average Monthly Contract Rent For Units With All Plumbing Facilities	(2) Average Monthly Contract Rent For Units Lacking Some or All Plumbing Facilities	(3) Percent Difference Between (1) and (2)
Brighton-Allston	$139	$90	54
Back Bay	179	95	88
West End	193	77	150
North End	111	51	118
Charlestown	91	68	39
East Boston	72	44	64
South Boston	83	52	60
South End	160	78	105
Roxbury	99	69	43
North Dorchester	94	71	32
South Dorchester	106	81	31
Roslindale	104	78	33
Jamaica Plain	105	69	52
West Roxbury	135	91	48
Hyde Park	110	81	36

TABLE II-3

THE STOCK OF SUBSTANDARD HOUSING UNITS IN 1970

USING ALTERNATIVE DEFINITIONS

	Percent of Occupied and Vacant Housing Units which are Substandard		
Area	SUB1	SUB2	SUB3
City of Boston	5.6%	16.3%	17.3%
Brighton-Allston	1.4	4.9	5.4
Back Bay	10.7	12.5	15.5
West End	13.6	17.0	19.0
North End	39.1	70.0	70.5
Charlestown	6.5	30.4	30.9
East Boston	7.3	42.8	43.5
South Boston	5.6	37.2	37.6
South End	22.6	29.8	32.9
Roxbury	2.6	14.3	14.9
North Dorchester	2.2	13.4	14.2
South Dorchester	1.5	7.1	7.7
Roslindale	1.0	4.5	5.0
Jamaica Plain	3.3	14.4	15.1
West Roxbury	1.5	3.6	3.7
Hyde Park	1.4	6.3	6.8

three times higher. However, using SUB3 increases the estimate of the substandard housing stock only minimally relative to the estimate employing SUB2. Thus adding the requirement that a standard housing unit possess adequate heating as well as all plumbing facilities has a dramatic impact on the estimate of the substandard housing stock.

The data in Table II-3 identify the location of the substandard housing stock within the City of Boston. Using SUB1, four neighborhoods -- the North End, the South End, the West End and Back Bay -- have 10% or more of their housing stock classified as substandard. In the North End, 39.1% of the housing units are substandard. In the South End, 22.6% of the housing units are substandard. The West End and Back Bay have 13.6% and 10.7%, respectively, of their housing units classified as substandard.[5]

There are seven neighborhoods where the percent of substandard housing units is under 3%. They are Roslindale, Hyde Park, Brighton-Allston, South Dorchester, West Roxbury, North Dorchester and Roxbury. The percent of substandard housing units within the remaining five neighborhoods ranges from 3.3% to 7.3%.

The data presented in Table II-3 suggest that the vast majority of the substandard housing stock in the City of Boston may be located in four neighborhoods -- the North End, the South End, the West End and Back Bay. As a matter of fact, using SUB1, there are 12,944 housing units in Boston which are substandard. Of this total, 8,165 or 63% are located in the above four neighborhoods while these neighborhoods contain only 21% of the City's housing units.

The impact of changing the definition of substandard housing from SUB1 to SUB2 in estimating the stock of substandard housing according to neighborhoods is quite diverse. In the North End, East Boston and South

Boston there is an increase of over 30 percentage points in the estimates of the substandard housing stock.[6] In six neighborhoods -- Brighton-Allston, Back Bay, the West End, Roslindale, West Roxbury and Hyde Park -- the estimates of the substandard housing stock increase by 5 percentage points or less. What is noteworthy is that using SUB2, 70% of the housing units in the North End are classified as substandard.[7] Also the four neighborhoods with the highest percent of substandard housing are the North End, East Boston, South Boston and Charlestown (all over 30%). This is in contrast to the findings based on SUB1 rather than SUB2. Using SUB1, the four neighborhoods with the highest percent of substandard housing are the North End, the South End, the West End and Back Bay. The only neighborhood appearing in both groups is the North End.

Using SUB2, there are 37,840 housing units in Boston which are substandard. Of this total, 16,023 or 42% are located in the North End, East Boston, South Boston and Charlestown, neighborhoods which contain only 16% of the City's housing units. Although the degree of concentration of substandard housing is quite similar when using either SUB1 or SUB2 as the definition of substandard housing, the area of concentration changes significantly.[8]

It is of interest to determine whether "substandardness" is a more prevalent characteristic of vacant housing units than occupied housing units. Table II-4 presents estimates of the percent of occupied housing units which are substandard and estimates of the percent of vacant housing units which are substandard. The definition of substandard used in Table II-4 is SUB1.

For the City of Boston, 5.1% of the occupied housing units are substandard and 11.7% of the vacant housing units are substandard. With respect to individual neighborhoods, West Roxbury, the North End and Back Bay have an extremely higher percent of substandard vacant housing units

TABLE II-4

SUBSTANDARD HOUSING STOCK (SUB1)

ACCORDING TO OCCUPANCY AND VACANCY

Area	Percent of Occupied Housing Units Which Are Substandard (SUB1)	Percent of Vacant Housing Units Which Are Substandard (SUB1)
City of Boston	5.1%	11.7%
Brighton-Allston	1.3	4.2
Back Bay	9.7	23.5
West End	13.1	19.1
North End	28.4	50.4
Charlestown	6.1	12.2
East Boston	6.6	18.3
South Boston	4.9	15.4
South End	22.5	23.3
Roxbury	2.6	2.6
North Dorchester	2.1	2.7
South Dorchester	1.1	2.5
Roslindale	0.9	5.7
Jamaica Plain	3.1	6.5
West Roxbury	0.8	39.3
Hyde Park	1.3	3.8

than substandard occupied housing units. All the neighborhoods with the exception of Roxbury have a higher percent of vacant substandard housing units than occupied substandard housing units, although the differences are relatively small for North Dorchester, South Dorchester, Jamaica Plain, Hyde Park and Brighton-Allston.[9]

D. A Comparison of the Substandard Housing Stock and Socio-economic Characteristics According to Neighborhood

The purpose of this section is to determine whether there are any relationships between the socio-economic characteristics of a neighborhood and the proportion of a neighborhood's housing stock which is substandard. Table II-5 presents the matrix of simple correlation coefficients between selected socio-economic characteristics and the percent of occupied and vacant housing units which are substandard. The socio-economic characteristics include the percent of the population which is white, the percent of the population which is black, the percent of the population which is Spanish-American, the percent of the population which is foreign born, the percent of the population which is of foreign stock and the level of educational attainment of the population.[10]

There are no significant correlations between any of the socio-economic characteristics and the percent of housing units which are substandard using SUB1 as the definition of substandard housing. When either SUB2 or SUB3 is employed as the definition of substandard housing, significant correlations emerge between the percent of substandard housing and both the educational attainment variable and the percent of the population which is foreign born. There is an inverse relationship between educational attainment and the stock of substandard housing and a positive relationship between the percent of population which is foreign born and the stock of substandard housing. The only tentative conclusion that can be reached is that neighborhoods with

TABLE II-5

MATRIX OF SIMPLE CORRELATION COEFFICIENTS OF SOCIOECONOMIC CHARACTERISTICS AND SUBSTANDARD HOUSING STOCK

Socioeconomic Characteristics	Percent of Occupied and Vacant Housing Units Which Are Substandard		
	SUB1	SUB2	SUB3
Percent White	+.15	+.11	+.10
Percent Black	-.18	-.14	-.15
Percent Sp.-American	+.12	+.27	+.27
Percent Foreign Born	+.10	+.57*	+.56*
Percent Foreign Stock	+.16	+.39	+.38
Educational Attainment	+.22	-.70*	-.70*

*Correlation coefficient is significant at the .05 level using a two-tail test.

relatively high stocks of substandard housing are characterized by both relatively low levels of educational attainment of the population, and relatively high proportions of the population who are foreign born. Clearly, a more expanded and detailed analysis is needed before any meaningful conclusions can be reached with respect to the relationship of the substandard housing stock to the socio-economic characteristics of the neighborhoods.

FOOTNOTES TO CHAPTER II

1. Since whites occupy approximately 85% of the housing units in Boston, the percent of owner-occupancy by whites must be higher than 27.2%, the percent of owner-occupancy for the population as a whole. Conversely, the percent of renter-occupancy by whites must be lower than 72.8%, the percent of renter-occupancy for the population as a whole.

2. Adequate heating includes steam or hot water heating, central warm air furnace, built-in electric units and floor, wall or pipeless furnace.

3. According to the 1970 Census of Housing, a housing unit with all plumbing facilities consists of units which have hot and cold piped water, as well as flush toilet, and a bathtub or shower inside the structure for the exclusive use of the occupants of the unit.

4. The more preferable measure of rent is gross rent. Clearly differences in contract rent may reflect differences in the rental contract with respect to the services provided by the landlord (such as heating fuel, utilities, etc.). However, average gross rent according to plumbing facilities is not available in the Census. If monthly contract rent for housing units with all plumbing facilities generally includes heat, utilities, etc. while monthly contract rent for units lacking some plumbing facilities generally does not, then part of the differences in average contract rents is due to this fact and not to the overall condition of the housing unit.

5. These rather high estimates of substandard housing units in areas such as the North End should be viewed with some caution. Under definition SUB1, if two housing units share, e.g. a bathtub or shower, then both units are considered substandard. Both units can be in excellent condition in all other respects, but under our definition they would be classified as substandard. At the other end of the spectrum, the relatively low estimates of substandard housing for areas such as Roxbury should also be viewed with caution. Although a housing unit contains all plumbing facilities, the unit may be in very poor condition when other factors, such as condition of the walls, floors, windows, and wiring system, are also considered.

6. The use of percentage increases in making these comparisons will tend, in some sense, to exaggerate the difference in estimates using alternative definitions of substandard housing.

7. The rather dramatic increase in the estimate of substandard housing using SUB2 rather than SUB1 in areas such as the North End, East Boston and South Boston is to a large degree a function of our definition of adequate heating. We chose, somewhat arbitrarily, to designate housing units which are heated by room heaters with flue as having inadequate heating. Since room heaters with flue are used to a relatively significant degree in specific areas of the city (such as the North End,

East Boston, and South Boston), our estimates of substandard housing for some neighborhoods are significantly higher than they would have been had room heaters with flue been considered adequate heating.

8. The area of concentration does not change as signficantly if one recognizes that the South End should probably be included in the relevant area of concentration since 29.8% (using SUB2) of the housing units in the South End are substandard. If the South End is included with the North End, East Boston, South Boston and Charlestown, then these areas have 52% of the City's substandard housing stock even though they have only 21% of the City's housing units.

9. If Table II-4 is reconstructed using SUB2 or SUB3, instead of SUB1, the differences in the percent of occupied substandard housing units and the percent of vacant substandard housing units are quite similar.

10. The educational attainment variable is the percent of persons over 25 who are high school graduates.

CHAPTER III

THE DATA BASE

This study relies on two basic sources of data: (1) The 1970 U.S. Census of Housing and Population; and (2) Expenditure and services data derived from documents supplied by various City departments. The data will be analyzed in two separate, but related ways in Chapters IV and V. In this chapter the data base is described briefly.

A. Census Data

The census data come primarily from the Fourth Count of the 1970 Census of Population and Housing. While some of the data from the Fourth Count can be obtained from printed reports, particularly "Census Tract Reports," summary computer tapes contain a much more detailed elaboration of housing and population characteristics, particularly with respect to the cross-classification of census information. File A of the Fourth Count Summary tapes for both population and housing presents data for complete census tracts.[1] A tract is one of the basic census subdivisions of large political units. (Block statistics are also available, but they do not give the same detailed characteristics as census tract reports.) The City of Boston is divided into 15 "neighborhoods". These neighborhoods represent such familiar names to Bostonians as Brighton-Allston, Charlestown, East Boston, etc. Thus the census neighborhoods tend to parallel traditional and historical neighborhood boundaries particularly where an area has very clearly delineated geographic boundaries or was a political subdivision annexed by Boston. Charlestown, separated from "mainland" Boston by the Charles River and annexed in 1873, satisfies both criteria.

The 15 census neighborhoods are subdivided into census tracts, the number of tracts depending on the size of the neighborhood. Although major thoroughfares such as Massachusetts Avenue and Blue Hill Avenue often serve as tract boundaries, it is more difficult to match the tracts with geographical and political boundaries.[2] To summarize, within the City of Boston, there are 147 census tracts each of which has a code number identifying the neighborhood in which the tract is located. Table III-1 summarizes this information and the map on the following page shows the neighborhood and tract boundaries.

Census tracts of Boston range in population from a low of 400 in the Charlestown tract 406 to a high of 14,963 in the Hyde Park tract 1401.[3] If all of Boston's 641,071[4] residents were distributed equally among the 147 census tracts, each tract would have 4,361 residents. The Fourth Count of Housing and Population gives detailed information for each of the 147 census tracts. From the Housing Census we obtained, among other items, data on the age of the structure, the rental values and the percent of owner-occupied units in each tract. Similarly, from the Population Census we obtained, among other items, data on the employment, income and family status of residents in each tract. The specific housing and population data used in the study will be described in Chapter V.[5]

The primary aim of the study was to attempt to relate the cost of providing housing-related services within neighborhoods (or tracts) to the housing and population characteristics of the neighborhood under study. A glance at the map shown on page 21 illustrates the dimension of the problem. In some cases census neighborhoods exactly coincide with the districts of City departments. Thus Charlestown, already discussed above, comprises all of Department of Public Works District 1A and all of Police District 15. Similarly, Brighton-Allston, bounded by the Charles River on the north, Brookline on the south and Newton on the west, is almost

Figure III-1

The Census Neighborhoods of Boston

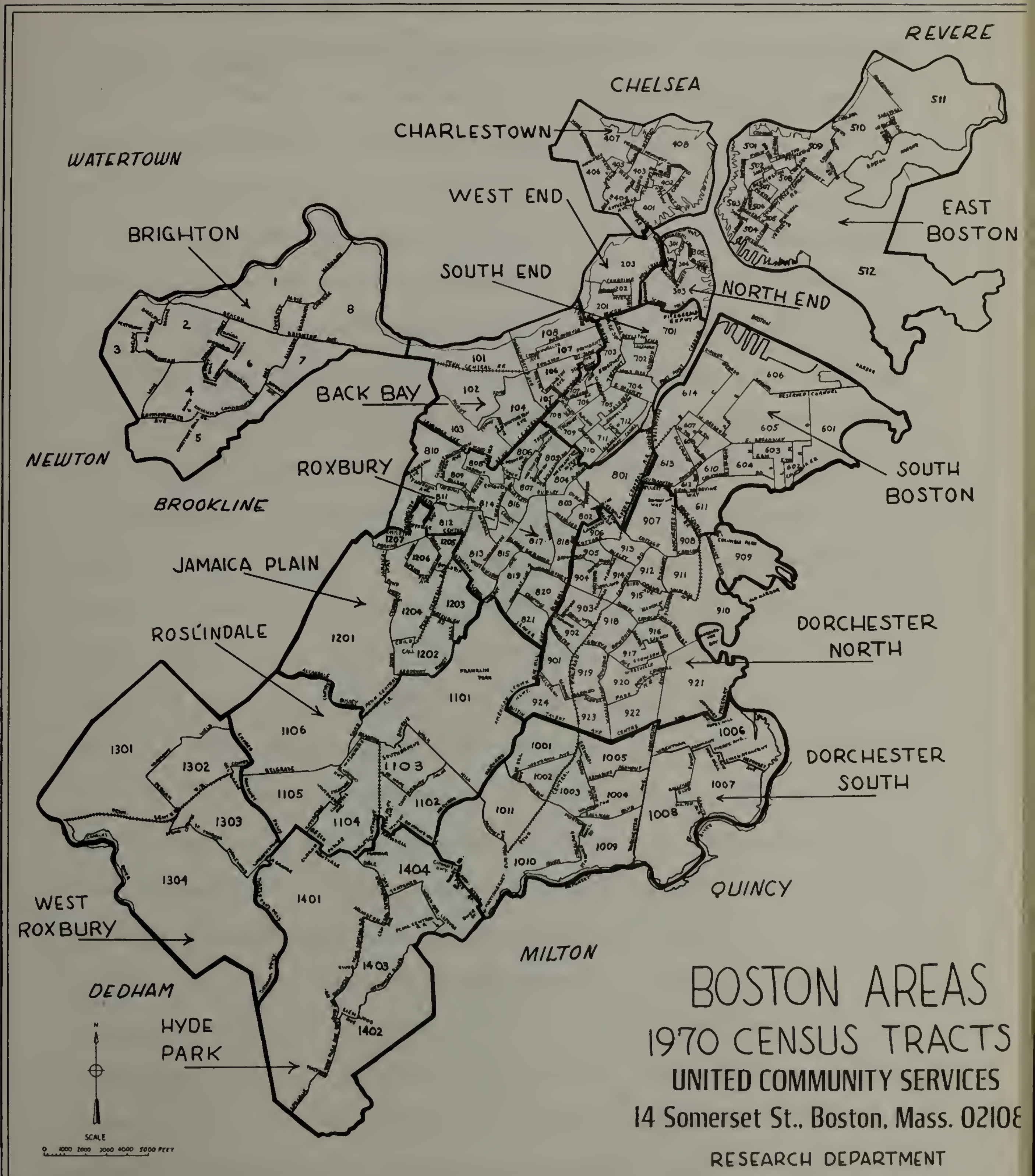

TABLE III-1

LOCATION OF CENSUS TRACTS BY NEIGHBORHOOD

Neighborhood	Tract Code Numbers	Number of Tracts
Brighton-Allston	1-8	8
Back Bay	101-108	8
West End	201-203	3
North End	301-305	5
Charlestown	401-408	8
East Boston	501-512	12
South Boston	601-614	14
South End	701-712	12
Roxbury	801-821	21
North Dorchester	901-924	24
South Dorchester	1001-1011	11
Roslindale	1101-1106	6
Jamaica Plain	1201-1207	7
West Roxbury	1301-1304	4
Hyde Park	1401-1404	4

physically separated from the rest of Boston (i.e., it meets the Back Bay at the Boston University bridge). Here again the census neighborhood comprises all of Department of Public Works District 4 and all of Police District 14. Finally, East Boston, like Charlestown separated by water from mainland Boston, is completely contained within Department of Public Works District 9 and Police District 7. But for the rest of the City, these clearly delineated boundaries do not hold for each and every City department. Thus the census neighborhood designated as the South End is served by part of Police District 1 (designated North End-Downtown by the Police Department) and by part of District 4 (designated South End-Back Bay), while Department of Public Works District 1B covers parts of census neighborhoods for the South End, Back Bay and Roxbury, and all of the North End and West End. Similarly, census neighborhood North Dorchester is served partly by Police District 2 (Roxbury-North Dorchester), partly by Police District 11 (Dorchester) and partly by Police District 3 (Mattapan). In turn, Police District 11 (Dorchester) serves census neighborhoods in North Dorchester and South Dorchester. But even if there were 15 census neighborhoods and 15 divisions (or districts) of every city department coinciding precisely with census neighborhoods, we would still have difficulty performing the statistical analysis described in Chapter V. Fifteen observations would be inadequate. Consequently, the 15 neighborhoods must be subdivided. For these purposes, the census tract represents an ideal subdivision. The problem is to obtain expenditures (and/or service data) on an equally disaggregated basis. This turned out to be a costly and time-consuming process, even for such apparently geographically distinct areas as Charlestown or East Boston. In these areas, as in all other census neighborhoods, department sub-districts (if they existed), such as police car sectors, did not coincide with census tract boundaries. The next section briefly describes the methodology we employed to allocate service expenditures to census tracts.[6]

B. Service Data - Brief Description

In Appendix A a more detailed description of our methodology is presented for some of the more complex procedures. That Appendix will enable the specialized reader to re-work our calculations and, more importantly, will provide a basis for discussion of the assumptions underlying our methodology. In this section we present a summary of our methodology which we believe will enable most readers to gain a general understanding of our service data. A very brief preview of the data is also presented. A systematic analysis of expenditure patterns generated by the methodology, and a study of the determinants of the expenditure patterns are reserved for Chapters IV and V.

Ideally, two pieces of information are needed for each service by census tract, namely (1) a measure of output or services rendered to the residents of a census tract, and (2) a measure of the cost of providing the service. Theoretically the two are separate and distinct concepts. Higher expenditures per capita do not necessarily mean greater services per capita. It could just as well mean higher cost of delivery per unit of output due to service conditions such as density, which may make it more difficult for the fire engine company to deliver fire fighting services. Conversely, higher services per capita do not necessarily involve greater costs per capita if the services can be delivered at lower unit costs due to favorable service conditions. Public expenditure studies tend to use costs and output interchangeably. Thus in measuring the benefits of such public goods as national defense or police protection, where there is no tangible measure of output, we traditionally equate output with "costs undertaken on behalf of." By definition, if the government has "undertaken more costs on 'your behalf,'" it is providing you with greater services. In brief, the measures of output and costs are not independent of each. Rather there is a one-to-one correspondence between output and costs.

For some services, namely police protection, fire protection and sanitation, independent measures of output (or demand) and costs have been identified. For the other services -- water, sewer and housing inspection -- independent measures of output and costs have not been obtained. Here the tradition is reversed. Meausres of "output" by census tract have been obtained and they have been used to estimate expenditures by census tract. The methodology for each service is discussed briefly below.

1. Police Protection (or Crime Prevention)

a. Methodology

Two independent sets of data were obtained from the Police Department -- crime data and manpower allocations. The crime data represent incidents reported to the Police Department on the basis of 825 reporting areas.[7] The Police Department provided a printout for each reporting area for all crimes (and services) for 1970 listed in accordance with the standard 2-digit classification scheme.[8] Concord Research Corporation of Burlington provided us with a list of the reporting areas in each tract. Using such data, it was relatively easy to calculate the number and type of incidents occurring in each census tract.[9] To standardize the data, the total number of crimes (or incidents) within the census tract were divided by the census tract population and then multiplied by 1,000, yielding a crime rate conforming to standard reporting procedures of number of crimes per 1,000 persons. The crimes and incidents were grouped into four major categories: CR1 - Part I Offenses (or Major Crimes); CR2 - Part II Offenses (or Minor Crimes), exclusive of traffic offenses and drunkenness; CR3 - Part III Services and Traffic Offenses; CR4 - Drunkenness.[10] In essence, the crime and service data was viewed in this study as a measure of demand (or need) for police services by census tract. Next, an estimate of the allocation of police services by census tract (roughly interpreted as the response to the demand) was needed.

The Police Department provided us with the allocation of police officers by Police Districts. A series based upon this allocation and weighted by the salaries of the various ranks of police officers, was constructed. The percentage distribution of this series by Police Districts was used to allocate Police Department expenditures for the prevention, control and reduction of crime to the 11 Police Districts.[11] Obviously, the assumption was made that expenditures for clerical staff and non-manpower expenditures were proportional to the allocation of police manpower expenditures. For many expenditures this is not an unreasonable assumption, since the greater the size of the police force of a given district, the more patrol cars are assigned to that district.

For each Police District, the expenditures allocated to the district were divided by the number of car sectors within that district to derive an estimate of the crime prevention and control expenditures for each car sector. Then, utilizing census tract maps, with the boundaries of police car sectors superimposed, we estimated the amount of patrol activity that each census tract received from the various car sectors serving the tract. With the cost of each car sector estimated above, the police expenditures within the tract were computed. Finally the expenditures were divided by the population of the tract to derive per capita expenditures. These expenditures were labelled COPP -- cost of police protection expenditures per capita. The CR and COPP data are analyzed in detail in Chapters IV and V. In the next section some data are briefly presented to illustrate the raw output of the methodology.

b. Data

In 1970 police expenditures in the City of Boston for crime prevention, control and reduction allocated to census tracts totaled $30,860,877.[12] For Boston COPP was $48.13. COPP expenditures ranged from a low of $2.70 per capita in the South Boston tract 612 to a high of $1,165.50 in the South End tract 701 (which includes Boston Common and the Combat Zone). For the City, expressed in crimes per thousand, the reported crime rates for CR1, CR2, CR3 and CR4 were 68.08, 52.55, 376.10 and 3.19 respectively.[13] CR1 ranged from a low of 8.2 in South Boston tract 602 to a high of 1767.6 in the South End tract 701. CR2 ranged from 8.7 in the North End tract 301 to 828.7 in tract 701. A low for CR3 of 48.0 also occurred in tract 301 and the high of 5,648.8 again occurred in tract 701. Finally, CR4 varied from zero in tracts 5, 301 and 305 to a high of 74.88 in the South End tract 703.[14] This material is summarized in Table III-2.

2. Fire Protection (or Fire Fighting)

a. Methodology

Two independent sets of data were obtained from the Fire Department -- fire rates and manpower allocations. The fire rates were based upon fires in structures for 1970. These fires were pin-pointed on a map in Fire Department Headquarters. Using census maps the tract location of each fire was determined. Dividing by population and multiplying by 1,000 a fire rate -- FR -- in terms of the number of fires per 1,000 persons was computed for each census tract.

TABLE III-2

COPP AND CR DATA, CITY OF BOSTON AND RANGE

		Range			
		High		Low	
Series	City Rate	Rate	Tract	Rate	Tract
COPP[1]	$48.13	$1,165.50	701	$ 2.70	612
CR1[2]	68.08	1,767.6	701	8.2	602
CR2[2]	52.55	828.7	701	8.7	301
CR3[2]	376.10	5,648.8	701	48.0	301
CR4[2]	3.19	74.88	703	0	5,301 and 305

[1]COPP are in dollars per capita.

[2]CR are "crimes" or services per thousand residents.

SOURCE: See text.

The allocation of fire expenditures was similar to the allocation of police expenditures but was not based upon as much detailed information. Instead of data on districts and car sectors, we had information on 72 land-based engine and ladder companies. Each company roughly has the same number of men and therefore it was reasonable to divide total fire fighting expenditures by the number of companies to estimate the cost per fire fighting company. Using census tract maps and superimposing the boundaries of fire fighting companies, we estimated the amount of fire-fighting coverage that each census tract received from the various fire companies serving the tract.[15] Based upon the estimated cost of a fire company indicated above, fire-fighting expenditures for each tract were then computed.

b. Data

Detailed analysis is reserved for the next two chapters. For Boston in 1970 COFF[16] was $36.19 and FR (weighted by the number of alarms)[17] was 3.37. COFF ranged from a low of $6.04 in Roxbury tract 812 to a high of $788.10 again in tract 701. FR varied from zero in South End tract 704 to 40.44 in tract 701.[18]

3. Housing Code Enforcement - Methodology and Data

Compared to the analysis of police and fire expenditures, the methodology was less complex, the data less detailed and the results perhaps less reliable for housing code enforcement.[19] Using street addresses, the tract location of each complaint was determined. Department of Housing Inspection expenditures of $896,582[21] for 1970 were then allocated to census tracts in proportion to the distribution of complaints.[22] Costs per tract were divided by population to obtain per capita expenditures called COHC.

In Boston COHC was $1.38 and ranged from a high of $10.56 in the South End census tract 709 to zero in tract 611 in South Boston.

4. Sewer Services - Methodology and Data

Some of the expenditures of the Sewer Division of the Department of Public Works are for so-called "pure public goods." The installation of a new drainage system benefits the entire community and it is difficult to assign these expenditures to any given tract or groups of tracts. Three localized activities were identified: sewer complaints, sewers cleaned and sewers repaired. In the absence of any data on the relative costs of the three activities, each was assumed to involve the same level of expenditures. Based upon these activities, 9,415 units of output identified by street location were allocated to census tracts. The distribution of these service activities was used to allocate $5,183,469 of sewer expenditures in 1970 to the census tracts.[23] Per capita costs in each tract were again obtained and designated COSE.

For the City in 1970 COSE was $8.09 and varied from a high of $73.87 in Charlestown tract 406 to $1.16 in Back Bay tract 103.

5. Water Service - Methodology and Data

The expenditures of the Water Division of the Department of Public Works also often involve the provision of pure public goods. A new purification facility or an improved reservoir benefits the entire City of Boston. The available data, which could be used to allocate expenditures to census tracts, were extremely limited. The installation of water meters in 1970 was the series utilized. The records of installations provided by the Water Division included addresses and the census location of each installation was determined. The distribution by census tract of 8,603 water meter installations (each installation representing a unit of service) was utilized to allocate $12,273,733 of water service expenditures in 1970 to the census tracts.[24] Dividing by tract populations, per capita costs, labelled COWS, were obtained for each census tract.

In 1970 COWS was $19.15 for the entire city and ranged from $.26 in the North Dorchester tract 909 to $105.63 in South End tract 701.

6. Refuse Collection[25] - Methodology and Data

For this service the methodology has been reversed. Data on tons of refuse collected and collection costs were provided by the Sanitation Division of the Department of Public Works. No attempt was made to further subdivide these areas.[26] These data combined with population estimates for each district enable us to easily compute tons of refuse per capita, collection costs per ton of refuse and the cost of refuse collection per capita (CORC) for each district. Also available were data on service conditions, such as the type of collection. For this service, with a limited number of observations, it was easier to transform some of the data on housing and population characteristics from a tract basis to a Department of Public Works district basis.

In 1969 payments to refuse collection contractors totaled $4,325,244 yielding CORC for the City of $6.74.[27] CORC ranged from $4.02 in Public Works District 5 (South Boston) to $8.28 in Public Works District 6 (West Roxbury). For the City per capita tons of refuse was 0.48 and ranged from 0.34 in Public Works District 5 to 0.95 in Public Works District 1B (Boston Proper).[28] Finally in Boston costs per ton of refuse collected were $14.02 and ranged from $7.87 in District 1B (Boston Proper) to $17.91 in District 9 (East Boston).

C. Land Use Data

One piece of information, similar to housing and population characteristics, not provided by the Census Bureau but essential to the study, was a measure of business and residential activity in each census tract. In brief, we needed to know the extent to which per capita expenditures were affected by the non-residential uses of land and, therefore, could not be explained by the housing and population characteristics of the census tract. Using the Boston Redevelopment Authority's land use maps, based on parcels of land, we identified four types of land use: commercial and industrial, mixed, other and residential.[29] For each tract we calculated the percentage of land devoted to each of the four categories. In addition, the data on residential land were used to calculate population density in each tract. The land use data yielded additional useful information on the characteristics of the census tracts.

The census, service and land use data briefly discussed in this chapter, and explained and listed more fully in Appendices A-E, form the basis of the analysis presented in Chapters IV and V.

FOOTNOTES
TO
CHAPTER III

1. A guide, U.S. Bureau of the Census, 1970 Census Users' Guide, U.S. Government Printing Office, Washington, D.C., 1970, describes the tapes more fully. Some information was obtained from the published volume, U.S. Bureau of the Census, Census of Population and Housing: 1970, Census Tract Reports, Final Report PHC(1)-29, Boston, Mass. SMSA, U.S. Government Printing Office, Washington, D.C., 1972.

2. This point will become clearer when department district boundaries are discussed.

3. Census tracts which have undergone major relocation due to urban renewal, such as Charlestown tract 406, 203 in the West End with 939 residents and 807 in the Dudley Station Section of Roxbury with 484 residents, tend to have very small populations. Census tracts with large populations include low density tracts like 1401 in Hyde Park and also such high density tracts as 101 in the Back Bay both of which have more than 10,000 residents.

4. This figure includes the 1,241 residents of the Harbor Islands.

5. To those unfamiliar with the Fourth Count, it should be pointed out that it includes data based on both a complete enumeration and upon 15 and 5 percent samples.

6. If uniform districts for service existed, we could have allocated population and housing characteristics to service districts. However, uniform service districts do not exist. (Police and fire districts do not match.) Moreover, there are more census variables to allocate than service variables. Thus early in the study, we determined that except where necessary the basic unit would be the census tract. Therefore, service expenditures had to be allocated to census tracts.

7. Actual incidents clearly exceed the number "reported" to the police. See footnote 10 of Chapter V.

8. Many of the "incidents" reported to the police are not crime; they include traffic violations and services such as ambulance calls.

9. In many cases the Police Reporting Areas, which are about six times as numerous as census tracts, and therefore relatively small, are completely contained within one census tract. Where they overlapped census boundaries, we made allocations based upon procedures described in Appendix A.

10. The classification scheme is listed in City of Boston, Sixty-Fifth Annual Report of the Police Commissioner, For the Year Ending December 31, 1970, Document No. 28, pp. 35-36 and 40. The crime and service classification, and our adjustments, are discussed more

completely in Appendix A. For notational simplicity, the symbols CR have been used. In some cases CR is a crime rate, in others a service rate.

11. In 1970, excluding the Harbor Patrol, District 8, there were 12 Districts. District 9 and District 10 were merged into District 2 and the data provided to us was for the merged district.

12. City of Boston, 1972 Program Budget, p. 245 (hereafter referred to as Budget). The manpower allocated above accounted for about $20 million of these expenditures. Funds for services to the community (p. 253) and administration (p. 259) were deliberately excluded. It is not clear that these expenditures should be distributed in accordance with our weighted police manpower series. In terms of the regression analysis of Chapter V, the exclusion does not effect the explanatory power of our equations as per capita expenditures in each tract would be increased proportionately. In terms of the allocation of the budget, if the excluded police expenditures of approximately $10 million are added in, all per capita police expenditures should be multiplied by 1.24 $\left(\frac{\$38,218,816}{\$30,860,877}\right)$. In addition the coefficients or the independent variables would increase by a factor of 1.24. In brief, our police expenditures per capita exclude administrative and other "overhead" costs which could not be directly allocated to police districts.

13. The City rates were based on the rearranged categories discussed above and therefore do not correspond exactly to the data presented in the Annual Report of the Police Commissioner. The printout only listed 2,043 incidents of drunkenness and not the 18,382 arrests reported on page 40 of the annual report.

14. It is difficult, given the data, to resist the casual observation that tract 701, with by far the highest COPP, also had the highest CR in three categories. This data does not "prove" that the Police Department is responding to the need for police protection nor does it "prove" that our method of allocation is correct. It is, however, reassuring to know that at least for extreme values, the Police Department's assignment of personnel and our method of allocation appear to make sense. To reach any conclusions these observations must also hold for non-extreme values. In Chapter V this analysis is performed. In particular we will indicate that obviously, as in tract 701, CR does not only depend upon the number of residents of a particular tract, or their characteristics, but also upon such other factors as land use in the tract.

15. The use of fire-company boundaries as a proxy for services to census tract is not as valid as the assumptions underlying the analagous use of patrol car sectors. As a car patrols within its sector, it is contributing to crime prevention and detection. A fire company located in a station house, with company boundaries, yields services when it responds to a call. Moreover, there is a rather complex pattern as companies cross their boundaries in response to both single and multiple

alarms. However, to the extent that proximity to a fire station house means more rapid response our methodology should yield a good proxy series. If a census tract is within the "boundaries" of several fire companies, it will be physically close to several fire stations and therefore receive a high level of fire services.

16. Budget, op. cit., p. 275. Only fire fighting expenditures were included. If all expenditures of the Fire Department are included, the COFF data reported by census tract should be multiplied by 1.07 $(\frac{\$24,819,436}{\$23,199,775})$. See footnote 12 above.

17. See Appendix A for details.

18. As with the police data, the upper-extreme observations make the methodology appear to be sound. Further conclusions await the analysis of Chapter V.

19. For this service, and for water and sewer expenditures, a further detailed explanation in Appendix A will not be needed.

20. It turned out that we only had 6,101 out of 24,038 complaints, or a 25.38% sample. Easy access to the total file could not be obtained. Although it was not a scientifically selected random sample, the complaints we did have were scattered through the City, throughout the year, and street names ranged throughout the alphabet.

21. Budget, op. cit., p. 231.

22. Obviously the disposition of more than six thousand complaints could not be traced. Therefore, a complaint is the unit of output, and each unit of output was assumed to cost the same amount.

23. Budget, op. cit., pp. 803, 809, 813 and XXVIII. Included in these costs were $77,700 for collection of sewer service charges, $119,947 expenditures of the Data Processing Unit of the Administrative Services Department, $1,355,441 in operating expenditures of the Sewer Division and $3,630,281 for the M.D.C. assessment. To be sure, these expenditures were partially offset by $3,299,964 of revenues from the sewer charge (Budget, p. 822).

24. Ibid., pp. 823, 829, 833 and XXVIII. Included in these costs were $317,523 for collection costs, $618,186 expenditures of the data processing unit of the Administrative Services Department, charged to the Water Fund, $5,132,304 in operating expenditures of the Water Division and $6,205,720 for the M.D.C. assessment. (In this case the assessment was paid in 1971, but was for water used in 1970). Again these expenditures were partially offset by water income of $9,952,257 (Budget, p. 844).

25. Disposal facilities serve the entire City and their costs cannot be allocated to census tracts except in proportion to the tons of refuse collected. They can be added into per capita costs by multiplying all

our data by 1.25 $\left(\frac{\$5,391,817}{\$4,325,244}\right)$. \$4,325,244 was paid to refuse collection contractors and \$5,391,817 includes the payments to the collection contractors plus other disposal contract payments plus the costs of the disposal section. Additionally, administrative and supervision costs are excluded. As noted in footnote 12 above, these exclusions affect all per capita figures proportionately and thus affect the size of our regression coefficients proportionately, but not the explanatory power of our equations.

26. Collection is done under contract, and given the difficulty of getting data, it was not feasible to contact the 9 contractors serving the 11 districts.

27. Annual Report of the Public Works Department of the City of Boston, 1969, p. 101. Data from the Budget was not used for total contractual payments because they did not match the numbers in the Annual Report. Only the Annual Report listed the payments to individual contractors. For the Sanitary Division, 1969 data was utilized for costs and tons of refuse inasmuch as 1969 is the latest year for which we have tons of refuse for each Public Works District. Population and housing characteristics continue to be for 1970. In one year the characteristics do not change very drastically. CORC only includes payment to refuse collection contractors.

28. Per capita tons of refuse are based on 1970 population and 1969 quantities of refuse collected.

29. The methodology and categories are explained more fully in Appendix B.

CHAPTER IV

THE COST OF HOUSING-RELATED SERVICES IN THE NEIGHBORHOODS OF BOSTON

This chapter presents a summary of the service expenditure data by census neighborhood. It represents an interlude between the description of the data of the previous chapter and the technical statistical analysis, relating service expenditures to demographic characteristics, to be presented in the next chapter. Selected references will be made to census tract expenditures in order to highlight particular patterns. Readers interested in pursuing their own comparison of tract expenditures are directed to Appendix E, which gives a complete tabulation of service expenditures by census tracts. No attempt is made to relate precisely or explain service expenditures in terms of population and housing characteristics. This type of multivariate analysis will be performed in Chapter V. In short, this chapter is descriptive. Casual and general observations will be made where insights have been obtained through the course of this study. The reader should recall that the pattern of service expenditures depends directly upon the method of allocation described in the previous chapter. Finally, based upon a study recently reported in the New York Times, some brief comparative observations are made.[1]

A. Service Expenditures by Neighborhoods

1. Per Capita Data

Table IV-1 presents per capita expenditures for five services identified by our standard notation for each of the 15 census neighborhoods.[2] For each service, neighborhoods are ranked, with 1 denoting the area with the highest per capita expenditures, and 15, the area with the lowest per capita expenditures for a given function. In addition, the total per capita

TABLE IV-1

PER CAPITA EXPENDITURES AND RANKING BY CENSUS NEIGHBORHOOD

Census Neighborhood	Population	COHC Exp.	COHC Rank	COFF Exp.	COFF Rank	COPP Exp.	COPP Rank	COWS Exp.	COWS Rank	COSE Exp.	COSE Rank	TOTAL Exp.	TOTAL Rank
Brighton-Allston	63,618	$0.98	9	$28.31	10	$35.27	12	$12.15	14	$4.42	14	$81.13	14
Back Bay	52,023	2.89	2	26.11	12	51.51	6	9.11	15	3.96	15	93.58	10
West End	13,603	1.33	6	48.25	5	69.53	4	15.25	13	4.50	13	138.86	4
North End	11,110	1.57	5	78.31	3	80.74	3	24.30	3	17.68	1	202.60	3
Charlestown	15,417	0.66	11	99.00	2	84.68	2	18.15	11	12.10	4	214.59	2
East Boston	38,830	0.40	14	55.03	4	42.12	9	23.17	4	13.19	3	133.91	5
South Boston	38,577	1.04	8	44.31	6	46.18	7	29.65	1	11.02	5	132.20	6
South End	24,332	4.10	1	119.81	1	161.02	1	24.72	2	15.34	2	324.99	1
Roxbury	62,681	1.28	7	27.61	11	61.86	5	16.45	12	7.24	11	114.44	7
North Dorchester	101,386	2.08	3	20.02	14	41.32	10	19.98	8	7.80	9	91.20	12
South Dorchester	75,500	1.62	4	39.62	7	26.26	14	21.23	6	7.81	8	96.54	9
Roslindale	40,025	0.42	13	34.70	8	35.37	11	19.90	9	7.60	10	97.99	8
Jamaica Plain	33,280	0.93	10	20.91	13	43.32	8	21.02	7	6.20	12	92.38	11
West Roxbury	31,184	0.19	15	19.58	15	24.50	15	19.01	10	9.04	6	72.32	15
Hyde Park	38,264	0.43	12	30.71	9	27.78	13	22.93	5	8.13	7	89.98	13
Boston[1]	641,071	1.38		36.19		48.13		19.15		8.09		$112.94	

[1]The population of the census neighborhoods does not add up to the population of Boston because as explained in Chapter III no expenditures have been allocated to the 1,241 residents of the Harbor Islands. As noted this means that on average the expenditure data for the census neighborhoods are over-stated by about 3 cents for each $10 million of city-wide expenditures. It should also be noted that per-capita data for Boston are not the average of the 15 per capita figures in the census neighborhoods, but rather total expenditures for a given function divided by total population (i.e., it is a weighted average).

SOURCE: See text.

expenditures for each census neighborhood are presented and ranked.[3] Finally, for comparative purposes, City-wide per capita expenditures are listed.

The South End, with total per capita expenditures of $324.99, ranks number 1. Total per capita expenditures in the South End are almost three times as high as city-wide per capita expenditures and exceed the figures for the second ranked neighborhood (Charlestown) by more than $100. The South End has the highest per capita expenditures for three services -- housing inspection (COHC), fire (COFF), and police (COPP) -- and the second highest expenditures for the remaining two services -- water (COWS) and sewer (COSE). Clearly per capita service expenditures in the South End are dominated by COFF and COPP which account for about 86 percent of the expenditures in the neighborhood.

For individual tracts within the South End it has already been observed that tract 701 has the highest per capita expenditures for COPP ($1,165.50), COFF ($788.10)[4] and COWS ($105.63), while tract 709 has the highest per capita expenditures for COHC ($10.56). Total per capita expenditures of $2,131.21 in tract 701 are almost 20 times the city average. The effect of the huge expenditures in tract 701 on the per capita expenditures of the South End and on its ranking can be exaggerated. While COFF and COPP in tract 701 are about seven times COFF and COPP in the South End and more than 20 times COFF and COPP in Boston, the figures for tract 701 only have a small weight of 4.8 percent (population of 701 ÷ population of the South End). Thus even without 701, COFF and COPP in the South End would be relatively high at $86.30 and $110.65. The South End would still rank number one for police expenditures and number two for fire expenditures. (The South End would also continue to rank number one for total per capita expenditures.) More important to the expenditure pattern of the South End is the fact that all tracts in the neighborhood (except 705 with respect to police services, and 706 with respect to fire services) have COFF and COPP values which exceed the city averages. Indeed for all 12 tracts in the South End figures twice the Boston average are observed for 7 values of COFF and 9 values of COPP.

Charlestown and the North End rank second and third respectively for total per capita expenditures and for COFF and COPP. In addition, the North End ranks first for COSE, third for COWS and fifth for COHC, while Charlestown ranks fourth for COSE. High per capita expenditures for COFF and COPP in Charlestown are partially explained by the geographic isolation of a neighborhood with a relatively small population.[5] This was very evident when police expenditures were allocated in Charlestown where the average cost of the two car-sector Police District 15 was estimated to be $652,707 compared to an average of $417,039 per car sector for the entire city.

The very high COFF in Charlestown is partially explained by the geographic isolation, but is also partially explained by the heavy concentration of waterfront warehouses (even with the cost of fire boats excluded). In the North End, as in Charlestown, the high COFF is explained in part by the concentration of waterfront warehouses and in part by other commercial activities. The high COPP in the North End, as in the South End, is associated with the concentration of commercial activity.[6] In both Charlestown and the North End total expenditures are dominated by COFF and COPP which account for 86 and 78 percent respectively of total per capita expenditures.

In Charlestown tract 406, which includes an industrial area adjacent to Cambridge, COFF is $610.52 (third highest tract) and COPP is $407.90

(fifth highest tract). Total per capita expenditures are more than ten times the city average. Removal of tract 406, with a weight of less than 3 percent, would not drastically change Charlestown's relative ranking. For Charlestown's 8 tracts, COFF is twice the Boston average in 5 tracts and COPP is twice the average in 4 tracts.

The pattern in the North End is interesting and encourages one to be cautious in interpreting the term "neighborhood." In tract 303 (which has slightly more than eight percent of the North End's population of 11,100 and includes the financial district), COFF is $633.92 (second highest tract) and COPP is $543.82 (third highest tract). In all the remaining tracts of the North End, COFF is less than the city average, and COPP is above the average (but below $75.00) in only two tracts. Clearly, tract 303, with a weight of 8 percent, has a greater impact on the neighborhood average than either tracts 701 or 406, both of which have weights of less than five percent. Indeed, if the expenditures (and the population) of 303 are subtracted, total per capita expenditures in the North End fall from $202.60 to $98.53. Other things being equal, the North End would rank seventh instead of third, joining six other neighborhoods with total per capita expenditures in the narrow range between $89 and $99.

At the other extremes, West Roxbury has the lowest total per capita expenditures and the lowest COFF, COPP and COHC. In West Roxbury police and fire expenditures account for only 61 percent of all expenditures compared to 75 percent in Boston and 86 percent in the South End. In all four tracts within West Roxbury, COFF is below the Boston average, ranging from a low of $7.34 in 1302 to a high of $32.46 in tract 1301.

Brighton-Allston and Hyde Park rank 14th and 13th respectively for total per capita expenditures. Brighton-Allston also ranks 14th for COWS and COSE and Hyde Park ranks 13th for COPP. In Hyde Park there are no wide disparities in per capita expenditures for the given categories. In Brighton-Allston, tract 1 (which roughly extends from the Boston University bridge to Harvard Avenue between the Charles River and Brighton Avenue) has COPP expenditures of about double the city average. Despite the large per capita expenditures in this commercial area, COPP for Brighton-Allston is about three-quarters of the average.

It is difficult to make any further general observations for the remaining neighborhoods. With respect to total per capita expenditures, ranked toward the top (4-7) are such widely diverse areas as the West End ($138.86), East Boston ($133.91), South Boston ($132.20), and Roxbury ($114.44). The bottom half, with total per capita expenditures confined to the narrow range mentioned above, includes such divergent areas as Roslindale ($97.99), Back Bay ($93.58) and North Dorchester ($91.20).

As indicated above, the reader is encouraged to review the expenditure data for all tracts presented in Appendix E. Most of the extremely high observations have already been discussed in this capsule review of neighborhood data.[7] In the South Boston tracts of 606 and 614, both of which have less than 1,000 residents, high COFF's and COPP's are again observed in industrial-commercial areas. In tract 606, COFF is $476.96 (fourth highest observation) and COPP is $399.90 (sixth highest), while in tract 614 COFF is $349.53 (fifth highest) and COPP is $447.30 (fourth highest). Despite these extreme observations, COFF and COPP for South Boston are close to the average. Finally, in Roxbury tract 801 (which has only 778 residents, but which apparently includes at least part of the Boston City Hospital), COFF is $294.27 (sixth highest) and COPP is $659.40 (second highest).

2. Percentage Distribution of Expenditures

An alternative but related way of analyzing expenditure patterns is to look at the percentage distribution for a given service and for total expenditures and to compare them with the percentage distribution of population. Clearly, neighborhoods with per capita expenditures above the average will account for a share of expenditures which is greater than their share of the City's population. The reverse will be true for neighborhoods with per capita expenditures below the average.

In Table IV-2 total expenditures by census neighborhood are presented, and in Table IV-3 the percentage distribution of the expenditure data is shown. The material in Table IV-3 is more relevant. As indicated in Chapter III, arbitrary decisions have been made as to which components of an agency's budget should be included. The percentage distribution is, therefore, more meaningful than the absolute data. Both sets of data have been presented although the analysis will focus primarily on Table IV-3 on the basis of neighborhoods.[8]

The analysis is again confined primarily to the extreme observations. Turning to Table IV-3 we see that the South End with only 3.8 percent of the population accounts for 10.9 percent of expenditures. As should be expected from the previous section, this pattern is even more pronounced for fire and police expenditures where the figures are 12.6 and 12.7 percent, respectively. Continuing at the upper-extreme, Charlestown, with 2.4 percent of the population, is responsible for 4.6 percent of total expenditures, and the North End, with 1.7 percent of all residents, accounts for 3.1 percent of expenditures. At the other extreme, West Roxbury has 4.9 percent of the population, but accounts for only 3.1 percent of total expenditures. Thus expenditures are about equal in the North End and West Roxbury (3.1 percent of the total), but the population of West Roxbury is about three times the population of the North End. West Roxbury's share of police and fire expenditures, 2.5 and 2.6 respectively, is about one-half of its share

TABLE IV-2

TOTAL EXPENDITURES BY CENSUS NEIGHBORHOOD

		Expenditure Category					
Census Neighborhood	Population	Housing Inspection	Fire	Police	Water Service	Sewers	Total
Brighton-Allston	63,618	$62,223	$1,801,033	$2,243,590	$773,244	$281,463	$5,161,553
Back Bay	52,023	150,267	1,358,407	2,680,270	473,767	205,783	4,868,494
West End	13,603	18,111	656,309	945,830	207,426	61,165	1,888,841
North End	11,110	17,483	869,991	897,000	270,022	196,454	2,250,950
Charlestown	15,417	10,131	1,526,300	1,305,410	279,841	186,604	3,308,286
East Boston	38,830	15,421	2,136,820	1,635,660	899,668	512,127	5,199,696
South Boston	38,577	39,998	1,709,456	1,781,600	1,143,913	425,045	5,100,012
South End	24,332	99,879	2,915,233	3,917,970	601,413	373,210	7,907,705
Roxbury	62,681	79,975	1,730,824	3,877,260	1,030,994	454,074	7,173,127
North Dorchester	101,386	210,876	2,029,978	4,188,860	2,025,167	790,998	9,245,879
South Dorchester	75,500	122,114	2,991,548	1,982,500	1,602,951	589,879	7,288,992
Roslindale	40,025	16,766	1,388,933	1,415,560	796,566	304,270	3,922,095
Jamaica Plain	33,280	31,022	695,993	1,441,540	699,604	206,303	3,074,462
West Roxbury	31,184	6,007	610,520	763,920	592,822	281,981	2,255,250
Hyde Park	38,264	16,318	1,175,251	1,062,850	877,571	311,009	3,442,999
Boston[1]	641,071	896,582	23,199,775	30,860,877	12,273,733	5,183,469	$72,414,436

[1] Details may not add to totals. Again Harbor Islands population is included in the totals.

TABLE IV-3

PERCENT DISTRIBUTION OF EXPENDITURES

BY CENSUS NEIGHBORHOOD

Census Neighborhood	Percent of Population	Percent Housing Inspection	Percent Fire	Percent Police	Percent Water Service	Percent Sewers	Percent Total
Brighton-Allston	9.92	6.94	7.76	7.27	6.30	5.43	7.13
Back Bay	8.12	16.76	5.86	8.69	3.86	3.97	6.72
West End	2.12	2.02	2.83	3.06	1.69	1.18	2.61
North End	1.73	1.95	3.75	2.91	2.20	3.79	3.11
Charlestown	2.40	1.13	6.58	4.23	2.28	3.60	4.57
East Boston	6.06	1.72	9.21	5.30	7.33	9.88	7.18
South Boston	6.02	4.46	7.37	5.77	9.32	8.20	7.04
South End	3.80	11.14	12.57	12.70	4.90	7.20	10.92
Roxbury	9.78	8.92	7.46	12.56	8.40	8.76	9.91
North Dorchester	15.82	23.52	8.75	13.57	16.50	15.26	12.77
South Dorchester	11.78	13.62	12.89	6.42	13.06	11.38	10.07
Roslindale	6.24	1.87	5.99	4.59	6.49	5.87	5.42
Jamaica Plain	5.19	3.46	3.00	4.67	5.70	3.98	4.25
West Roxbury	4.86	0.67	2.63	2.48	4.83	5.44	3.11
Hyde Park	5.97	1.82	5.07	3.44	7.15	6.00	4.75
Boston[1]	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[1]Details may not add to totals due to rounding.

SOURCE: Based upon Table IV-2.

of population.

With respect to individual services there are some interesting patterns. Back Bay, with 8 percent of the population, accounts for about 17 percent of housing inspection expenditures, while East Boston, Roslindale and Hyde Park, each with about 6 percent of the population, are each responsible for less than 2 percent of housing inspection expenditures.

Table IV-4 summarizes this information for total expenditures and for the five service categories. The index constructed for each neighborhood and service equals the percent of expenditures allocated to a neighborhood, divided by the percent of the population residing in that neighborhood. The rankings are, of course, the same as in Table IV-1. Census neighborhoods were arranged on the basis of the index for total expenditures, which shows at one extreme the South End, with an index value of 2.87, and at the other extreme West Roxbury, with a value of 0.64. In the South End and in the North End, the percent of expenditures always exceeds the percent of population. Therefore the index for these two neighborhoods is always greater than one. Conversely, Brighton-Allston is the only neighborhood for which the index is always less than one.

B. Refuse Collection Expenditures for Public Works Districts

Data on refuse collection by Public Works District are presented in Tables IV-5 and IV-6. Again the tables are related. Districts with per capita expenditures above the averages will again account for a percent of expenditures which is greater than the percent of the population within the district.

Table IV-5 lists per capita cost of refuse collection (CORC), per capita tons of refuse collected, and cost per ton of refuse for each district. The districts are ranked (1 again signifies the highest number)

TABLE IV-4

INDEX OF PERCENT EXPENDITURES DIVIDED

BY PERCENT POPULATION BY CENSUS NEIGHBORHOOD

Census Neighborhood	Total Expend-itures	Housing Inspection Expend-itures	Fire Expend-itures	Police Expend-itures	Water Expend-itures	Sewer Expend-itures
South End	2.87	2.93	3.31	3.34	1.29	1.89
Charlestown	1.90	.47	2.74	1.76	.95	1.50
North End	1.80	1.13	2.17	1.68	1.27	2.19
West End	1.23	.95	1.33	1.44	.80	.56
East Boston	1.18	.28	1.52	.87	1.21	1.63
South Boston	1.17	.74	1.22	.96	1.50	1.36
Roxbury	1.01	.91	.76	1.28	.86	.90
Roslindale	.87	.30	.96	.74	1.04	.94
South Dorchester	.85	1.16	1.09	.54	1.11	.97
Back Bay	.83	2.06	.72	1.07	.48	.49
Jamaica Plain	.82	.67	.58	.90	1.10	.77
North Dorchester	.81	1.49	.55	.86	1.04	.96
Hyde Park	.80	.30	.85	.58	1.20	1.01
Brighton-Allston	.72	.70	.78	.73	.64	.55
West Roxbury	.64	.14	.54	.51	.99	1.11

SOURCE: Based upon Table IV-3.

TABLE IV-5

PER CAPITA REFUSE COLLECTION COSTS BY PUBLIC WORKS DISTRICTS

		Costs Per Capita		Refuse Per Capita		Costs Per Ton of Refuse		
Public Works District		CORC	Rank	Tons of Refuse Per Capita	Rank	Costs Per Ton	Rank	Population
1A	Charlestown	$5.89	10	0.365	10	$16.11	4	15,417
1B	Boston Proper	7.45	3	0.946	1	7.87	11	65,635
2	Jamaica Plain	6.41	8	0.389	8	16.46	3	47,803
3	Dorchester North	7.49	2	0.490	3	15.27	6	85,496
4	Brighton	6.55	7	0.430	5	15.23	7	63,618
5	South Boston	4.02	11	0.339	11	11.86	10	39,094
6	West Roxbury	8.28	1	0.558	2	14.84	8	54,724
7	Dorchester South	7.36	4	0.426	6	17.26	2	91,403
8	Hyde Park	6.78	6	0.466	4	14.54	9	38,776
9	East Boston	7.05	5	0.394	7	17.91	1	38,830
10	Roxbury	5.97	9	0.388	9	15.35	5	94,237
	Boston[1]	$6.74		0.481		$14.02		641,071

[1]Details may not add to totals due to rounding. Total population also includes residents of the Harbor Islands.

SOURCE: See text.

TABLE IV-6

REFUSE COLLECTION COSTS AND PERCENTAGE

DISTRIBUTION BY PUBLIC WORKS DISTRICT

		Population		Collection Costs		Tons of Refuse	
Public Works District		Number	Percent Distribution	Amount	Percent Distribution	Amount	Percent Distribution
1A	Charlestown	15,417	2.40	$90,862	2.10	5,640	1.83
1B	Boston Proper	65,635	10.24	489,050	11.31	62,150	20.15
2	Jamaica Plain	47,803	7.46	306,246	7.08	18,610	6.03
3	Dorchester North	85,496	13.34	640,248	14.80	41,930	13.59
4	Brighton	63,618	9.92	416,862	9.64	27,370	8.87
5	South Boston	39,094	6.10	157,202	3.63	13,260	4.30
6	West Roxbury	54,724	8.54	453,194	10.48	30,530	9.90
7	Dorchester South	91,403	14.26	672,387	15.55	38,960	12.63
8	Hyde Park	38,776	6.05	262,915	6.08	18,080	5.86
9	East Boston	38,830	6.06	273,613	6.33	15,280	4.95
10	Roxbury	94,237	14.70	562,665	13.01	36,660	11.88
	Boston[1]	641,071	100.00	$4,325,244	100.00	308,470	100.00

[1]Details may not add to totals due to rounding.

SOURCE: See text.

for each variable. CORC depends upon both per capita tons of refuse and collection costs per ton of refuse.[9]

CORC is highest in District 6 (West Roxbury), which has the second highest tons of refuse per capita $(\frac{G}{P})$ but only the eighth highest collection cost per ton of refuse $(\frac{C}{G})$. It is difficult to make an exact comparison with the other expenditure categories which are based upon census neighborhoods but a rough comparison of Public Works Districts and census neighborhoods can be made based on Table A-2. (No attempt was made to combine the data of Tables IV-2 and IV-5.) Thus District 6 includes parts of West Roxbury, Hyde Park and Roslindale. West Roxbury had the lowest per capita expenditures and Hyde Park ranked 13th. Roslindale, however, had an intermediate rank of 8. At the other extreme, District 5 (South Boston) had the lowest CORC. District 5 also had the lowest $\frac{G}{P}$ and the next to lowest $\frac{C}{G}$. District 5 comprises all of census neighborhood South Boston and only a small fraction of Roxbury and North Dorchester. Thus the relevant comparison is with South Boston, which had an intermediate ranking with respect to total per capita expenditures.

The other interesting comparisons are for Districts 1A, 4 and 9, which correspond precisely with census neighborhoods Charlestown, Brighton-Allston and East Boston. Bearing in mind that there are 15 census neighborhoods and only 11 Public Work Districts, Charlestown has the second lowest CORC, but the second highest per capita figure for the total category and for police and fire services. Brighton-Allston has an intermediate ranking with respect to CORC, but had the second lowest figure for total per capita expenditures. East Boston has roughly an intermediate ranking for both CORC and for total per capita expenditures.

Table IV-6 yields some interesting statistics. District 1B (Boston Proper) has only 10.2 percent of the population but accounts for 20.1

percent of the refuse collected.[10] The remaining tons of refuse are distributed more (although not completely) in proportion to population.

C. Comparative Analysis

The complexity of the allocation methodology and the admitted shortcomings of some of the data may strain the credibility of our expenditure estimates. Confidence in this study is, we believe, bolstered by the results of a study recently reported in the New York Times.[11] In some aspects the study done in New York is similar to this report, but in other areas very dissimilar. Planning district boundaries (instead of census tracts) were used to delineate neighborhoods. As in this study, the fact that the planning districts did not coincide with service districts presented problems. The New York study covered fire, police, sanitation, health services, human services and all levels of public education. A major focus of our study, presented in Chapter V, is to identify the factors that determine the allocation of resources to the neighborhoods of Boston. Apparently, a similar study of the determinants of expenditure patterns was not undertaken in New York.

The absolute magnitude of per capita expenditures in the Planning Districts is less important than relative ranking and here the comparisons are interesting. Manhattan's Planning Districts 1 and 5 ranked one-two with respect to per capita police and fire expenditures. District 1 (Times Square-Union Square) includes the theater district, mid-town shopping area and the sex industry (X-rated movies, books, etc.), while District 5 (lower Manhattan) includes the Wall Street Financial District. Combined Districts 1 and 5 are similar to tracts 701 (Boston Common-Combat Zone) and 303 (financial district). Tracts 701 and 303 ranked one-two respectively with respect to COFF and one-three with respect to COPP. In both cities, police and fire services are provided to business districts with relatively few residents. Consequently, per capita expenditures are extremely high.[12]

At the lower extremes, casual comparisons can best be made at the neighborhood level. In Boston the "suburban" area of West Roxbury had the lowest COFF and COPP. West Roxbury is similar to such New York City "suburban" neighborhoods as South Beach-Greenbelt in Staten Island, East Queens-Floral Park and Woodhaven-Kew Garden in Queens, and East Flatbush in Brooklyn, all of which had either a relatively low COFF or a low COPP or both.

Expenditures have been allocated to areas and the results have been examined in a summary fashion. In the next chapter, greater insight is gained as we analyze the variables that explain the expenditure patterns.

FOOTNOTES TO CHAPTER IV

1. "City's Spending in 62 Neighborhoods Varied Widely in 1969-1970, Study Finds," New York Times, Vol. CXXII, November 13, 1972, pp. 1 and 44.

2. Due to the use of different boundaries, expenditures by "neighborhoods" for refuse collection (CORC) are discussed later in this chapter.

3. It should be obvious that the ranking of total per capita expenditures will be dominated by police and fire expenditures which, on a city-wide basis, account for about 75 percent of the expenditures allocated in this study for the five categories. In individual neighborhoods and tracts, police and fire expenditures will often account for an even larger fraction of total per capita expenditures.

4. The influence of commercial activity on COFF and COPP will be discussed later in this chapter and in Chapter V.

5. If the population of Boston were distributed equally among the 15 neighborhoods there would be 42,738 residents in each neighborhood. Both the North End (pop. 11,110) and the West End (pop. 13,603) have fewer residents than Charlestown (pop. 15,417) but they are not isolated and "share" police and fire stations with contiguous areas such as the South End and the Back Bay. Moreover, the other two relatively isolated areas -- East Boston (pop. 38,830) and Brighton-Allston (pop. 63,618) -- have more residents and can more effectively utilize their "own" police and fire stations.

6. The effect of commercial activity on COFF and COPP is evaluated more precisely in the multi-variate analysis of Chapter V which views the world more continuously. In the extreme cases, however, casual observations are not unwarranted.

7. Low observations are usually not as extreme (i.e., there is a boundary of zero expenditures) and often harder to explain. Thus for COFF the high observation of $788.10 was about 22 times the average, while the low observation of $6.04 was one-sixth of the average.

8. No attempt will be made to carry this analysis down to the tract level. Per capita and population data for all tracts presented in the Appendices permit the interested reader to disaggregate Tables IV-2 and IV-3 to the tract level.

9. CORC is equal to costs (C) divided by population (P). Cost per ton of refuse is equal to C divided by tons of refuse G. Finally, tons of refuse per person is equal to G divided by P. Thus:

$$CORC = \frac{C}{P} = \frac{C}{G} \cdot \frac{G}{P}$$

The determinants of $\frac{C}{G}$ and $\frac{G}{P}$ will be discussed in Chapter V.

10. Again we see the influence of commercial activity. Business firms have their own refuse collection service. However, trucks under contract to the city do empty litter baskets. Tons of refuse per person in Boston Proper are about double the city-wide average, but obviously all of it is not attributed to the residents. Shoppers, commuters, visitors, etc. also contribute to the refuse of downtown Boston.

11. The study, reported in the New York Times, op. cit., is entitled Municipal Expenditures by Neighborhoods, and was apparently done for the City Administrator, but not officially released. It was directed by Peter Salins of Hunter College.

12. One fascinating statistic should be noted. In both New York and Boston the high observation for per capita police expenditures is about 30 times the city average.

CHAPTER V

THE DETERMINANTS OF THE COST OF HOUSING-RELATED SERVICES: THEORY AND EVIDENCE

A. Regression Analysis

This section is a brief, non-rigorous introduction to regression analysis as applied to this study. The reader who is already familiar with this type of statistical analysis should move ahead to the next section.

In determining the relationship between substandard housing and the cost of the various city services one would like, ideally, to find the functional relationship,

$$y = f(x),$$

where y, the dependent variable, measures the cost of a particular service and x, the independent variable, measures the degree or extent of substandard housing. The problem is simplified if we assume that the relationship is linear, i.e.,

$$y = A + Bx + u.$$

In this equation, A and B are unknown constants and u is an error term. If A and B were known, then the value of y could be predicted for a given value of x with a degree of accuracy determined by the error term (which can be either positive or negative).

The statistician obtains estimates of A and B by using the linear regression model. This procedure, as applied to our study, involves first the collection of values for the variables x and y for each of the 147 census tracts in Boston. Then a regression line is found which "best" fits the 147 data points. The estimate of A, denoted by a, is the y-intercept of the regression line and the estimate of B denoted by b, is the slope of the regression line. The statistically predicted value of y, denoted by $\hat{y}$, for a given value of x is,

$$\hat{y} = a + bx.$$

The error of the prediction is $e = y-\hat{y}$, which is the deviation of the predicted value of y from its actual value. The process of fitting a regression line to the data points involves, in essence, minimizing the size of this error. If the error is satisfactorily small and a and b are accepted as statistically significant estimates of A and B, we would accept the regression equation as a reliable device for predicting y.

At this point a numerical example may be useful. Suppose the estimates of A and B turned out to be 30 and .5, respectively. The regression equation would be:

$$\hat{y} = 30 + .5x,$$

where $\hat{y}$ is the dollar cost of fire protection per capita and x is the percent of housing units which are substandard. Then, for example, if 20% of housing units were substandard in a particular census tract, the predicted cost of fire protection would be:

$$\hat{y} = 30 + .5(20) = \$40 \text{ per capita.}$$

If the percent substandard declined to 19% (a change of one percentage point) then the predicted value is

$$\hat{y} = 30 + .5(19) = 30 + 9.50 = \$39.50 \text{ per capita.}$$

Notice that the change in the cost of fire protection, $.5 per capita, is equal to b (= .5). In general, b is the change in $\hat{y}$ for each one unit change in x. Had x changed by 6 units (6 percentage points), the change in $\hat{y}$ would have been equal to:

$$(6)\ (b) = (6)(.5) = \$3.00 \text{ per capita.}$$

Until now the discussion has been simplified by assuming that only one independent variable was needed to explain or predict the dependent variable y. But, of course, the cost of fire protection, for example, in each census tract depends on other variables as well as the percent of sub-standard housing.[1] To take account of these other variables the multiple regression model is used. An example of a multiple regression equation is:

$$y = b_o + b_1x_1 + b_2x_2 + b_3x_3$$

Here it is implicitly assumed that three independent variables (x_1, x_2 and x_3) are needed to explain adequately the dependent variable y.

The method of finding the coefficients b_o, b_1, b_2 and b_3 is simply an extension of the method previously discussed for the single independent variable case. The interpretation of the coefficients is somewhat different. For example, b_3, the coefficient of the variable x_3, measures the change in the dependent variable y for each unit change in x_3, <u>holding the other variables (x_1 and x_2) constant</u>.

The parameter b_o could be interpreted as the value of $\hat{y}$ when all the independent variables are zero. However, a word of caution is in order. Generally speaking, the regression equation can be a reliable predictor of y only for values of the independent variables which are in (or close to) the range of values of the actual data points. In most regression studies (including this one), it is highly unlikely that <u>all</u> of the independent variables take on the value of zero. Hence the above interpretation of b_o is faulty. In fact, it is best not to place any interpretation on b_o at all.

We conclude this section with a brief description of how to judge the reliability of the predictions of a regression equation. Of the various measures of reliability that are available, two will be mentioned -- the coefficient of determination (R^2) and the "t-values" of b_1, b_2, etc.

A basic objective of regression analysis is to explain the variation in the dependent variable y. In practice it is impossible to explain all of the variation, since part of the variation may be due to random error or to the influence of variables which, for one reason or another, have not been included in the regression equation. The coefficient of determination, R^2, is the fractional part of the variation of y which is explained by the regression equation. The "ideal" regression equation would have $R^2 = 1$. A regression with no explanatory power would have $R^2 = 0$.

While the value of R^2 measures the overall reliability of the regression equation, the t-values measure the reliability of each of the coefficients. If a variable is included in the regression equation which has little or no influence on the dependent variable, its coefficient should be approximately zero. Put another way, an estimated coefficient should be significantly different than zero before one concludes that the corresponding independent variable contributes to the explanation of the dependent variable.

To test for this significance, the t statistic is calculated for each coefficient. High values of t indicate a low probability that the coefficient is zero. For example, in this study if $t = 1.98$ then the probability that the coefficient is zero is about .05 for a two-tail test. A t-value of 2.6 lowers this probability to .01.

B. The Cost of Police Protection

1. Specification of the Model

We have included police protection as a housing related service not so much because certain crimes are housing related (e.g., housebreaking and burglary), but because it was hypothesized that low quality housing might add to an overall environment conducive to crime. Hence housing quality is related to the cost of police protection to the extent that: a) low quality housing contributes to crime rates, and b) higher crime rates induce higher police costs.

Stated more formally, the relationship we wish to investigate is an indirect one, as postulated in the following five equations.

1. COPP = f_p (CR1, CR2, CR3, CR4, INC, NWH, INDCO)

2. CR1 = f_1 (SUB, UNEMP, INC, AUTO, INDCO, YOU, EDUC, SEN, DENS, STAB)

3. CR2 = f_2 (SUB, UNEMP, INC, INDCO, YOU, EDUC, SEN, DENS, STAB)

4. CR3 = f_3 (SUB, INC, INDCO, YOU, EDUC, SEN, DENS, STAB)

5. CR4 = f_4 (SUB, DROP, INDCO, YOU, DENS, STAB)

where COPP is the dollar cost of police protection per capita

CR1 is the Part I crime rate (crimes per thousand people)

CR2 is the modified Part II crime rate (crimes per thousand people)

CR3 is the Part III service rate (police services per thousand people)

CR4 is the Drunkenness rate (incidents per thousand people)

SUB is the percent of all housing units which are classified as substandard. Three alternate definitions were employed (SUB1, SUB2, SUB3), as discussed in Chapter III.

INC is mean family income

UNEMP is the unemployment rate

AUTO is the number of automobiles per thousand people

INDCO is the percent of land area classified as industrial or commercial

YOU is the percent of the population between 14 years of age and under 25 years of age

EDUC is a measure of educational attainment. Three alternative educational variables were constructed. EDUC1 is the percent of persons 25 years old and over with less than 5 years of schooling. EDUC2 is the percent of persons 25 years old and over who are high school graduates. EDUC3 is the percent of persons 25 years and over who are college graduates.

SEN is the percent of population 65 years old and over

DENS is the population per square mile of residential area (the units are thousands of people per square mile)

DROP is the percent of males 16 years old and over not in the labor force, not in school, not in institutions, and not over 65 years old.

NWH is the percent of the population which is non-white

STAB is the percent of occupied housing units in which head of household moved into unit in 1959 or earlier.

In equation (1), COPP is assumed to depend primarily on the four "crime rates" and secondarily on three socio-economic variables. It is not assumed to depend directly on SUB. The influence of SUB on COPP can be traced by first investigating the influence of SUB on each of the four crime rates in equations (2) - (5) and then by examining the influence of the crime rates on COPP in equation (1).

In the original formulation of this model we wanted to include COPP on the right-hand sides of equations (2) - (5). This was based on the assumption that the crime rates should depend not only on the socio-economic characteristics of each neighborhood[2] but also on the amount of police protection (COPP) provided to the neighborhood. The fact that police presence in a neighborhood should deter crime means that the COPP-CR relationships in (2) - (5) ought to be negative. However, it was felt that crime rates (in 1970) should probably depend on police allocations made in the previous year (1969). Since the previous year's manpower allocations were not available, we decided to exclude COPP from equations (2) - (5).[3]

We now proceed to give a detailed explanation of each of the equations in our model.

Specification of Equation (1)

The four crime rates are included in the COPP equation for obvious reasons. In our discussions with officials of the Boston Police Department, we were told that the allocation of policemen among the different areas of the city is primarily determined by neighborhood crime rates. Hence we would expect a positive relationship between COPP and each crime rate.[4]

At the same time we wanted to test other hypotheses about how police resources are allocated. It may be that neighborhoods with more political influence receive more police protection. We have included average income (INC) to see whether, other things being equal, wealthier neighborhoods receive more police protection.

The variable NWH is included to test the claim that non-white neighborhoods receive less than their fair share of city services. In this case a negative relationship between COPP and NWH would be expected.

INDCO is included in the COPP equation in an attempt to see whether the existence of business districts influences the allocation of police resources over and above their impact on crime rates. Clearly, an industrial and commercial area will have a large number of reported crimes per resident, i.e., there are many crimes against property and people who do not live in the area. We believe that this effect is captured in the crime rate variables. Given that the crime rate variables are included in the COPP equation, a significant positive relationship between COPP and INDCO reflects the fact that, other things being equal (i.e., crime rates), commercial and industrial areas receive more police protection. A positive relationship between COPP and INDCO suggests either that commercial and industrial establishments influence the allocation of police resources, or that the potential impact of INDCO on crimes was not fully captured by the crime rate variables.[5]

Before discussing the specification of each of the crime rate equations, it might be well to discuss in general the nature and measurement of the socio-economic variables included in these equations. The socio-economic variables characterize the residents of a particular neighborhood. To the extent that crimes committed in a particular neighborhood involve only residents of that neighborhood, i.e., both the criminal and victim are residents of the neighborhood, then the socio-economic variables characterize both criminals and victims. However, if criminals do not generally reside in those neighborhoods where they commit their crimes, then the socio-economic variables characteristics the victims only. This issue as to whether the socio-economic variables characterize both the criminals and victims or only the victims results in ambiguity as to the expected relationships between particular socio-economic variables and the crime rate.[6] An example of this ambiguity is the relationship between CR1 and income. If one assumes that the income variable characterizes the criminals and not the victims, then one might postulate an inverse relationship between CR1 and income. On the other hand, if one assumes that the income variable characterizes the victims, then one might postulate a positive relationship between CR1 and income.[7] Given these ambiguities, interpretation of the estimated crime rate equations must be undertaken with caution.

Specification of Equation (2)

Equation (2) attempts to explain the Part I crime rate (CR1). It should be noted that the greatest proportion of crimes in this category are auto theft, burglary, larceny, robbery and assault.

The substandard housing variable (SUB) is included in equation (2) because poor housing quality may affect the crime rate. People may tend to spend less time in their housing unit if it is substandard. As a result of being on the streets, many "incidents" may be reported to the police that otherwise might not -- such as family quarrels or fights. These "incidents," if they took place in the home, would be less likely to involve the police and as a result the reported number of assaults would be lower. Additionally, since substandard housing units are likely to be less secure than standard housing units, they are more likely to be burglarized. Thus the relationship between SUB and CR1 should be positive.

The unemployment rate (UNEMP) is included in equation (2) to represent a pool of potential criminals. The greater the degree of unemployment in a neighborhood the greater the possibilities of individuals or families with a zero income flow. Thus, the unemployed are more likely to engage in such criminal activities as robbery, burglary, larceny and auto theft. Since UNEMP characterizes the criminals rather than the victims, it must be assumed that such criminals commit their crimes in their own neighborhoods in order for there to be an empirical relationship between UNEMP and CR1. The relationship between UNEMP and CR1 is hypothesized to be positive.

The relationship between CR1 and the income variable (INC) is ambiguous, as noted earlier. If INC characterizes the victims of crimes, then one would expect a positive relationship between INC and CR1, especially given the type of crimes included in CR1 (robbery, burglary, etc.). If INC characterizes primarily the criminals (a less likely assumption), then one would expect an inverse relationship between INC and CR1.

The inclusion of AUTO in equation (2) rests on the hypothesis that the greater the number of automobiles in a neighborhood the greater the likelihood of auto theft. Thus we can hypothesize a positive relationship between AUTO and CR1.

The crime rate variables are crimes per capita. Crimes per capita will be very high if in a given area there are either many activities which increase the likelihood of crime or there are many people who spend time in the area but do not live there, i.e., they might work in the area and be potential victims of crime. Neighborhoods with large commercial and industrial areas have both characteristics. Particularly with respect to CR1, one would expect more robberies, burglaries and larcenies in industrial and commercial areas. Thus INDCO is included in equation (2) and should be positively related to CR1.

The inclusion of YOU (the percent of the population between 14 years of age and under 25 years of age) in equation (2) rests on the hypothesis that young people commit a disproportionate number of the crimes involving auto theft and shoplifting. Again since YOU characterizes the criminals rather than the victims, it must be assumed that such criminals commit their crimes in their own neighborhoods in order for there to be an empirical relationship between YOU and CR1. Under this assumption, the relationship between YOU and CR1 is hypothesized to be positive.

EDUC is included because of the belief that criminals generally have low levels of educational attainment. If in fact EDUC characterizes the criminals and criminals commit their crimes in their own neighborhoods, then there should be an inverse relationship between EDUC and CR1.[8] However, if one argues that crime reporting is higher among well-educated victims than poorly educated victims, then one could hypothesize a positive relationship between EDUC and CR1, assuming that EDUC primarily characterizes the victims rather than the criminals.

The inclusion of SEN (the percent of the population 65 years old and over) rests on the assumption that the elderly are more likely to be victims of crimes than other age groups in the neighborhood. The elderly are less able to defend themselves against criminals. Thus one would expect the elderly to be the most likely victims (relative to other age groups) of robbery, assault and purse-snatching.

The relationship between the density of a neighborhood (DENS) and CR1 is ambiguous. Clearly the more crowded a neighborhood is, the greater the likelihood of tension and conflict among the residents. As a result there may be more assaults in such a neighborhood (all other things being equal). Thus, one might expect a positive relationship between CR1 and DENS. However, the lower the density of neighborhood, the more likely there may be such crimes as robbery and burglarly. This may result from the fact that criminals may believe that the probability of detection during a crime and capture is lower in neighborhoods of low population density. Under this assumption, one would expect an inverse relationship between DENS and CR1.

STAB is included in equation (2) because the longer the residents of a neighborhood have lived there, the more likely there will be self-policing activity in the neighborhood. As a result, one would expect an inverse relationship between STAB and CR1.

Specification of Equation (3)

Equation (3) attempts to explain the Part II crime rate (CR2). Crimes that fall into this category include such crimes as arson, forgery, fraud, embezzlement, sex offenses (other than rape), narcotics, gambling, offenses against family and children, vagrancy, and violations of liquor laws. Since there are so many different crimes included in CR2, in presenting the justification of each independent variable in equation (3), a complete enumeration of the reasons will not be presented. Rather for each included variable, its relationship to only several of the types of crimes included in CR2 will be discussed.

SUB is included in equation (3) because people who live in substandard housing units may spend more time on the streets and as a result of family quarrels or arguments may involve the police and generate more arrests for disorderly conduct. Thus, the relationship between SUB and CR2 should be positive.

The inclusion of UNEMP in equation (3) can be justified on the same grounds as in equation (2). The unemployed are more likely to be engaged in criminal activities such as forgery, narcotics, gambling, etc. Again, the relationship between UNEMP and CR2 should be positive.

The relationship of income (INC) to CR2 is probably less ambiguous than the relationship of INC to CR1. Low income areas are more likely to have more reported crimes with respect to narcotics, gambling, non-support and desertion. The actual crime rates with respect to these offenses may be similar in high-and-low-income areas, but the reported crimes, at least, are expected to be different. Thus one expects an inverse relationship between INC and CR2.

INDCO is included in equation (3) for the same reasons it is included in equation (2). Specifically, crimes such as arson, embezzlement, and liquor law violations are more likely to occur in areas with a high degree of industrial and commercial activity. Thus one expects a positive relationship between INDCO and CR2.

The inclusion of YOU in equation (3) may be based on the hypothesis that narcotics offenses and violations of the liquor laws are more prevalent in neighborhoods with a higher percent of young people. The relationship between YOU and CR2 is expected to be positive.

EDUC is included in equation (3) because uneducated people are more likely to be victims of fraud and because they are more likely to be ignorant of the laws concerning such crimes as gambling, narcotics, sex offenses, etc. The relationship between EDUC1 and CR2 is expected to be positive, and negative between EDUC2 or EDUC3 and CR2.

The inclusion of SEN in equation (3) might be justified on the assumption that the elderly are commonly victims of fraud.[9] Thus one would expect a positive relationship between SEN and CR2.

The relationship between DENS and CR2 should be positive. High density may reduce the quality of life in a neighborhood, thereby creating frustration and a need for escape. As a result, narcotics use, and therefore narcotics arrests, may be positively related to density.

STAB is included in equation (3) for the same reason it was included in equation (2). Thus, STAB and CR2 are expected to be inversely related.

<u>Specification of Equation (4)</u>

Equation (4) attempts to explain the Part III service rate (CR3). CR3 includes primarily police services and not crime. This includes such services as medical assistance of all kinds, traffic services, landlord-tenant disputes, lost property, family trouble, vehicular accidents, injuries, etc. Again, these services are so numerous and diverse that only some of the reasons why each independent variable is included in equation (4) will be presented.

SUB is included in equation (4) because persons living in substandard housing units may be involved in a higher proportion of landlord-tenant disputes than persons living in standard housing units. SUB and CR3 are expected to be positively related.

The inclusion of INC in equation (4) is based on the hypothesis that high-income people rely primarily on private sources of services rather than public sources. Thus one would expect an inverse relationship between INC and CR3.

INDCO is included in equation (4) for the reasons it is included in equations (2) and (3). In particular, business areas may have a great many accidents and injuries requiring a police response. As a result, one expects a positive relationship between INDCO and CR3.

The inclusion of YOU in equation (4) is based on the hypothesis that young people may be involved in more accidents and injuries on the streets than other age groups. Also young people may be under the influence of drugs in public more often than other age groups. If they should require emergency help, it is likely that the police would be involved. Thus one expects a positive relationship between YOU and CR3.

EDUC is included in equation (4) because the more educated a person is the more likely he or she is to know where to obtain a particular public or private service and therefore the less likely he or she would be to call the police whenever any problem arises. Thus one would expect an inverse relationship between EDUC2 or EDUC3 and CR3, and a positive relationship between EDUC1 and CR3.

The inclusion of SEN in equation (4) is based on the hypothesis that the elderly may have a relatively high proportion of illnesses, accidents, and injuries which will result in a need for police services. Thus one expects a positive relationship between SEN and CR3.

DENS is included in equation (4) because accidents and injuries are more likely to occur in high rather than low density areas. DENS and CR3 are expected to be positively related.

The inclusion of STAB in equation (4) is based on the hypothesis that in stable neighborhoods, where people know one another for a long time, many services that might normally be supplied by the police will be supplied by the residents. As a result, one expects a negative relationship between STAB and CR3.

Specification of Equation (5)

Equation (5) attempts to explain the Drunkenness rate (CR4).

SUB is included in equation (5) because people who live in substandard housing units may be more likely to drink in public than in their homes and as a result may be more susceptible to arrest for drunkenness than people who drink in their homes. Thus one would expect a positive relationship between CR4 and SUB.

DROP is included in equation (5) as a measure of the number of people who have dropped out of society. This in fact would characterize the so-called "winos" that one sees on the streets. Thus one would expect a positive relationship between DROP and CR4.

The inclusion of INDCO in equation (5) is for the same basic reason it is included in the other crime rate equations. In particular, "winos" may congregate in industrial and commercial areas in order to panhandle. Thus one would expect a positive relationship between INDCO and CR4.

DENS is included in equation (5) because professional drunks are likely to congregate in areas where there are lots of people so their panhandling activities can be carried on more efficiently. DENS and CR4 should be positively related.

The inclusion of YOU in equation (5) is based on the hypothesis that the young are less able to "hold" their liquor, and as a result may be more likely to appear drunk in public. Thus there should be a positive relationship between YOU and CR4. However, one might argue that the young drink relatively less than other age groups and therefore are less likely to be drunk in public. Under this assumption, one would expect a negative relationship between YOU and CR4.

STAB is included for the same basic reason it was included in the other crime rate equations. Neighborhoods with longtime residents are likely to have a high degree of self-policing. As a result, residents who are drunk in public are likely to be escorted either home or into a private housing unit. As a result, there would be relatively fewer arrests for drunkenness in such neighborhoods. STAB and CR4 should have an inverse relationship.

2. Presentation of Results

We performed ordinary least squares regressions with equations (1) - (5) several different times, using the alternative definitions of SUB and EDUC. Here we report the results using SUB3 and EDUC1.

The t-values are in parentheses below each regression coefficient. The values of R^2 are corrected for degrees of freedom, and reported as $\bar{R}^2$. The F statistics for each equation are also reported.

(1) COPP = 4.221 + .299CR1 - .050 CR2 + .091 CR3 + .289 CR4 - .0012 INC
(4.6) (.2) (3.0) (1.2) (.8)

- .159 NWH + .599 INDCO
(.9) (2.6)

$\bar{R}^2$ = .826

F = 99.9

(2) CR1 = -98.581 + .346 SUB3 + 2.073 UNEMP + .0178 INC - .444 AUTO
(.4) (.4) (4.0) (2.4)

+ 2.706 INDCO + 2.838 YOU + 6.99 EDUC1 + 9.359 SEN - 1.067 DENS
(5.1) (1.7) (2.0) (3.3) (2.3)

- 4.702 STAB
(4.4)

$\bar{R}^2$ = .408

F = 11.0

(3) CR2 = -21.492 + .856 SUB3 + 5.85 UNEMP + .002 INC + 2.155 INDCO
(1.7) (2.0) (1.0) (6.7)

+ 1.123 YOU + 2.854 EDUC1 + 4.235 SEN - .811 DENS - 2.455 STAB

(1.1) (1.3) (2.5) (3.1) (3.8)

$\bar{R}^2$ = .395

F = 8.1

(4) CR3 = 65.511 + 5.405 SUB3 + .011 INC + 14.855 INDCO + 10.535 YOU

(1.6) (.7) (6.7) (1.5)

+ 27.542 EDUC1 + 28.715 SEN - 6.135 DENS - 18.074 STAB

(1.9) (2.4) (3.4) (4.2)

$\bar{R}^2$ = .371

F = 11.8

(5) CR4 = 6.927 + .213 SUB3 - .129 DROP + .162 INDCO + .198 YOU

(2.2) (.3) (2.2) (.9)

- .087 DENS - .259 STAB

(1.4) (1.7)

$\bar{R}^2$ = .062

F = 2.6

The results in equation (1) indicate that, overall, more police officers are allocated to neighborhoods with higher crime rates.[10] Three out of the four crime rates have positive signs, two of which are statistically significant (CR1 and CR3).[11] The value of $\bar{R}^2$ indicates that about 83% of the variance in COPP is explained by the variables in equation (1).[12]

The coefficient of CR1 can be interpreted as follows. If the Part I crime rate increases by one crime per thousand people, then per capita police costs increase by 29.9¢ (= $.299). (This assumes no change in the other crime rates, NWH, INDCO or INC.) Of course, this is only an estimate. Since the t-value is 4.6, the standard error of the estimate is .065.[13] The 95% confidence interval is 29.9¢ ± 1.98(.065) = (17¢, 42.8¢). That is to say, we can be 95% sure that the actual increase in per capita police costs ranges between 17¢ and 42.8¢.

A similar interpretation applies to CR3. If the service rate increases by one service per thousand people, then per capita police cost increases by an estimated 9.1¢. The 95% confidence interval ranges from 2.9¢ to 12.3¢. The coefficient of CR4 is statistically insignificant. This means that there is a reasonable chance that the influence of CR4 on COPP could be positive, negative or even close to zero.

The estimated coefficients of INC and NWH are also statistically insignificant. Hence in this regression equation there is no conclusive evidence that the cost of police protection in a particular neighborhood depends on either the average family income or on the percent of the population which is non-white.

The variable INDCO has a positive and significant effect on COPP. This implies that COPP in the more industrial and commercial neighborhoods is higher than it would be if policemen had been allocated solely on the basis of crime rates. As indicated earlier, this may suggest that business establishments are able to influence the allocation of police resources.

The discussion of the coefficient of CR2 has been left until last since the result here indicates a statistical problem, multicollinearity, which we have been unable to deal with satisfactorily. The variables CR2 and CR3 are very highly correlated.[14] The result is that CR2 is insignificant in this equation, contrary to our theoretical expectation.

An easy but not wholly satisfactory solution is to exclude either CR2 or CR3 from the equation and reestimate it. Excluding CR2, equation (1) becomes, (1a) $COPP = 4.205 + .295\ CR1 + .085\ CR3 + .281\ CR4 - .0012\ INC - .173\ NWH$

$\qquad\qquad\qquad\qquad (4.8) \qquad\quad (5.7) \qquad\quad (1.2) \qquad\quad (.8) \qquad\quad (1.1)$

$+ .599\ INDCO$

(2.6)

$\bar{R}^2 = .827$

$F = 117.3$

Excluding CR3 from equation (1),

(1b) $COPP = 15.799 + .329\ CR1 + .528\ CR2 + .227\ CR4 - .0018\ INC - .355\ NWH$

$\qquad\qquad\qquad\qquad (5.0) \qquad\quad (4.7) \qquad\quad (.9) \qquad\quad (1.1) \qquad\quad (2.2)$

$+ .587\ INDCO$

(2.5)

$\bar{R}^2 = .816$

$F = 108.9$

A comparison of (1a) with (1) reveals that the estimated coefficients and their t-values show little change except that the t-value for CR3 increases from 3.0 to 5.7. In equation (1b) there are two important changes. In equation (1) the coefficient of CR2 was negative and insignificant. In equation (1b) the coefficient is positive with a high value of t (= 4.7). This supports our view that low explanatory power of CR2 in equation (1) was due to the presence of CR3.

Secondly, the variable NWH, whose coefficient is insignificant in equations (1) and (1a), becomes significant in equation (1b). This suggests that a significant negative relationship between NWH and COPP might be masked by the multicollinearity problems in equation (1). However, the question of whether COPP is lower, all other things being equal, in those neighborhoods having a higher percent of non-white residents has not been conclusively answered by our empirical analysis. Further work is needed.

In equations (2) - (5) the overall explanation of crime rates is only partly successful. The value of $\bar{R}^2$ for equations (2) - (4) ranges from .37 to .41, but for equation (5), $\bar{R}^2$ is only .06. Ironically, SUB3 is significant only in equation (5). Had we included other variables in (5) which more adequately explain CR4, there is no guarantee that SUB3 would still be significant. Put another way, SUB3 may be significant in (5) only because it is serving as a proxy for other (excluded) variables which better explain CR4.

Based on the results we do have and lacking a better model for explaining crime rates, we conclude that we have failed to show that substandard housing, per se, implies higher crime rates.[15] Even if we discard equations (2) - (5) and include SUB directly in equation (1), none of the versions of SUB shows up as statistically significant.

The variables which do have a significant influence on crime rates are of some interest. INDCO, significant in all four equations, has a positive influence on crime rates, thereby meeting with our expectations. The variable STAB, significant in equations (2) - (4), has a negative influence, i.e., stable neighborhoods experience less crime than those in which the population is more transient.

The positive significant effect of SEN in (2) - (4) adds some evidence to the claim that old people are quite often the victims of crime. INC was significant only in equation (2), the Part I crime rate equation. Its coefficient is positive, indicating that INC is a characteristic of the victims of Part I crimes.

Population density, DENS, shows up with a negative coefficient in each equation.[16] Of the remaining variables, UNEMP, YOU and EDUC1, which were thought to be characteristics more of criminals than of victims, were not consistently significant variables. Hence, it would seem that a study which would offer a better explanation of crime rates should involve more direct observations on the characteristics of criminals themselves. This implies, of course, that some source other than census data should be employed.

C. The Cost of Fire Fighting

1. Specification of the Model

Our approach to relating the quality of housing to the cost of fire fighting is much the same as it was for police protection. Here we employ two measures of housing quality, SUB and AHU, in equation (6) which, along with other variables, explain the fire rate, FR.

(6) $FR = g_1$ (SUB, AHU, SEN, EDUC, PERRO, INDCO).

Then the fire rate is included in equation (7), which determines the cost of fire fighting, COFF.

(7) $COFF = g_f$ (FR, INC, NWH, INDCO, LOTH, DENS)

where FR is the fire rate (fires per 1,000 people)

COFF is the cost of fire fighting per capita

AHU is the percent of housing units in structures built in 1939 or earlier

PERRO is the percent of all housing units having more than one person per room

LOTH is the percent of land area classified as institution or park land

SUB, SEN, EDUC, INDCO, INC, NWH, and DENS are defined in Section B of this chapter.

Equation (6) deals with the fire rate, which is hypothesized to be a function of the socio-economic and housing characteristics of the neighborhood. The cost of fire fighting (equation 7) is then estimated as a function of the fire rate and a set of socio-economic and geographic variables.

Specification of Equation (6)

SUB is included in equation (6) to estimate the effect of housing quality on the fire rate. Although the relationship between housing quality and the cost of providing municipal services may be somewhat ambiguous and indirect with respect to some municipal services (e.g., police protection), no such ambiguity exists with respect to the cost of fire fighting. The quality of housing should have a significant effect on the cost of fire fighting in a neighborhood because it is the condition of a housing unit which to a large degree determines the likelihood of fire in the unit. Substandard housing units generally possess one or more or the following characteristics:

(1) The presence of inadequate and/or defective electrical wiring

(2) The unit is generally very old and therefore more likely to be contained in a wood structure

(3) The presence of numerous fire hazards because substandard units are generally not maintained as well as standard units.

Thus, one hypothesizes a positive relationship between SUB and FR.

AHU is included in the FR equation because while old housing units may meet our definitions of standard housing they may still be more susceptible to fire than newer housing units, due to inadequate wiring, etc. AHU and FR should be positively related.

SEN is included because the greater the proportion of elderly people, the greater may be the likelihood of fires. The housing units of the elderly may be more susceptible to fires due to the advancement of senility. Thus the relationship between SEN and FR is expected to be positive.

The inclusion of EDUC in equation (6) is based on the hypothesis that the number of fire hazards is likely to be lower in the housing units of well-educated people than those of poorly-educated people. EDUC and FR are expected to be inversely related.[17]

The number of persons per room (PERRO) is included in equation (6) to measure the population density of a housing unit. Overcrowding may increase the likelihood of fire because it results in more clutter and therefore more accidents. The relationship between PERRO and FR is expected to be positive.

INDCO is included in the fire rate equation for the same basic reason that it is included in the crime rate equations. Neighborhoods with large commercial and industrial areas will have many fires in non-residential structures. Given that there are relatively few residents in these areas, it follows that the fire rates in commercial and industrial areas will be higher than the fire rates in residential neighborhoods. INDCO should capture this effect and therefore should be positively related to FR.

Specification of Equation (7)

Equation (7) attempts to explain the cost of fire fighting per capita (COFF). The inclusion of other variables beside the fire rate (FR) in this equation is aimed at identifying other possible influences on fire fighting expenditures.

INC, NWH, and INDCO are included in the COFF equation for the same basic reasons that they were included in the COPP equation. The inclusion of LOTH (the percent of land area classified as institution or park land) in equation (7) recognizes that the cost of fire protection may be higher in neighborhoods where there are large amounts of institutional or park land. In such neighborhoods the residential areas may be separated by the institutional and park land, which would result in greater travel times from a given fire station to the fire ground. As a result, more fire fighting manpower and equipment (per capita) may be required to offer adequate fire protection in such neighborhoods, as compared to neighborhoods with no institutional or park land. Thus one expects a positive relationship between LOTH and COFF.

DENS is included in the COFF equation as a measure of congestion in residential areas. The more congested the area the longer it will take for the fire fighters and their equipment to reach the scene of a fire. As a result, more fire fighters and equipment (per capita) may be required to offer adequate fire protection in congested residential areas than in non-congested residential areas. Thus DENS and COFF are expected be positively correlated.

2. Presentation of the Results

In estimating equation (6) we also tried an alternate definition of AHU, namely AHUO, which is the percent of occupied housing units in structures built in 1939 or earlier.

$$(6)\quad FR = -5.367 + \underset{(1.4)}{.199}\ PERRO + \underset{(1.9)}{.049}\ AHUO + \underset{(1.3)}{.159}\ SEN + \underset{(.7)}{.0849}\ EDUC1$$

$$- \underset{(.9)}{.056}\ SUB1 + \underset{(5.9)}{.130}\ INDCO$$

$$\bar{R}^2 = .223$$

$$F = 7.99$$

The coefficients of PERRO, SEN, AHUO and EDUC1 have the positive signs as expected, but fail to meet our criterion for statistical significance.

The coefficient of SUB1 is not only insignificant but has the wrong sign. The same conclusion holds if one substitutes SUB2 or SUB3. Thus it appears that neither SUB nor AHU is a very convincing proxy for the unmeasurable attribute, "condition of housing units in which fires are likely to occur."

The variable INDCO is quite significant. There are more fires per capita in industrial commercial areas, as expected. Overall the equation has a fairly low value of $\bar{R}^2$. The F-statistic is 7.99, which is significant at the .01 level.

It may be that more fires do occur under the housing and socio-economic conditions in our equation, but not necessarily in a given year. That is, equation (6) may be a better predictor of fire rates in the long run. If we were to calculate the fire rate for a period of several years, perhaps the results would improve.

(7) COFF = -31.33 + 12.33 FR + .00056 INC - .543 NWH + 1.355 INDCO

(14.2) (.4) (3.1) (5.3)

+ .648 LOTH - .184 DENS

(3.1) (1.4)

$\bar{R}^2$ = .73

F = 66.8

Four of the six variables show up as statistically significant and represent a quite reasonable explanation of COFF. The fire rate, FR, has an exceptionally high t-value. It indicates that the Fire Department has geographically allocated fire fighting manpower and equipment close to those neighborhoods with high fire rates.

The negative coefficient for NWH indicates that fewer fire department dollars (per capita), other things being equal, are allocated to non-white neighborhoods than to white neighborhoods.

The positive relationship between COFF and INDCO implies that even if one adjusts for the fact that more fires occur in industrial and commercial areas, these areas still receive more fire department dollars than other areas. This could be explained if fires in industrial and commercial buildings were generally more dangerous and damaging to life and property than other fires. It may also suggest that business establishments are able to affect the allocation of fire fighting resources.

LOTH has a positive influence on COFF as we predicted. INC and DENS were insignificant.

D. The Cost of Housing Code Enforcement

1. Specification of the Model

A one-equation model is employed to analyze the cost of housing code enforcement.

(8) COHC = h(SUB, AHUO, EDUC, NWH, OWNOC, RENVL, SPAN, APARTO, MIXED, SEN)

where COHC is the cost of housing code enforcement per capita

OWNOC is the percent of occupied housing units which are owner-occupied

RENVL is the average gross rent for renter-occupied units for which rent is tabulated

SPAN is the percent of the population which is Spanish-American

APARTO is the percent of occupied housing units in structures with 5 or more units

MIXED is the percent of land classified as mixed, i.e., containing both residential and industrial and commercial structures

SUB, AHUO, EDUC, NWH, and SEN are defined in Sections B and C of this chapter.

Since the distribution of complaints to the Department of Housing Inspection is used to allocate the department's expenditures among census tracts, it is not possible to estimate separate equations for the housing "complaint" rate and the cost of housing code enforcement (COHC).[18] As a result, the cost of housing code enforcement is stated as a function of a set of socio-economic and housing variables.

SUB is included in the COHC equation because substandard housing units are more likely to have violations of the housing code than standard units and therefore will generate more complaints to the Department of Housing Inspection (DHI). Thus one expects SUB and COHC to be positively related.

The inclusion of AHUO in the COHC equation is based on the hypothesis that older buildings are less likely to meet housing code standards and as a result, tenants in these units will register more complaints than tenants in newer housing units. AHUO and COHC are expected to be positively related.

EDUC is included because well-educated people are more likely to have knowledge of what constitutes a housing code violation and are therefore more likely to register complaints with the DHI than less-educated people. EDUC2 and EDUC3 should be positively related to COHC, but EDUC1 should be negatively related to COHC.

The inclusion of NWH rests on the assumption that there may be less communication between black tenants and white landlords. As a result, black tenants may register more complaints with the DHI than white tenants. NWH and COHC are expected to be positively related.

OWNOC is included in the COHC equation because housing complaints are registered by tenants (or renters) and not by owners of housing units. All other things being equal, one would expect the number of complaints to be smaller the higher the percent of owner-occupied housing units in a neighborhood. Thus one expects an inverse relationship between OWNOC and COHC.

The inclusion of RENVL is based on the assumption that the higher the rental value of a housing unit the less likely there is to be housing code violations. Also, if there were violations, high-rent tenants would more likely go to the landlord to get action because they believe their high rent provides adequate leverage. Low-rent tenants are more likely to consider going to the landlord a waste of time, and as a result, are more likely to immediately complain to the DHI. Thus RENVL and COHC are likely to be inversely related.

SPAN is included because Spanish-American people may be unaware of the existence of the DHI. Also, they may not speak English too well and as a result may have difficulty communicating with housing regulation authorities. These two facts suggest an inverse relationship between SPAN and COHC.

The inclusion of APARTO in the COHC equation is designed to recognize that a particular violation could bring multiple complaints because many tenants individually register complaints with the DHI. Also, tenants in large apartment buildings may be more likely to register a complaint with the DHI under the theory that there is strength in large numbers and as a result, they are less fearful of retaliation on the part of the landlord. APARTO and COHC are expected to be positively related.

MIXED is included in the COHC equation because residents in these areas may have to respond to a different set of problems. Restaurants and other business establishments in the building, or in adjacent buildings, may attract rodents and insects not only to the restaurants, but also to the adjacent apartments. Thus one expects a positive relationship between MIXED and COHC.

The inclusion of SEN in the COHC equation is based on the hypothesis that the elderly are less likely than other age groups to register complaints with the DHI. The reason is that the elderly are not very mobile and would therefore be fearful of retaliation by the landlord. Thus one expects SEN and COHC to have a negative relationship.

2. Presentation of the Results

Our estimate of the COHC equation turned up a large number of significant variables.

(8) COHC = -1.030 + .0778 SUB1 + .0248 AHUO - .1425 EDUC1 + .0304 NWH

(4.5) (3.1) (4.4) (7.5)

- .0208 OWNOC + .0013 RENVL - .010 SPAN - .0071 APARTO + .0253 MIXED

(1.5) (.3) (.4) (.8) (2.1)

+ .0835 SEN

(3.0)

$\bar{R}^2$ = .49

F = 15.0

Both the SUB1 and AHUO have positive significant effects on COHC, as we expected. Here SUB1 has a t-value of 4.5. When SUB2 or SUB3 were used, their t-values were 1.4 and 1.6 respectively, and the value of $\bar{R}^2$ dropped to around .43 in each case. In this equation then, the simple definition of SUB (lacking some or all plumbing facilities) works quite well.

For the education variable we used EDUC1. Its negative coefficient seems to show that less educated people tend to report fewer housing code violations. We also tried EDUC2. As would be expected, its coefficient was positive and significant with a t-value of 2.0.

The NWH coefficient is signficant and positive supporting our hypothesis that non-whites, more often than whites, have to resort to reporting poor housing conditions to the DHI. The MIXED variable emerges as significant, but not with the expected sign, while OWNOC, RENVL, SPAN and APARTO do not.

The one surprise in this equation was the variable SEN, which turned out to be positively related to COHC. Neighborhoods with high percentages of older people generate more housing complaints, even though we have controlled for old and substandard housing. It would seem that older people fear retaliation from their landlords less than we anticipated.

E. The Cost of Water Services

1. Specification of the Model

The estimates of water service costs per capita and sewer service costs per capita are clearly the least reliable cost estimates employed in this study. As discussed earlier in Chapter III, the expenditures of the Water Division were allocated among census tracts utilizing the distribution of water meter installations in 1970. This technique of estimation will yield meaningful estimates of water service costs by census tract only if water meter installations constitute the vast majority of services supplied by the Water Division, or if there is high correlation between water meter installations by census tract and "other services" supplied by the Water Division by census tract. Clearly this latter assumption is untenable. The major component of Water Division expenditures is the cost of water and the amount of water used in each census tract will clearly not be correlated with the number of meters installed in each census tract. In general, the amount of water used will primarily be a function of the size of the population. It was not possible, given resource limitations, to collect data on water use by census tracts. Thus the allocation of water services expenditures was made using data on installations of meters. Given the inadequacy of this procedure, the empirical results presented in this section should be viewed with extreme skepticism.

The model employed to explain the cost of water services per capita (COWS) is:

(9) COWS = f(OWNOC, AHUO, SUB, INDCO, STAB)

where COWS is the cost of water services per capita

OWNOC, AHUO, SUB, INDCO, and STAB are defined earlier in this chapter.

The inclusion of OWNOC in the COWS equation reflects the fact that there will be more water meters per capita in neighborhoods with a high proportion of owner-occupied housing units relative to renter-occupied units. Generally, most structures have only one water meter, regardless of the number of housing units contained in the structure. As a result, areas with a great many multiple family structures would be expected to have fewer water meters per capita than areas with many single family structures. Thus one would expect a positive relationship between OWNOC and COWS.

AHUO is included in the COWS equation because older structures are more likely to require the replacement of water meters and also because the water lines in older neighborhoods are more likely to need repairs and replacement than those in newer neighborhoods. As a result, one would expect a positive relationship between AHUO and COWS.

The inclusion of SUB has no real justification other than that the effect of substandard housing was the initial focus of this study. It is possible that SUB will be significant in the estimated equation. However, its significance would probably be due to the fact that substandard housing units are generally old housing units. Thus the influence being captured by SUB is probably the same effect which is being measured by AHUO.

INDCO is included in the estimated equation because structures containing industrial and commercial activities require water meters and water services, even though there are no people living in such structures. As a result, water service costs per capita will be higher in neighborhoods with industrial and commercial activity as compared to neighborhoods with no industrial and commercial activity. Thus INDCO and COWS should be positively related.

STAB is included in the COWS equation as a proxy measure for the degree of housing construction in a neighborhood and also as a measure of the changes in ownership of housing units. Clearly, the greater the housing construction in a neighborhood, the greater will be the demand for water meter installations. Also, changes in ownership of housing units may increase the demand for new water meters. As a result, one expects a negative relationship between STAB and COWS.

2. Presentation of the Results

(9) COWS = 1.298 + .4058 OWNOC + .1195 AHUO + .1827 SUB3 +
(4.1) (1.9) (2.5)

.2951 INDCO - .2976 STAB
(5.5) (2.2)

$\bar{R}^2$ = .290

F = 12.9

OWNOC, INDCO and STAB all have significant coefficients with the expected effect on COWS. Hence there are more new water meters installed per capita in neighborhoods with high percentages of owner-occupied units or with high percentages of industrial-commercial use. Fewer water meters per capita are installed in neighborhoods with higher percentages of long-time residents.

SUB3 is significant while AHUO is not quite significant. As explained earlier, it is difficult to understand why SUB3 should have a positive effect on COWS, except to the extent that SUB3 reflects the age of the neighborhood. But intuitively, AHUO should have been the better proxy.

With this idea in mind, we also estimated the COWS equation as before, excluding SUB3.

(9a) COWS = -2.6519 + .2906 OWNOC + .1906 AHUO + .3277 INDCO - .1359 STAB
(3.3) (3.2) (6.2) (1.1)

$\bar{R}^2$ = .265

F = 14.1

Here AHUO has a higher t-value than either SUB3 or AHUO in the original COWS equation, but STAB has a lower t-value than before. The $\bar{R}^2$ has also dropped somewhat. Nevertheless, equation (9a) probably captures the effect of old neighborhoods on COWS better than equation (9).

F. The Cost of Sewer Services

1. Specification of the Model

As stated in the previous section, the estimates of sewer service costs per capita are among the least reliable cost estimates employed in this study. As discussed earlier in Chapter III, the expenditures of the Sewer Division were allocated among census tracts utilizing the distribution of sewer complaints, sewers cleaned and sewers repaired by census tract in 1970. This procedure will yield only reasonably useful estimates of sewer costs per capita if the costs of each of the services delivered were identical. However, data were not available on the costs of each delivered service. Given the inadequacy of our cost estimation technique, the empirical results presented in this section should be interpreted with extreme caution.

The model employed to explain the cost of sewer services per capita (COSE) is:

(1) COSE = f(INDCO, DENS, AHUO, SUB)

where COSE is the cost of sewer services per capita

INDCO, DENS, AHUO and SUB are defined earlier in this chapter.

INDCO is included in the COSE equation for two reasons. First, areas with industrial and commercial activity will have higher sewer service costs per capita relative to areas with no industrial and commercial activity, simply because industrial and commercial areas require sewer services, even though there are no residents in the area. Second, businesses may be more likely to complain and receive service than individual residents if there are malfunctions in the sewer system. Thus one expects a positive relationship between INDCO and COSE.

DENS is included in the COSE equation because there are fewer sewers per person in dense areas than in sparsely inhabited areas. As a result, one would expect COSE to be inversely related to population density.

AHUO is included in the COSE equation as a proxy for the "age" of a neighborhood. Older neighborhoods are more likely to require sewer repairs than new neighborhoods due to the age (and therefore the condition) of the sewer facilities. Thus one expects a positive relationship between AHU and COSE.

The inclusion of SUB in the COSE equation is based primarily on the fact that it was the initial focal point of this study. However, one might rationalize its inclusion on the grounds that people who live in substandard housing units may spend relatively more time on the streets than people who live in standard housing units. As a result, the streets may become littered, which may in turn clog sewers and require more frequent cleanings and repairs than in neighborhoods with primarily a standard housing stock. This would be reinforced if one argued that residents of substandard housing areas have less incentive to keep their streets clean. Thus one might expect SUB and COSE to be positively related.

2. <u>Presentation of the Results</u>

$$\text{(10)}\quad \text{COSE} = 3.1149 + \underset{(7.3)}{.2466\ \text{INDCO}} - \underset{(3.5)}{.0696\ \text{DENS}} + \underset{(.9)}{.0354\ \text{AHUO}} + \underset{(3.4)}{.1428\ \text{SUB3}}$$

$\bar{R}^2 = .378$

$F = 23.18$

Both INDCO and DENS have the expected effect on COSE. SUB3 has a positive and significant effect, but the coefficient of AHUO, though positive, is insignificant.

G. The Cost of Refuse Collection

1. Specification of the Model

In Chapter IV it was noted that the cost of refuse collection (CORC) depends on two factors: $\frac{G}{P}$, tons of refuse per capita, and $\frac{C}{G}$, collection costs per ton of refuse, where C denotes costs, G tons of refuse and P, population. Given that CORC is defined as $\frac{C}{P}$ the statement is obvious since

(11) $\text{CORC} = \frac{C}{P} = \frac{C}{G} \cdot \frac{G}{P}$

To explain CORC we must explain $\frac{C}{G}$ and $\frac{G}{P}$. In general, $\frac{C}{G}$ depends upon service conditions and represents the cost of supplying refuse collection, while $\frac{G}{P}$ depends upon housing and population characteristics, and thus represents the demand for collection services.

Two equations were estimated for the 11 Public Works Districts described in Chapter III and Appendix A. In specifying the equation for $\frac{C}{G}$ more variables have been included than can actually be used in estimating the equations, in order to give a more complete theoretical description of the factors affecting collection costs per ton of refuse.[19] For $\frac{C}{G}$ we have the following equation:

(12) $\frac{C}{G} = f_1(\text{TYPE, DISP, HAUL, PICK, DENS, PRES})$.

In brief, the costs of collection per ton of refuse are related to six service conditions.

TYPE refers to the practice of having separate rubbish and garbage collection in some districts. A dummy variable was constructed. It equals zero for combined collection, and 1 for separate collection. Separation of garbage and rubbish should be more expensive, and thus $\frac{C}{G}$ should be positively related to TYPE.

DISP refers to the number of disposal points. For an individual contractor it can involve as many as three separate places for garbage, combustible rubbish and non-combustible rubbish. It is expected that $\frac{C}{G}$ is positively related to DISP.

HAUL represents the one-way distance to the main disposal site; the greater the distance, the greater the costs.

PICK is the estimated number of structures in the district. The more pick-up points per ton of refuse (i.e., the more single-family dwellings), the higher $\frac{C}{G}$.

DENS is the number of people per square residential mile. Density should reduce travel time and therefore reduce $\frac{C}{G}$. The negative correlation between DENS and PICK is probably very high.

PRES is the percent of land used for residential purposes. As the percent of non-residential land (1-PRES) increases, the costs per ton of refuse will tend to increase, as trucks must ride through areas (parks and commercial districts) not served by the contractor. Thus we would expect a negative relationship between $\frac{C}{G}$ and PRES.

The demand equation estimated was as follows:

(13) $\frac{G}{P} = f_2(\frac{H}{P}, \text{INC, SUB3, PRES})$

$\frac{H}{P}$ represents the number of households per person. There may be fixed volume of refuse produced by a household. Each household, regardless of the number of people in it, will tend to read one daily newspaper, one weekly magazine, etc. With more people there will be more refuse, but it will not increase proportionately. Thus we would expect the sign of the coefficient of $\frac{H}{P}$ to be positive.

As average family income increases, families buy more newspapers and use more disposable products. Thus $\frac{G}{P}$ should increase as INC increases.[20]

SUB3 is a substandard housing variable defined in Chapter II. It is often argued that due to inadequate facilities, refuse is scattered (and therefore not collected) in areas with substandard housing. In addition, some units classified as SUB3 have no kitchen facilities. The residents may not eat in the unit and therefore generate less garbage. Thus, $\frac{G}{P}$ should be negatively related to SUB3.

PRES is included in this equation because we are again interested in (1-PRES). In commercial and industrial areas and in parks, non-residents generate refuse which must be collected by contractors from litter baskets. Thus in a given area, as (1-PRES) increases, $\frac{G}{P}$ will increase. Consequently, $\frac{G}{P}$ should be negatively related to PRES.

2. <u>Presentation of the Results</u>

Our estimated equation for $\frac{C}{G}$ is:

$$(12)\quad \frac{C}{G} = \underset{}{18.171} + \underset{(.1)}{.2514\ \text{TYPE}} + \underset{(2.2)}{2.313\ \text{DISP}} + \underset{(2.6)}{1.150\ \text{HAUL}} - \underset{(4.9)}{.194\ \text{DENS}} - \underset{(1.2)}{.090\ \text{PRES}}$$

$\bar{R}^2 = .833$

$F = 10.9$

We have included all of the theoretically chosen variables except PICK. Had PICK been included in the equation, its t-value would have been only .5, while reducing the degrees of freedom by one. As the equation stands, the F-statistic is significant at the .01 level.[21]

Both the number of disposal points and the hauling distance have the positive effect on $\frac{C}{G}$ that we anticipated. For example, we have estimated that an increase in the hauling distance by one mile will increase the cost per ton by $1.15.

DENS has a significant negative effect on $\frac{C}{G}$. An increase of 1,000 residents per square mile of residential area, decreases the cost per ton by 19¢. PRES also has the expected negative effect, but its coefficient is insignificant.

For tons of refuse per capita we find,

$$(13)\quad \frac{G}{P} = -1.672 + \underset{(5.0)}{1.539}\frac{H}{P} + \underset{(6.2)}{.00008}\ INC + \underset{(3.9)}{.0109}\ SUB3 + \underset{(4.2)}{.0112}\ PRES$$

$\bar{R}^2 = .910$

$F = 26.3$

SUB3 and PRES have positive effects on $\frac{G}{P}$, contrary to our expectations. Analysis of this result is complicated by the fact that SUB3 and PRES are highly and negatively correlated.[22] To illustrate this complication, we report the following equation:

$$(13a)\quad \frac{G}{P} = -.567 + \underset{(2.3)}{1.22}\frac{H}{P} + \underset{(2.6)}{.00006}\ INC + \underset{(.4)}{.00092}\ SUB\ 3$$

$\bar{R}^2 = .696$

$F = 8.6$

Here SUB3 is insignificant. In fact, dropping SUB3 from this equation <u>increases</u> $\bar{R}^2$ from .696 to .725 and causes little change in the estimates for $\frac{H}{P}$ and INC. Specifically,

$$(13b)\quad \frac{G}{P} = -.546 + \underset{(2.7)}{1.281}\frac{H}{P} + \underset{(2.8)}{.00005}\ INC$$

$\bar{R}^2 = .725$

$F = 14.2$

Moreover, adding PRES to this last equation reduces $\bar{R}^2$ slightly (from .725 to .723).

(13c) $\frac{G}{P} = -.715 + 1.474\frac{H}{P} + .00005INC + .00217\ PRES$

(2.8) (2.8) (.9)

$\bar{R}^2 = .723$

$F = 9.7$

Hence, neither SUB3 nor PRES individually adds anything to the explanation of $\frac{G}{P}$.

In all of the equations for $\frac{G}{P}$, $\frac{H}{P}$ and INC exert positive significant effects on the amount of refuse per capita as expected.

H. The Effect of Housing Policy on the Cost of Providing Municipal Services

Given the focus of the study, in this section we concentrate on the savings that could be realized through housing policies aimed at improving the quality of housing.[23] Based upon our equations, we believe that the quality of housing is reflected in two variables -- SUB and AHUO.

Our empirical analysis failed to uncover any consistent relationship between housing quality and the cost of providing municipal services. The only municipal service the costs of which are clearly affected by housing quality is housing code enforcement. In the COHC equation, both SUB1 and AHUO are statistically significant.

The coefficient of SUB1 in the COHC equation is .0778. This implies that the expected reduction in per capita housing inspection costs as a result of one percentage point reduction in the stock of substandard housing is 7.78¢. If we construct a 95% confidence interval for our estimate, then we can be 95% certain that the actual reduction in per capita housing inspection costs ranges between 4.38¢ and 11.18¢. The City of Boston in 1970 spent $1.38 per capita for housing inspection. Thus, the projected level of per capita housing inspection costs as a result of a one percentage point reduction in the substandard housing stock ranges from approximately

\$1.27 to \$1.34. The total dollar savings would be between \$28,078 and \$71,671. If we assume that all substandard housing were eliminated (about 6% of the housing stock was classified as substandard, using SUB1), then the total savings would be between \$168,468 and \$430,026. Since the 1970 expenditures of the Department of Housing Inspection were \$896,582, there would be a 19 to 48% saving in housing inspection costs.

The coefficient of AHUO in the COHC equation is .0248. This implies that the expected reduction in per capita housing inspection costs as a result of a one percentage point reduction in the percent of housing structures built in 1939 or earlier is 2.48¢. If we construct a 95% confidence interval for our estimate, then we can be 95% certain that the actual reduction in per capita housing inspection costs ranges between .90¢ and 4.06¢. The total dollar savings from a one percentage point reduction would be between \$5,769 and \$26,027.

There was no significant empirical relationship between housing quality and the cost of providing police and fire services to a neighborhood. There is a significant statistical relationship between the housing quality variables and the costs of providing sewer services, water services and refuse collection. Both SUB3 and AHUO are significant in the COWS and COSE equations. However, we attach no importance to our empirical analysis of these municipal service costs since, as indicated earlier, the cost estimates for water services and sewer services are the least reliable cost estimates employed in this study. With respect to refuse collection costs, the substandard housing variable is significant but has a theoretically unexpected relationship with the cost variable. Thus we believe that the empirical analysis has not uncovered any significant or meaningful relationship between housing quality and the cost of providing refuse collection, water services and sewer services.

I. Potential Savings from Housing-Related Policies

In the course of this investigation an important, potentially expensive by-product of housing policies was uncovered. In the crime rate equations stability[24] had a significant and negative impact on the level of crime. Stability of neighborhood depends on numerous factors. Our society is very mobile and public policies are not designed to discourage voluntary mobility. However, public policies, especially housing policies, often force people to move. For example, the benefits of urban renewal must be balanced against the costs. One cost that should now be considered is the fact that an urban renewal project which involves relocation reduces stability (as defined in this study) and thereby increases crime rates. Conversely, an urban renewal project which is designed to increase stability will reduce crime rates. A reduction in crime rates should be viewed as a social benefit even if police expenditures were not reduced. But the equations also clearly indicate that a reduction in crime rates reduces police expenditures.

In equation (2) we found that if stability (STAB) increases by 1 percentage point, then the number of Part I crimes per thousand people decreases by 4.702. In equation (1) we observed that if Part I crimes fall by one per thousand people, then COPP decreases by 29.9¢. Thus if STAB increases by one percentage point for the entire city, COPP decreases by $1.41 (29.9¢ x 4.702). The total saving in police expenditures is estimated at $903,910 (641,071 persons x $1.41 per person).

In equation (4) we learned that if STAB increases by 1 percentage point, then the number of Part III services per thousand persons (CR3) decreases by 18.074. A reduction of Part III services by one per thousand persons reduces COPP by 9.1¢. Thus an increase in STAB by one percentage point for the entire city will decrease COPP by $1.64 (9.1¢ x 18.074) and police expenditures by $1,051,356 ($1.64 per person x 641,071 persons).

In summary, as a result of the decrease in CR1 and CR3 in response to a one percentage point increase in[25] STAB, police expenditures are estimated to decrease by almost $2 million.

FOOTNOTES TO CHAPTER V

1. Another simplification, which is still retained here, is that there is a direct link between fire protection cost and the percent of substandard housing. The actual regression equations constructed in this study for fire fighting assume a somewhat less direct relationship. See Section C of this chapter.

2. The concept of neighborhood as used here is that of a census tract. Earlier the concept referred to larger geographical areas (e.g., Allston-Brighton).

3. In fact, the allocation of police manpower that was available was for 1972. We were told at the time that these allocations had not changed much over time. In the hopes that they had not, we initially put COPP in the crime equations. The regression results indicated a very strong and positive COPP-CR relationship, contrary to our expectations. This undoubtedly meant that the crime equations were not well identified, a serious problem that occurs whenever any simultaneous set of equations is estimated. Put another way, we were unable to distinguish the negative COPP-CR relationship in equations (2) - (5) from the positive COPP-CR relationship in equation (1). Future work must include a much better formulation of the crime equations before the deterrent effects of police protection can be measured.

4. See footnote 10 of this chapter.

5. Police Commissioner diGrazia, in commenting on this study, has observed that allocation decisions are also dependent upon the potential for crime, which cannot be captured by our CR variables. INDCO areas are potentially high crime areas. The presence of police resources in INDCO areas may have a greater impact than in other areas in reducing the actual crime rate below the potential crime rate. Thus resources properly allocated on the basis of the potential crime rate may appear to be "misallocated" on the basis of the actual or reported crime rate as used in this study.

6. Theoretically, it is possible that all victims are "victimized" in neighborhoods other than their neighborhood of residence, and most criminals only operate in their own neighborhood. Under these conditions, the socio-economic variables would characterize the criminals only. In general, this would appear unlikely. Additionally, a more unlikely case would involve a crime committed in a neighborhood in which both the criminal and victim are not residents of the neighborhood. If this was generally true, then the socio-economic variables would characterize neither the victim nor the criminal.

   Clearly for certain types of crimes, neither of the above two cases is possible (e.g., breaking and entering). However, these ambiguities suggest that future research on the determinants of crime rates should disaggregate as much as possible the crime categories used in this study, so as to increase the likelihood of determining whether the socio-economic variables characterize primarily the victims or the criminals. Such disaggregation was not attempted in this study, since its primary purpose was not to explain crime rates, but rather the cost of police protection.

7. One might argue that even if the socio-economic variables characterize the victims, there may still be a negative relationship between income and CR1. However, since CR1 is dominated by auto theft, robbery, burglary, and larceny, a positive relationship between CR1 and income is more likely, especially if one assumes profit-maximizing behavior on the part of the criminal. This relationship would be reinforced if crime reporting is higher among high-income people than low-income people.

8. There are three alternative educational attainment variables employed in the empirical analysis. These variables are defined earlier in this analysis. An inverse relationship is expected between EDUC2 or EDUC3 and CR1. However, given its construction a positive relationship would be expected between EDUC1 and CR1.

9. Since fraud is the only crime in CR2 which is likely to involve the elderly rather than other age groups, it is highly unlikely that one could find an empirical relationship between CR2 and SEN.

10. The reader may object to our use of the reported crime rate in the COPP equation. We are aware that the reported crime rate deviates from the actual crime rate. Moreover, it is likely that the ratio of reported to actual crimes varies from neighborhood to neighborhood. In explaining the size of this ratio it would be useful to look at the ways in which incidents (crimes or requests for police service) are reported. Incidents may be reported (a) by a telephone call from a citizen, (b) directly to a police officer in the neighborhood, or (c) by a police officer who directly observes the crime or the need for police service.

    An individual would be less likely to report an incident if he felt that the police response to his call would be slow or inadequate. This would be particularly true for incidents reported by telephone, and to a lesser extent, for incidents reported to policemen in the area. This objection is important and certainly deserves further study. If the Police Department wants to better serve the needs of the public, it would be very useful to obtain estimates of the actual crime rate by neighborhood.

    By using the reported crime rate in the COPP equation, we have implicitly assumed that (1) the Police Department does not have accurate estimates of the actual crime rate by neighborhood, and hence (2) the Police Department relies on the reported crime rate in allocating its manpower by neighborhood.

    Even if our rationale is accepted, there is a second, but we think less important, objection that can be made. Since some incidents are reported directly to or by policemen in the neighborhood, it may be that increasing police manpower in a neighborhood increases the proportion of actual crimes that are reported. This might account for part of the positive correlation between reported crime rates and COPP. But it is our contention, though unproven here, that this correlation is primarily explained by a conscious police effort to allocate manpower on the basis of crime rates. Of course, the reader may rely on his intuition or feelings in interpreting our results.

11. In this study, a regression coefficient is considered significant only if it is significant at the .05 level using a two-tail t test.

12. Police expenditures and crime rates, as explained in Chapter III and Appendix A were partially allocated on the basis of area. Thus some correlation between the dependent variable COPP and the independent variables CR1, CR2, etc. may have been "built-in". It was not possible to separate out this influence, nor to determine its impact. Some insight can perhaps be gained from our analysis of fire expenditures in equation (6) and (7). For fire services we do not have "built-in" correlation between COFF and FR, and obtain an $\bar{R}^2$ of .72.

    Perhaps our ability to explain a larger percentage of the variance of COPP than COFF is due to the "built-in" correlation.

13. The standard error can be found for any of the coefficients by dividing the coefficient by its t-value.

14. The simple correlation coefficient between CR2 and CR3 is .97.

15. This remained true when we tried the alternate definitions, SUB1 and SUB2. In general, their t-values were lower than those of SUB3.

16. Including population in the denominator of the dependent variable, CR, and in the numerator of the independent variable, DENS, probably "built-in" some negative relationship which overwhelmed any positive effect.

17. This inverse relationship is expected between EDUC2 or EDUC3 and FR. A positive relationship is expected between EDUC1 and FR.

18. Separate equations could only be estimated if data were available to construct independent measures of a housing "complaint" rate variable and COHC. The data and methodology for the construction of COHC are discussed earlier in Chapter III.

19. With 11 observations the number of independent variables must be limited, as we do not have nearly as many degrees of freedom as in the other equations with 147 observations. We also expect a high degree of collinearity among the service condition variables.

20. The inclusion of $\frac{H}{P}$ and INC in the estimated equation can be defended in the context of the following theory: Let G_1 represent the refuse

of the i^{th} household and G the sum of the refuse in all households. For the i^{th} household the amount of refuse generated is composed of a fixed component (newspapers, etc.) and a variable component positively related to the number of persons in the household, and a variable component positively related to the income of the household. Mathematically,

(a) $G_i = a + bP_i + CI_i$

where a is a constant, P_i is the number of persons in the i^{th} household and I_i is the income of the i^{th} household.

Summing over all households we have:

(b) $G = aH + bP + cI$

where P is total population and I is total income.

Dividing by P yields:

(c) $\frac{G}{P} = a\frac{H}{P} + b + c\frac{I}{P}$

Substituting INC as a proxy for $\frac{I}{P}$ we have part of the equation estimated.

21. $F_{5,5} = 10.97$ at the .01 level.

22. The simple correlation coefficient between SUB3 and PRES is -.81.

23. No attempt is made to estimate the savings due to a change in such variables as income or education of the population. This is viewed to be beyond the scope of the present study.

24. The reverse causation can be hypothesized. It could be true that an increase in crime rates reduces stability as residents attempt to "flee" high crime areas. To test the alternative hypotheses, we would need time series data, so that we could observe the lag structure.

25. STAB did not have a statistically significant impact on CR4, but it did affect CR2. However, a change in CR2 did not have a significant effect on COPP in equation (1). The reader should recall our discussion of multicollinearity with respect to CR2 and CR3 in equation (1) alone. We cannot compute the effect of CR3 on COPP from equation (1a) and of CR2 on COPP from equation (1b). In essence, that would result in double counting. As we have computed the savings the entire effect from the two highly correlated variables (CR2 and CR3) is basically accounted for by CR3 in equation (1). These estimates may be low because our police expenditures exclude administrative expenditures and the cost of centralized forces. Potential savings, if all expenditures were variable costs, could be 24% higher. See footnote 12, Chapter III.

CHAPTER VI

CONCLUSIONS AND POLICY IMPLICATIONS

This chapter summarizes the results of the empirical analysis and indicates their implications for public policy and future research. Section A summarizes the empirical results with respect to the determinants of the per capita costs of providing the six municipal services analyzed in this study. Section B discusses the empirical results of the crime and fire rate analysis. Section C presents the implications of the empirical analysis with respect to public policy and Section D lists some areas of future research.

A. The Determinants of Municipal Service Costs

In general, it appears that the explanatory power of the estimated cost equations is highly correlated with the "quality" of our per capita cost estimates. The cost estimates are most reliable for police protection, fire fighting and refuse collection. The explanatory power of these cost equations ranges from 73% to 84%. The least reliable cost estimates are for water services and sewer services, and the explanatory power of these cost equations are 29% and 38%, respectively. The cost estimates for housing code enforcement are, in our opinion, fairly reasonable and the amount of variation in costs explained by the housing code enforcement equation is 50%. However, it should be noted that the "success" of the estimated equations in explaining variations in municipal service costs per capita among neighborhoods is also a function of the extent to which the individual cost equations are appropriately specified. Thus it could be argued that our success in explaining police, fire, and refuse collection costs merely reflects the fact that these cost equations are "well" specified. Conversely, the rather low explanatory power of the water service and sewer service cost equations reflects the rather "poor" specification of these equations. We believe that the "success" of the estimated cost equations is primarily a function of the quality of the service cost estimates and only secondarily a result of specification problems.

The empirical results with respect to the cost equations estimated for police protection, fire fighting, and refuse collection, as indicated above, are quite substantial. The empirical analysis of the cost of police protection supports the hypothesis that police expenditures are primarily allocated among neighborhoods on the basis of crime and service rates. This conclusion is based on the fact that the most significant variables explaining differences in per capita police costs among neighborhoods are differences in neighborhood crime and service rates.

With respect to the costs of fire fighting per capita, it appears that the Fire Department allocates fireffighting manpower and equipment primarily according to the incidence of fires. This conclusion is based on the fact that the most significant variable explaining differences in per capita fire fighting costs among neighborhoods is the differences in neighborhood fire rates.

In Chapter V it was noted that per capita refuse collection costs in a given neighborhood depend upon the amount of refuse generated per capita and collection costs per ton of garbage. The empirical analysis suggests that differences in per capita tons of garbage among neighborhoods are primarily determined by differences in income and the number of households per capita. Differences in collection costs are explained by hauling distances, disposal facilities, and population density.

The empirical analysis of the costs of housing code enforcement per capita can be considered only moderately successful, as indicated earlier. The empirical results suggest that per capita costs are highest in those neighborhoods characterized by relatively large stocks of substandard housing, older housing structures, high levels of educational attainment, relatively high proportion of non-whites, and a relatively high proportion of elderly people.

The empirical analysis of both sewer service costs and water service costs can be considered a bust (or failure). The primary reason for this, we believe, is the poor reliability or quality of our per capita cost estimates for these services. As a result, no importance should be attached to our empirical analysis of these municipal service costs.

B. Crime and Fire Rate Analysis

Although it was not the primary purpose of this study, a crude attempt was made to explain differences in neighborhood crime rates and neighborhood fire rates. With the exception of the drunkenness rate (CR4), we are able to explain about 40% of the variation in neighborhood crime and police service rates. We believe that there are two primary reasons for our limited success in this respect. First, the dependent variables (CR1, CR2, CR3) were over-aggregated. In other words, there were too many "different" types of crimes included in each crime rate variable. As a result, specification of the individual crime rate equations was poor. Independent variables were included in the estimated equation even though they were expected to be related to only one type of crime included in the crime rate variable. As a result, the empirical relationship between the independent variables and the dependent variable would be expected to be rather weak. Second, the data used to construct our independent variables (the socio-economic and housing characteristics of the neighborhoods) did not enable us to construct separate variables relating to the characteristics of the victims on the one hand, and the criminals on the other hand.

No attempt was made in this study to overcome these difficulties. For our purposes -- estimating the determinants of per capita municipal service costs -- the use of "aggregate" crime rate variables was appropriate. Additionally, failure to explain to any significant degree the differences in neighborhood crime rates in no way affected our ability to analyze differences in cost of police protection per capita among neighborhhoods. However, our empirical results have clear implications for future research on the determinants of crime rates using intra-city data. First, crime rate variables should be disaggregated as much as possible to allow for a more proper and complete specification of the estimated equations. Second, separate variables reflecting the socio-economic characteristics of the victims and criminals must be constructed for use as independent variables in the estimated crime rate equations.

With respect to the fire rate, we are only able to explain about 22% of the variation in neighborhood fire rates. One possible explanation of our lack of success is that our fire rate equation is rather poorly specified. Another possibility is that we have chosen the "correct" independent variable set, but the dependent variable, the fire rate, should be measured over several years. In other words, our fire rate equation may be a better predictor of fire rates in the long run than in the short run. Another possibility is that the assumption implicit in our estimated fire equation that each of the explanatory variables exerts an "independent" influence on the fire rate is incorrect.[1] In fact, it may be the influence of one variable working in concert with another variable which affects the fire rate. For example, neither substandard housing nor the percent of elderly people per se will affect fire rates. But the percent of elderly people living in substandard housing units may affect the fire rate. Whatever the case, our empirical results do suggest promising areas of further research in the area of explaining the incidence of fire.

C. Public Policy Implications

Given the purpose of the project, the implications of our findings for government housing policies need to be emphasized. On the basis of our analysis, we believe that public officials, in evaluating housing programs, should consider the possible savings of a rational policy. In particular, a housing program which

1) reduces or eliminates substandard housing,
2) reduces the average age of the stock of housing, and
3) increases the stability of neighborhoods,

can decrease the cost of providing municipal services.

Specifically, we have already observed that the elimination of substandard housing and a reduction of one percentage point in the percent of housing units in structures over 30 years old are expected to reduce the cost of housing inspection by more than one-third (about $325,000). In addition, an increase in the stability of neighborhoods by one percentage point is expected to reduce the cost of police protection by about six percent (almost $2 million). More importantly, an increase in stability tends to reduce crime significantly. All these savings cannot and should not be ignored in a cost-benefit analysis of housing programs.

We also believe that the immense amount of data we have generated and analyzed can also be used as a partial basis for policy decisions in many other areas of government. Thus a reduction in the number of disposal facilities will, given our equations, clearly reduce the cost of refuse collection. Similarly, an increase in density appears to lower crime rates and thereby reduces the cost of police protection. However, such policy decisions have concomitant social costs which, in the context of this study, would be inappropriate to discuss.

D. Future Research

We believe we have uncovered an enormous amount of useful data and that we have developed some generally useful methodology. Throughout this report, we have noted important areas that warrant further investigation, and we have made recommendations for facilitating these studies. These recommendations are briefly summarized below:

1) To facilitate planning and program budgeting, every effort should be made to adopt common district boundaries for all city agencies. Socio-economic data should then be compiled for these districts.

2) To improve the explanatory powers of the crime rate equations, greater disaggregation of data is required. This level of data is now available. In addition, socio-economic characteristics on criminals and on the victims of crimes should be compiled. The potential insights in this area are unlimited, given the amount of data currently available.

3) To improve our results, we need a more precise allocation of variables than was possible in this study. Use of a geographic base file, now available but too expensive for our limited budget, would facilitate the integration of census and service data.

4) To increase the ability of city agencies to respond to the demands of studies such as this, research funds should be available. These funds would enable the agencies to enlist necessary technical assistance without interrupting their normal work schedule.

FOOTNOTES
TO
CHAPTER VI

1. This assumption may also be incorrect with respect to our crime rate equations, and as a result could be responsible for the low explanatory power of these equations.

APPENDIX A

THE DERIVATION OF SERVICE DATA BY CENSUS TRACT

In this Appendix the derivation of the data for police, fire and refuse collection is described more fully.

A. Police

1. Crime Rates

For each of the 825 reporting areas, the printout provided by the Police Department grouped reported incidents into three categories based upon the standard crime code. Part I offenses, with seven categories, includes such major crimes as criminal homicide, rape, armed robbery and auto theft. No adjustments were made in this category. Part II offenses include such varied crimes as arson, fraud, sex offenses other than rape and prostitution, narcotic drug laws and vandalism. But it also includes traffic offenses, which we believe could be explained better by the variables that explained services than the variables that explained minor crimes. In addition, Part II offenses appeared to be dominated by drunkenness.[1] Consequently, violation of traffic laws (Code 29) and drunkenness (Code 23) were removed from Part II offenses. Traffic offenses were added to Part III offenses which include, among other items, medical care (Code 30), lost and found property (Code 32) and minor disturbance (Code 33). Finally, a new and separate category was created for drunkenness.[2]

The next task was to allocate the four rearranged crime and service categories to the census tracts. As explained in Chapter III, Concord Research Corporation of Burlington, Massachusetts provided a printout, based on their geographic base file, which for each census tract listed the reporting areas either completely or partially contained within the given tract. For reporting areas listed only once, there was no problem, i.e., they were completely within a census tract, and the incidents occurring in that reporting area were, obviously, totally allocated to that census tract. About 80% of the 825 reporting areas were totally within one census tract. In the remaining cases the boundaries of the reporting areas were carefully compared to the boundaries of the census tracts, and incidents were allocated to census tracts in proportion to the area of the reporting area that was within the given tract.[3] With all incidents allocated to a tract, crime (and service) rates were computed and transformed into standard reporting forms of crimes per 1,000 population. CR1, CR2, CR3 and CR4 represent these rates for the four categories discussed above.

2. Expenditures

The allocation of police expenditures to census tracts involved a three-step procedure of estimating costs per district, estimating costs per car sector, and allocating costs of car sectors to census tracts.

To estimate the costs per district, we obtained the district assignments of 1823 police officers.[4] These data are presented in column 1 of Table A-1. The 1823 police officers in the 11 districts included personnel in seven ranks: captains, lieutenants, lieutenant detectives, sergeants, sergeant-detectives, detectives, and patrolmen. To obtain a more accurate estimate of the distribution of costs by police district, we weighted the number of officers in each category by their salaries, using the average annual salary of patrolmen as the basis of the constructed index.[5] The weighted allocation of police officers is presented in column 2 of Table A-1. (Naturally, since each category above the rank of patrolman was multiplied by an index number greater than one, the weighted "manpower" series is bigger than the unweighted series.) The percentage distribution of this

TABLE A-1

ALLOCATION OF POLICE EXPENDITURES TO DISTRICT AND CAR SECTORS

Police Districts[1]	(1) Number of Police Officers	(2) Weighted Allo-cation	(3) Percent Distri-bution	(4) Total Expenditures	(5) Number of Car Sectors	(6) Expenditure Per Car Sector (Col 4 ÷ Col 5)
District 1, North End-Downtown	237	246.37	12.95	$ 3,996,484	9	$444,054
District 2, Roxbury-North Dorchester	310	320.30	16.83	5,193,886	16	324,618
District 3, Mattapan	140	146.45	7.70	2,376,288	5	475,258
District 4, South End-Back Bay	288	297.75	15.65	4,829,727	11	439,066
District 5, Roslindale, West Roxbury, Hyde Park-Readville	157	163.79	8.61	2,657,122	8	332,140
District 6, South Boston	114	120.50	6.33	1,953,494	5	390,699
District 7, East Boston	95	100.83	5.30	1,635,624	3	545,209
District 11, Dorchester	171	177.65	9.34	2,882,406	7	411,772
District 13, Jamaica Plain	104	110.26	5.79	1,786,845	4	446,711
District 14, Brighton-Allston	132	138.41	7.27	2,243,586	4	560,897
District 15, Charlestown	75	80.43	4.23	1,305,415	2	652,707
Totals[2]	1,823	1,902.74	100.00	$30,860,877	74	$417,039 (ave.)

[1]District 2 represents the merging of Districts 9 and 10, District 8 Harbor Patrol is omitted.

[2]Details may not add to total due to rounding.

SOURCE: See text.

series (column 3, Table A-1) has operational significance, as it was used to allocate $30,860,877 to the 11 police districts. This allocation is shown in column 4.

The next step was to estimate the cost for each of the 74 car sectors. The number of car sectors in each police district is presented in column 5. Costs per police district divided by the number of car sectors in the given district represents the estimate of costs per sector in the various districts (column 6). Costs per sector vary from a low of $324,618 in the 16-car sector District 2 to a high of $652,707 in the 2-car sector District 15. For Boston the average cost of a car sector is $417,039.

Finally, the amount of coverage (police services) was determined by comparing census tract boundaries with car sector boundaries. Based upon area, a determination was made of how much coverage each census tract received from the various car sectors serving the tract. Given the coverage, and given the cost of a car sector, the cost of police protection in each tract was easily estimated. Dividing by population yielded per capita data for the 147 census tracts.

The three-step procedure can be summarized by reference to several tracts. Tract 2 in Brighton-Allston is served by Police District 14 with four car sectors. Tract 2, it is estimated, received 0.25 of the services of car sector 14-3 and 0.10 of the services of car sector 14-4 for a total of 0.35 of the services of a car sector. The estimate of the average cost of a car sector in District 14 is $560,897. The total cost of providing police services to tract 2 is $196,314 (0.35 x $560,897). With a population of 9,245 per capita costs are $21.20 $(\frac{\$196,314}{9,245})$.

In South End tract 703 served in part by District 1 and in part by District 4, the varying costs of car sectors are considered. Thus tract 703 receives 0.35 of the services of car sector 1-9 and 0.63 of the services of three car sectors in District 4. The average costs of a car sector in Districts 1 and 4 is \$444,054 and \$439,066, respectively. The total cost of police expenditures in tract 703 is estimated to be \$432,030 (0.35 x \$444,054 + 0.63 x \$439,066). Per capita costs are \$145.00[6] $(\frac{\$432,030}{2,978})$. Similar calculations were performed for all 147 tracts.

B. Fire Data

1. Fire Rate

As explained in Chapter III above, a map at Fire Department Headquarters which pinpointed the location of all 2,161 fires in structures was used to allocate fires to census tracts by super-imposing census tract maps over the fire map. Thus we had an exact count of the number of fires in structures for each tract. To build in some differentiation among types of fires, each two-alarm fire (identified by a colored pin on the map) was counted as two fires, each three-alarm fire as three fires, etc.[7] Fire rates per 1,000 persons were then computed.

2. Fire Expenditures

Fire fighting expenditures of \$23,199,775 were allocated to census tracts by first assuming that the cost of each of the 72 land-based fire companies was the same.[8] Thus we estimated the cost of a fire company to be \$305,260. The amount of fire services received by a census tract was again determined by comparing census tract boundaries with fire company boundaries. As with the allocation of police services, a determination based upon area was made of how much coverage each census tract received from the various fire companies serving the tract. Given the coverage and given the cost of a fire company, the cost of fire fighting services in each census tract was easily estimated. Per capita estimates were then calculated for each of the 147 tracts. Thus South End census tract 701 was served by the equivalent of three fire companies at a total cost of \$915,780 (\$305,260 x 3).[9] Per capita costs were estimated to be \$788.10, $(\frac{\$915,780}{1,162})$.[10]

C. Refuse Collection Data

This section describes the service areas and the data unique to Refuse Collection.

1. Service Areas

For Refuse Collection, Public Works districts have been used as the observation rather than census tracts. There are 11 Public Works Districts. They are listed in Table A-2, column 1. In column 2 the census neighborhoods within each Public Work District are listed. In three cases -- Districts 1A, 4 and 9, census neighborhoods coincide exactly with district boundaries. In these cases it was easy to compile the needed census data by aggregating data for all tracts within the census neighborhood. In the remaining cases the usual allocations, based upon area, were made. Thus the population of Public Works District 6 was estimated to be 54,976.[11] Similar estimates were made for other census variables used in the Refuse Collection equations.

2. Data

For the Refuse Collection Equations discussed in Chapter V, some of the service conditions variables were derived from data originally provided by the Sanitation Division.[12] In particular, two service conditions variables were used in the equation; type of collection and the number of disposal locations.

Six districts (2, 3, 4, 6, 7 and 8) have their garbage and rubbish

TABLE A-2

COMPARISON OF PUBLIC WORKS DISTRICTS AND CENSUS NEIGHBORHOODS

	(1) Public Works District	(2) Census Neighborhoods
1A	Charlestown	Charlestown (All)
1B	Boston Proper	All of West End and North End, Parts of Back Bay, South End and Roxbury
2	Jamaica Plain	Parts of Roxbury, Roslindale and Jamaica Plain
3	Dorchester North	Parts of Roxbury and Dorchester
4	Brighton	Brighton (All)
5	South Boston	All of South Boston, Parts of Roxbury and North Dorchester
6	West Roxbury	Parts of Roslindale, West Roxbury and Hyde Park
7	Dorchester South	Parts of North Dorchester, South Dorchester and Roslindale
8	Hyde Park	Parts of South Dorchester, Roslindale, West Roxbury and Hyde Park
9	East Boston	East Boston (All)
10	Roxbury	Parts of Back Bay, South End, Roxbury and Jamaica Plain

collected separately. There was no way to quantify this effect, particularly since only about 7,800 tons (less than 3% of total refuse collection) is accounted for by the separate collection of garbage. Nevertheless, separate collection does affect collections costs per ton of refuse. The standard statistical technique is to construct a dummy variable, assigning a "1" to the variable with areas with separate collection and a "0" to the variable for all other areas. The data for the type (TYPE) of collection is shown in column 1 of Table A-3.

The number of disposal locations (DISP) was also taken into account. In some areas, such as District 2, combustible rubbish, non-combustible rubbish and garbage are all disposed of in one location (Gardner Street). In other areas, such as District 9, there are separate disposal locations for each type of refuse. This series is presented in column 2 of Table A-3.

Estimates of the one-way haul distance (HAUL) to the disposal facility were also obtained (column 3 of Table A-3).[13]

TABLE A-3

SERVICE CONDITIONS IN PUBLIC WORKS DISTRICTS

District and Location		(1) TYPE	(2) DISP	(3) HAUL (in miles)
1A	Charlestown	0	2	3.0
1B	Boston Proper	0	2	1.5
2	Jamaica Plain	1	1	2.0
3	Dorchester North	1	2	5.1
4	Brighton	1	1	4.2
5	South Boston	0	2	1.0
6	West Roxbury	1	1	1.0
7	Dorchester South	1	2	3.8
8	Hyde Park	1	1	2.7
9	East Boston	0	3	2.5
10	Roxbury	0	2	4.5

SOURCE: See text for derivation and explanation of symbol.

FOOTNOTES TO APPENDIX A

1. According to the Annual Report of the Police Commissioner (p. 40) there were 18,382 arrests (not incidents) for drunkenness. This accounts for about two-thirds of the Part II arrests. Yet the reported incidents (which normally exceed arrests) turned out to be only about 2,000 on the printout by reporting areas provided by the Police Department.

2. An area of further study would be a separate analysis of each crime. Factors which explain auto thefts do not necessarily explain criminal homicide. This disaggregated analysis is clearly beyond the scope of the present study.

3. Allocations based upon area for the reporting areas not completely contained within one census tract represented the only alternative available to us. A far better (but more expensive) method would be to use the street addresses for incidents reported in the 185 reporting areas in conjunction with a Geographic Base File. This would permit a more accurate allocation of incidents. Moreover, our method of allocation for these 185 reporting areas and the method of allocation of police expenditures present some statistical problems which are discussed in Chapter V above.

4. Unfortunately the data we received were for August, 1972. We could not obtain the data for 1970, but we were assured that the percentage allocation of manpower had not changed very much between 1970 and 1972.

5. The weights were based upon the average annual salaries on January 1, 1971 of police officers for the seven ranks. Using the average annual salary of patrolmen at $10,537 as the base set equal to 1.00, the weights are as follows: captains, 1.61; lieutenants, 1.44; lieutenant-detectives, 1.45; sergeants, 1.24; sergeant-detectives, 1.27; detectives, 1.05. For details, see City of Boston, Program Budget, 1971.

6. Worksheet calculations for each of the tracts are available upon request.

7. In terms of our regression equations in Chapter V, these "weights" make sense. For the fire rate equation such independent variables as population density or average age of structures are just as likely to explain the seriousness of fires as the number of fires. Similarly, for the fire expenditure equations, the allocation of fire fighting resources, in theory, should be explained by the expected number of fires and by the expected seriousness of fires, measured by the number of alarms.

8. We ignored companies stationed on fire boats (Engs. 31 and 47) and two companies on Long Island (Eng. 54 and Lad. 31).

9. 0.20 of Engine 10, 0.25 of Engine 4, .30 of Ladder 8, .05 of Engine 43, 1.00 of Engine 7, 1.0 of Engine 25 and .20 of Engine 26.

10. Worksheet calculations for each of the tracts are available upon request.

11. This was done by adding all of the population of tracts 1105 and 1301-1303, and part of the population of tracts 1104, 1106, 1304 and 1401. Again, the exact worksheet calculations for all the districts are available upon request. These population figures exceed the estimates of the Sanitation Division. Their estimate of 50,000 is probably based upon the 1960 census.

12. Department of Public Works, Contract For Collecting and Removing Garbage.

13. Circle Inc.-Harvard University Study, Solid Waste Handling in Boston Neighborhoods, May, 1971, Table 19.

APPENDIX B

THE DERIVATION OF LAND USE VARIABLE BY CENSUS TRACT

The Boston Redevelopment Authority (BRA) has maps for each planning district which identify the use of each parcel of land within the planning district. For the purpose of this study four categories of land use were identified: industrial and commercial, mixed, residential and other. The land use maps were superimposed upon the census tract map. Land within a tract was classified as follows:

1. All areas primarily classified by the BRA as used for industrial or commercial purposes was classified as industrial and commercial.

2. In some areas where a parcel of land classified as residential by the BRA was next to (or mixed in with) parcels classified as industrial or commercial, we designated the area as mixed.[1]

3. Our definition of residential land included all land classified as residential by the BRA, plus one-half of the land classified as mixed above.[2]

4. All other land classified by the BRA, such as park and institutional land was classified as other for this study.

Using a polar planimeter the total area in square miles of each census tract and of the four categories of land within each tract was determined.[3] This data was then used to further describe the characteristics of the census tract. Thus our density variable was equal to the population of the tract, divided by residential area, as defined and measured by the above procedures.

FOOTNOTES TO APPENDIX B

1. This classification, rarely used, simplified the measurement problems. Mixed land in our definitions constituted less than one square mile of land or about two percent of all land in the City. Usually a relatively small area which was approximately one-half residential and approximately one-half commercial and industrial was classified as mixed.

2. In order to minimize the possibility of residents with no land classified as residential, thereby obtaining an absurd result for the measure of density, one-half of land classified as mixed was added to the residential land.

3. Each census tract and each sub-area was planimetered twice to insure accuracy. The two readings varied very little and the average of the two readings was used in the study. The average reading for each tract, and for each area within the tract, was then multiplied by a conversion factor of 33.05 in order to convert the readings into acres and divided by acres per square mile to convert the unit of measurement to square miles.

   Thus, for each area planimetered:

   $$\frac{\text{Planimeter Reading x 33.05}}{\text{Acres Per Square Mile}} = \text{Number of Square Miles in Given Area}$$

   To further check the accuracy of the planimeter reading, initially the square mileage of the sub-areas within a tract was totalled and compared with the individual reading for the tract. Eventually when we were satisfied of the accuracy of the methodology, residential area was computed as a residual equal to the total area of the tract minus the following areas: industrial and commercial, other, one-half of mixed. Using our notation, RES = Total Area - INDCO - OTHER - ½ MIXED.

APPENDIX C

DEFINITION OF TERMS AND SOURCE OF DATA

Acronym	Explanation of Term	Source
Service Variables:		
COFF	Cost of fire fighting per capita	See Chapter III and Appendix A
COHC	Cost of housing code enforcement per capita	See Chapter III
COPP	Cost of police protection per capita	See Chapter III and Appendix A
CORC	Cost of refuse collection per capita	Same as above
COSE	Cost of sewer services per capita	See Chapter III
COWS	Cost of water services per capita	Same as above
C/G	Cost per ton of refuse	See Chapter III and Appendix A
CR1	Part I crime rate (crimes per thousand people)	Same as above
CR2	Modified Part II crime rate (crimes per thousand people)	Same as above
CR3	Part III service rate (police services per thousand people)	Same as above
CR4	Drunkenness Rate (incidents per thousand people)	Same as above
DISP	Disposal facilities (number needed) for refuse	See Appendix A
FR	Fire rate (fires per thousand people)	See Chapter III and Appendix A
G/P	Tons of refuse per capita	Same as above
HAUL	Hauling distance for refuse	Appendix A
H/P	Households per person	See Chapter V, Section G
PICK	Number of refuse pickup points	Same as above

Acronym	Explanation of Term	Source
TYPE	Type of refuse collection (dummy variable, 0 = combined collection and 1 = separate rubbish and garbage)	See Appendix A
Land Use Variables:		
INDCO	Percent of land area classified as industrial or commercial	See Chapter III and Appendix B
LAND	Total land area in square miles	Same as above
LOTH	Percent of land area classified as institutional or park land	Same as above
MIXED	Percent of land area classified as mixed	Same as above
PRES	Percent of land area classified as residential	Same as above
RES	Total residential area in square miles	Same as above
Socioeconomic Variables:		
AUTO	Number of automobiles per thousand people	1970 Census of Population, Fourth Count
DENS	Population density (thousands of people per square mile of residential area)	See Appendix B
DROP	Percent of males 16 years of age and over not in labor force, not in school, not in institutions, and not over 65 years of age.	1970 Census of Population, Fourth Count
EDUC1	Percent of persons 25 years old and over with less than 5 years of schooling	Same as above
EDUC2	Percent of persons 25 years old and over who are high school graduates	Same as above
EDUC3	Percent of persons 25 years old and over who are college graduates	Same as above
INC	Mean family income	Same as above
NWH	Percent of the population which is non-white	Same as above

Acronym	Explanation of Term	Source
POP	Total Population	Same as above
SEN	Percent of the population which is 65 years old and over	Same as above
SPAN	Percent of the population which is Spanish-American	Same as above
UNEMP	Percent of persons 16 years old and over unemployed on April 1, 1970	Same as above
YOU	Percent of population between 14 years of age and under 25 years of age	Same as above
Housing Variables:		
AHU	Percent of housing units (occupied and vacant) in structures built in 1939 or earlier	1970 Census of Housing, Fourth Count
AHUO	Percent of occupied housing units in structures built in 1939 or earlier	Same as above
APART	Percent of housing units (occupied and vacant) in structures with 5 or more units	Same as above
APARTO	Percent of occupied housing units in structure with 5 or more units	Same as above
OWNOC	Percent of occupied housing units which are owner-occupied	Same as above
PERRO	Percent of occupied housing units having more than one person per room	Same as above
RENVL	Average gross rent for total renter-occupied units for which rent is tabulated	Same as above
STAB	Percent of occupied units in which head of household moved into unit in 1959 or earlier	Same as above

Acronyms	Explanation of Term	Source
SUB1	Percent of occupied and vacant housing units which do not have all plumbing facilities	Same as above
SUB2	Percent of occupied and vacant housing units which do not have all plumbing facilities and adequate heating	Same as above
SUB3	Percent of occupied and vacant housing units which do not have all plumbing facilities, adequate heating and both direct access and complete kitchen facilities	Same as above

APPENDIX D

PRINTOUT OF CENSUS DATA BY TRACT

All variables are to be read as percentages (e.g., in tract 1, 5.00% of the land is classified as mixed.) except for the following:

CR1, CR2, CR3, CR4:	crimes (or services) per thousand people
FR:	fires per thousand people
DENS:	thousands of persons per square mile of residential land
INC:	average annual family income in dollars
AUTO:	automobiles per thousand people
POP:	number of residents
RENVL:	monthly contract rent in dollars

TRACT NUMBER	CR1	CR2	CR3	CR4	FR
1	70.40	36.00	329.60	0.25	3.28
2	20.20	22.09	280.90	0.43	1.83
3	20.60	11.39	122.10	0.43	2.19
4	31.29	16.50	185.30	0.35	2.27
5	52.40	15.60	214.20	0.00	2.93
6	45.59	27.20	308.29	0.97	3.34
7	95.70	29.90	389.00	0.93	2.79
8	73.39	29.50	333.20	1.18	3.08
101	146.30	49.69	247.80	3.22	2.53
102	217.89	55.00	445.90	2.30	2.17
103	96.09	57.59	517.70	3.52	3.36
104	153.80	54.00	355.90	3.42	4.25
105	199.39	118.10	522.40	4.17	3.03
106	414.00	156.60	938.90	8.35	8.87
107	225.00	73.30	527.50	3.30	3.71
108	183.90	37.90	315.90	0.47	4.14
201	95.50	40.19	375.50	0.36	2.93
202	49.00	23.79	312.00	0.77	5.44
203	135.39	72.40	475.39	3.48	7.20
301	12.70	8.70	48.00	0.00	1.24
302	55.00	38.40	243.20	0.51	2.59
303	586.70	303.50	2485.60	5.32	37.27
304	44.10	32.59	303.29	0.32	1.31
305	45.70	28.30	280.00	0.00	0.49
401	106.79	180.70	614.30	7.71	3.30
402	22.70	76.00	448.00	2.14	1.71
403	24.79	50.19	222.10	1.38	2.20
404	66.40	87.69	289.00	4.65	6.64
405	21.50	33.10	188.70	0.50	3.51
406	167.50	160.00	1057.50	10.00	25.00
407	32.09	49.50	252.80	0.89	3.56
408	60.09	106.40	930.50	2.64	1.98
501	21.60	50.00	330.60	3.09	2.83
502	19.50	46.90	263.40	4.04	3.81
503	36.60	77.30	498.29	6.20	7.33
504	24.00	43.90	109.50	1.41	4.25
505	16.40	25.80	127.40	0.54	2.19
506	63.00	108.20	529.80	41.80	3.42
507	17.09	31.09	186.60	6.34	3.80
508	13.60	30.20	195.30	4.43	2.01
509	22.90	26.50	164.20	1.60	1.14
510	25.60	25.40	180.10	1.95	1.56
511	32.09	42.19	248.50	2.23	1.48
512	21.69	47.40	253.39	0.32	3.90
601	16.20	36.60	315.70	0.97	0.97
602	8.20	13.79	127.19	0.00	1.50
603	17.09	24.19	169.20	0.48	6.85
604	16.90	22.40	209.00	0.65	2.14
605	50.00	89.60	732.40	0.86	5.17

TRACT NUMBER	CR1	CR2	CR3	CR4	FR
606	324.29	393.29	3155.09	37.71	23.70
607	40.40	53.39	621.90	5.01	2.22
608	47.80	66.80	583.30	3.51	9.85
609	45.19	72.40	522.80	3.60	6.80
610	16.10	25.00	273.59	1.61	1.88
611	25.29	37.50	358.00	4.39	0.48
612	19.50	27.79	421.59	0.69	0.69
613	120.09	185.50	1665.09	7.00	10.50
614	530.50	599.20	4416.00	24.80	17.17
701	1767.59	828.70	5648.79	35.28	40.44
702	333.50	210.10	1284.60	21.19	5.82
703	297.80	239.39	1446.59	74.88	5.70
704	115.00	66.00	379.79	5.17	0.00
705	110.19	92.50	554.60	4.16	9.36
706	68.90	59.19	354.50	2.83	4.46
707	277.20	235.60	1413.70	8.62	24.42
708	109.29	123.10	543.20	4.34	4.34
709	148.50	142.10	769.00	4.75	6.34
710	194.80	169.80	937.09	4.02	10.46
711	205.30	107.59	558.00	5.66	8.49
712	134.50	105.70	582.10	2.08	6.68
801	340.60	293.00	2170.90	15.42	21.85
802	54.80	69.60	486.20	36.58	9.14
803	57.50	77.30	547.30	11.87	5.47
804	199.20	240.30	1196.89	9.51	9.51
805	118.00	126.00	821.40	10.20	7.28
806	119.29	144.60	724.20	6.16	11.77
807	404.90	438.00	2188.00	30.99	30.99
808	56.00	50.40	433.40	4.31	2.98
809	58.79	53.50	357.89	9.03	4.04
810	110.09	57.40	387.50	10.06	2.17
811	80.19	53.09	418.00	6.43	2.70
812	58.20	54.00	556.20	4.16	4.75
813	100.19	81.19	523.90	6.91	6.91
814	60.09	85.50	551.20	5.34	4.90
815	77.40	90.09	456.59	2.40	4.12
816	63.39	106.79	674.00	7.40	12.69
817	74.10	65.40	403.79	1.86	3.93
818	75.00	79.19	432.89	1.31	3.41
819	84.90	99.90	478.59	1.67	5.01
820	124.60	96.40	528.40	3.39	3.67
821	86.50	66.80	465.79	1.62	3.98
901	57.00	46.09	395.30	1.41	2.82
902	99.60	61.69	405.70	1.95	7.03
903	120.39	111.89	533.30	1.56	5.33
904	79.40	96.79	463.50	2.83	6.07
905	86.50	87.80	405.50	5.11	5.11
906	66.80	51.09	423.90	3.45	7.30
907	49.29	45.89	366.70	3.69	2.11

TRACT NUMBER	CR1	CR2	CR3	CR4	FR
908	45.19	41.50	369.20	4.33	3.09
909	133.50	168.79	882.09	3.87	2.79
910	48.59	40.09	268.00	4.37	1.09
911	32.70	31.20	245.60	3.34	1.59
912	64.40	52.59	442.40	5.88	2.24
913	79.80	96.69	637.40	5.39	6.11
914	106.69	117.50	626.00	3.89	15.89
915	39.70	36.69	357.70	4.41	2.65
916	40.09	40.89	289.70	3.90	5.01
917	28.30	28.79	264.20	1.57	2.62
918	72.90	60.00	525.90	2.74	2.32
919	61.29	62.40	424.79	1.13	4.34
920	52.50	52.69	387.80	2.44	1.68
921	52.59	50.40	337.29	4.43	2.57
922	82.50	79.69	470.60	4.17	2.54
923	58.79	53.70	412.89	0.80	1.60
924	53.90	59.19	459.69	0.26	3.47
1001	60.40	82.50	541.50	0.39	5.37
1002	60.50	84.10	535.00	0.46	3.68
1003	35.70	47.40	355.39	0.65	2.39
1004	29.59	29.00	175.00	0.19	0.38
1005	60.00	55.80	426.00	1.08	1.75
1006	59.59	45.80	313.10	3.21	0.72
1007	36.80	30.20	197.60	1.68	1.30
1008	46.40	32.30	205.19	2.12	1.79
1009	31.69	31.89	209.39	1.76	3.08
1010	33.59	25.50	209.69	0.53	1.33
1011	54.29	40.00	347.59	0.63	2.65
1101	48.50	41.79	334.90	4.72	2.60
1102	48.09	29.29	245.50	2.18	5.68
1103	81.50	36.30	380.90	0.73	2.57
1104	23.00	19.70	222.60	1.95	1.95
1105	17.90	15.30	169.60	2.04	0.90
1106	16.60	10.30	145.60	1.70	1.10
1201	30.20	26.50	199.20	3.26	2.35
1202	36.60	26.69	273.40	3.84	5.43
1203	67.30	67.90	470.60	8.80	7.36
1204	38.70	41.79	314.80	5.47	3.96
1205	40.89	47.19	426.70	2.53	10.97
1206	30.40	26.69	267.10	2.87	3.16
1207	50.70	34.19	231.50	2.41	0.80
1301	22.40	14.19	159.29	0.49	0.81
1302	16.50	22.59	178.50	2.08	2.08
1303	15.40	18.79	163.10	1.61	1.12
1304	22.50	16.29	172.39	0.87	1.26
1401	12.50	16.50	167.10	1.13	0.66
1402	11.89	15.00	143.00	0.41	0.82
1403	25.70	42.00	291.00	2.23	1.11
1404	17.90	12.19	140.70	0.27	1.63

TRACT NUMBER	INDCO	LAND	LOTH	MIXED
1	34.40	0.897	47.50	5.00
2	0.00	0.402	6.20	2.00
3	0.00	0.508	25.30	0.00
4	0.00	0.481	20.30	6.70
5	4.50	0.621	59.10	0.00
6	0.00	0.425	31.90	3.80
7	31.30	0.238	0.00	0.00
8	25.10	0.926	25.10	29.10
101	21.40	0.257	61.00	7.80
102	42.00	0.319	28.20	0.00
103	1.60	0.300	87.30	0.00
104	0.00	0.263	68.10	19.30
105	0.00	0.069	0.00	75.30
106	74.20	0.140	10.00	10.00
107	53.90	0.185	0.00	0.00
108	4.80	0.144	27.00	0.00
201	12.20	0.114	30.70	0.00
202	30.40	0.045	4.30	0.00
203	54.60	0.326	24.20	0.00
301	0.00	0.035	34.20	0.00
302	53.50	0.028	0.00	0.00
303	70.40	0.273	20.00	4.30
304	38.60	0.043	11.30	0.00
305	33.30	0.080	50.60	0.00
401	61.50	0.090	0.00	0.00
402	46.50	0.057	0.00	0.00
403	20.20	0.069	0.00	0.00
404	48.20	0.175	15.30	0.00
405	14.80	0.046	0.00	0.00
406	76.40	0.229	14.40	0.00
407	62.80	0.296	12.50	0.00
408	45.70	0.365	42.70	0.00
501	22.30	0.103	13.50	0.00
502	5.70	0.086	0.00	0.00
503	24.00	0.125	45.60	16.00
504	37.30	0.075	0.00	0.00
505	0.00	0.045	100.00	0.00
506	0.00	0.068	20.50	32.30
507	0.00	0.035	0.00	40.00
508	0.00	0.072	35.60	0.00
509	45.00	0.295	21.60	0.00
510	5.80	0.442	51.90	0.00
511	27.20	0.832	36.60	0.00
512	3.90	1.923	92.50	0.00
601	0.00	0.760	85.20	1.00
602	0.00	0.056	14.20	0.00
603	1.80	0.110	6.30	7.20
604	4.00	0.148	12.80	0.00
605	53.90	0.447	12.70	3.10

TRACT NUMBER	INDCO	LAND	LOTH	MIXED
606	51.90	0.676	43.60	1.80
607	0.00	0.047	0.00	0.00
608	12.50	0.056	0.00	0.00
609	16.60	0.072	9.70	0.00
610	0.00	0.057	0.00	0.00
611	2.10	0.278	76.70	0.00
612	13.10	0.038	0.00	10.50
613	87.90	0.173	2.20	2.20
614	75.80	0.417	10.20	13.90
701	70.30	0.498	29.60	0.00
702	49.00	0.107	0.00	51.90
703	49.10	0.169	29.60	0.00
704	100.00	0.105	0.00	0.00
705	9.50	0.115	6.90	0.00
706	29.40	0.050	13.70	0.00
707	38.30	0.060	0.00	0.00
708	48.00	0.075	0.00	0.00
709	27.60	0.065	26.10	0.00
710	17.20	0.057	50.00	0.00
711	15.30	0.052	71.10	0.00
712	53.60	0.176	30.50	0.00
801	48.90	0.418	15.50	0.00
802	0.00	0.085	0.00	0.00
803	16.00	0.105	12.20	0.00
804	58.90	0.112	0.00	0.00
805	12.10	0.106	0.00	22.40
806	49.20	0.138	15.20	24.60
807	44.80	0.098	8.10	0.00
808	37.00	0.089	21.30	0.00
809	10.50	0.095	17.80	0.00
810	2.10	0.233	73.00	0.00
811	2.20	0.226	65.90	0.00
812	16.10	0.118	14.40	5.10
813	22.90	0.221	0.00	0.00
814	26.60	0.154	0.00	0.00
815	2.20	0.131	0.00	0.00
816	36.30	0.065	0.00	0.00
817	17.70	0.253	13.40	0.00
818	16.70	0.131	0.00	0.00
819	7.30	0.150	4.00	0.00
820	15.10	0.145	0.00	0.00
821	4.40	0.136	0.00	0.00
901	4.00	0.171	0.00	0.00
902	17.10	0.105	0.00	0.00
903	10.30	0.145	0.00	0.00
904	7.40	0.093	0.00	0.00
905	4.30	0.069	0.00	0.00
906	0.00	0.114	0.00	0.00
907	56.70	0.326	4.20	1.80

TRACT NUMBER	INDCO	LAND	LOTH	MIXED
908	17.50	0.080	0.00	12.50
909	17.40	0.390	62.00	0.00
910	45.70	0.365	28.20	0.00
911	4.30	0.160	7.50	2.50
912	9.10	0.120	13.30	3.30
913	15.60	0.101	0.00	0.00
914	6.90	0.130	6.10	0.00
915	3.20	0.152	3.90	5.20
916	8.60	0.115	11.20	5.10
917	5.30	0.113	20.30	0.00
918	14.50	0.165	12.70	0.00
919	7.70	0.180	6.60	3.30
920	2.00	0.191	6.80	0.00
921	28.50	0.542	8.80	0.70
922	5.30	0.223	5.30	6.20
923	4.50	0.131	5.30	0.00
924	8.60	0.253	9.80	0.00
1001	9.30	0.321	34.20	0.00
1002	15.00	0.133	0.00	0.00
1003	0.00	0.159	0.00	0.00
1004	8.30	0.238	5.00	1.30
1005	0.00	0.327	3.30	3.40
1006	22.10	0.552	13.90	1.20
1007	30.20	0.526	23.10	0.00
1008	4.40	0.735	49.20	2.00
1009	7.70	0.387	16.00	0.00
1010	5.30	1.038	38.00	0.00
1011	3.60	0.356	8.10	9.50
1101	2.20	1.920	85.10	0.00
1102	8.60	0.208	34.10	0.00
1103	19.80	0.301	27.80	0.00
1104	1.70	0.555	10.20	0.00
1105	5.00	0.514	3.50	0.00
1106	6.70	1.107	26.60	0.00
1201	0.60	1.493	50.10	0.00
1202	43.40	0.273	5.10	0.00
1203	3.90	0.251	6.30	0.00
1204	10.40	0.383	7.50	0.00
1205	12.00	0.083	24.00	0.00
1206	0.00	0.098	0.00	0.00
1207	0.00	0.149	59.70	0.00
1301	3.80	1.697	67.30	0.00
1302	8.80	0.507	0.00	0.00
1303	3.30	0.618	13.20	0.00
1304	11.30	2.098	48.30	0.00
1401	6.90	2.457	57.80	0.00
1402	8.00	1.151	33.30	0.00
1403	27.70	0.611	7.10	0.00
1404	2.30	0.722	20.30	0.00

TRACT NUMBER	DENS	YOU	SEN	EDUC1	EDUC2	EDUC3	INC
1	28.50	20.94	11.40	7.49	48.44	8.59	10447
2	24.71	22.55	12.03	2.79	62.89	13.88	10833
3	19.05	18.45	14.26	4.37	66.67	19.22	13509
4	22.75	27.44	18.65	5.97	53.58	16.33	11457
5	34.67	30.84	23.21	2.44	74.83	24.81	10158
6	32.89	24.83	13.07	5.01	59.15	12.93	9364
7	59.00	42.41	15.31	3.21	67.72	20.29	9539
8	25.93	44.51	7.07	3.53	57.52	17.24	9681
101	292.68	81.24	4.25	1.16	94.32	35.73	12514
102	82.23	45.37	12.72	1.82	74.07	25.56	8281
103	139.39	56.68	4.06	1.11	69.60	29.28	5957
104	114.60	56.55	13.89	3.95	62.25	17.70	8611
105	61.20	34.87	19.14	3.51	58.19	11.05	7937
106	106.39	13.89	21.20	1.33	79.42	33.80	24556
107	83.51	49.17	10.69	0.82	88.77	41.56	15006
108	64.05	46.80	10.00	0.75	91.10	45.14	24604
201	83.73	23.36	13.90	1.01	89.61	51.43	27485
202	128.50	36.36	12.06	3.23	70.66	31.50	12881
203	62.39	23.97	14.61	2.91	74.14	38.25	22121
301	139.30	16.66	14.04	19.66	23.95	3.80	6433
302	148.00	19.07	14.18	24.31	24.47	2.82	9734
303	46.95	19.91	13.41	5.78	78.93	37.36	13498
304	137.86	16.51	16.61	22.36	27.73	5.61	8289
305	154.61	18.35	13.48	23.51	21.21	3.16	9077
401	51.85	19.28	9.25	2.14	62.69	13.80	13805
402	75.09	24.31	11.08	6.89	42.66	2.92	7820
403	65.87	19.73	11.50	3.84	41.97	1.55	9402
404	23.51	18.87	12.09	2.75	47.00	2.75	9913
405	49.80	22.23	7.63	2.23	44.55	3.59	10631
406	19.04	22.00	5.50	4.27	47.05	5.34	8295
407	30.71	18.28	12.22	4.28	43.11	2.80	12009
408	36.00	17.19	15.47	5.76	34.33	0.75	6506
501	58.69	20.75	9.80	6.66	36.58	2.15	9160
502	54.30	19.22	11.22	11.29	36.96	2.53	9030
503	63.28	20.42	12.07	14.31	23.75	1.13	6591
504	45.04	18.80	10.58	16.34	20.16	1.24	8784
505	37.51	18.12	12.68	12.58	24.50	4.13	8703
506	33.93	15.01	11.85	15.33	23.16	2.01	8456
507	56.25	20.06	10.73	14.77	19.73	0.00	8479
508	52.82	16.71	15.38	20.23	24.96	0.32	7602
509	44.55	17.45	10.65	8.59	36.72	2.35	9822
510	27.33	18.25	11.36	4.13	45.79	1.72	9972
511	22.33	18.59	13.74	7.38	47.69	6.01	10109
512	45.88	19.32	9.69	8.25	33.84	1.48	8443
601	38.12	19.21	16.07	1.96	56.60	7.56	10913
602	55.50	16.55	11.18	4.19	52.48	5.67	10328
603	41.66	19.00	12.29	4.99	47.25	5.48	11398
604	49.27	17.29	18.85	7.33	47.03	5.79	10654
605	32.66	21.55	9.87	4.92	40.46	3.65	9185

TRACT NUMBER	DENS	YOU	SEN	EDUC1	EDUC2	EDUC3	INC
606	38.65	22.30	14.11	12.25	31.17	4.56	7087
607	74.77	16.77	7.69	9.43	28.50	1.10	5823
608	29.00	17.52	16.11	5.70	30.46	0.72	7941
609	47.16	20.20	11.92	5.72	44.93	5.16	9475
610	63.94	17.25	14.69	3.74	40.37	2.16	6947
611	34.74	15.85	25.46	3.17	35.61	1.79	7378
612	46.29	17.00	15.05	4.95	36.56	4.84	9258
613	57.13	22.98	6.88	7.30	25.26	8.55	6319
614	18.06	23.66	15.26	10.67	37.80	0.00	10490
701	80.76	13.59	20.56	11.41	72.06	24.89	18975
702	63.62	30.50	11.99	18.87	34.54	3.97	7457
703	82.72	16.85	17.49	5.45	62.62	23.37	12038
704	100.00	16.55	15.17	11.12	43.96	5.35	6460
705	50.07	16.93	14.72	14.12	35.40	7.12	7792
706	85.00	15.29	15.74	6.13	48.03	17.15	10519
707	18.81	14.94	11.63	1.59	61.36	20.45	7611
708	64.94	13.73	12.90	5.65	42.55	10.52	6845
709	63.06	11.89	15.43	8.46	24.53	5.05	6394
710	65.36	28.82	21.09	6.57	50.57	7.37	7751
711	100.35	33.00	11.04	8.10	58.10	30.75	8964
712	85.46	16.54	13.83	10.93	30.64	5.97	5712
801	5.22	17.99	8.48	19.62	29.97	1.85	7939
802	23.15	17.58	16.36	9.88	32.60	4.56	6775
803	43.22	20.00	7.73	8.34	31.66	2.28	6879
804	36.54	15.40	6.18	12.28	26.77	0.62	5103
805	16.73	16.76	23.54	8.45	20.89	1.11	5270
806	55.75	19.00	12.83	8.13	26.65	1.17	5750
807	10.52	18.59	21.07	9.83	39.34	8.52	6750
808	81.43	16.32	14.47	7.63	41.64	10.08	5852
809	47.20	29.15	13.08	2.67	56.62	18.52	11368
810	87.37	35.04	10.69	4.49	58.84	21.60	9598
811	41.02	28.36	18.48	6.30	54.78	11.97	9881
812	63.89	19.96	9.56	8.82	34.69	3.73	5468
813	23.67	18.72	8.57	6.41	49.10	3.28	7516
814	19.85	19.20	13.77	7.81	41.71	11.91	6955
815	22.52	16.44	13.00	6.19	51.88	6.25	8463
816	22.50	16.19	7.93	4.49	51.12	1.84	7654
817	27.76	18.98	9.70	6.49	42.57	3.13	7543
818	34.96	19.31	10.57	7.05	38.86	4.23	7525
819	31.51	17.48	11.69	4.71	50.88	4.48	8275
820	28.75	17.35	14.44	5.87	48.14	4.41	8455
821	42.48	21.60	5.61	3.46	58.28	4.66	7379
901	38.64	20.07	3.46	2.96	53.76	4.06	7805
902	29.40	22.75	2.26	4.19	42.65	2.48	6663
903	24.53	18.68	5.42	7.01	35.05	2.13	6836
904	28.36	22.56	5.75	6.04	34.78	3.21	7793
905	35.53	16.71	7.88	11.52	35.47	1.60	6887
906	22.82	17.40	10.76	20.82	27.53	1.29	6580
907	30.56	20.00	11.66	7.44	42.78	2.18	9872

TRACT NUMBER	DENS	YOU	SEN	EDUC1	EDUC2	EDUC3	INC
908	26.45	20.38	9.85	6.54	40.48	0.96	10152
909	59.12	19.26	8.00	8.71	30.42	0.68	5003
910	38.52	19.56	11.39	3.35	52.57	4.66	10058
911	46.52	19.40	10.18	4.85	46.89	3.29	10813
912	39.24	18.87	16.66	5.34	48.22	5.66	10511
913	32.32	15.50	11.22	7.54	37.43	1.73	7225
914	29.51	19.49	10.58	6.17	39.06	5.43	7630
915	41.31	19.56	12.75	4.48	44.91	4.98	9361
916	39.34	18.87	10.68	3.06	44.86	4.49	9428
917	45.41	19.23	10.11	4.03	46.67	1.73	9891
918	39.40	19.01	8.94	4.38	44.54	1.70	8787
919	34.85	19.40	4.96	4.10	44.98	5.60	8019
920	37.59	19.81	9.98	3.93	45.10	2.34	10105
921	20.69	17.92	14.58	3.54	45.80	4.40	10415
922	22.47	17.31	16.57	4.34	57.44	5.95	11636
923	31.70	20.50	9.06	5.73	45.05	3.75	8243
924	36.35	19.53	5.91	5.89	49.09	2.99	7144
1001	42.11	18.14	8.35	10.57	42.05	1.54	7367
1002	38.40	19.23	6.33	3.66	47.52	4.17	7902
1003	28.97	18.51	11.41	6.89	53.55	5.68	9584
1004	25.40	16.43	15.97	2.46	63.65	10.19	11658
1005	29.12	19.37	13.50	4.11	50.04	4.61	9792
1006	27.69	18.26	13.06	1.47	56.52	5.20	10552
1007	21.32	17.52	16.90	3.45	60.14	6.53	12891
1008	18.41	18.69	17.14	2.93	66.70	8.26	12232
1009	15.38	16.07	17.35	1.61	64.87	6.70	11858
1010	19.16	17.04	17.43	6.13	58.48	8.14	11658
1011	31.63	19.46	10.95	7.41	51.82	5.69	8939
1101	33.25	17.83	15.43	5.97	46.79	4.76	9940
1102	19.20	16.58	19.60	4.81	54.01	5.95	9801
1103	17.22	18.07	13.33	7.01	60.39	5.52	11635
1104	16.73	18.37	12.14	4.53	56.02	8.32	11430
1105	18.75	19.52	14.01	5.08	59.94	7.77	11772
1106	13.53	16.44	19.45	7.18	61.37	11.81	13192
1201	10.40	13.82	16.96	2.35	68.12	21.23	14885
1202	31.33	19.37	12.20	4.94	47.62	6.97	9425
1203	24.63	17.56	16.92	8.64	36.15	5.03	8767
1204	23.19	16.57	22.80	5.66	49.72	10.66	10832
1205	44.69	17.94	10.59	8.54	33.69	2.82	7457
1206	35.48	18.80	12.65	5.38	43.53	5.05	9506
1207	41.38	19.93	16.06	3.93	68.61	21.00	14600
1301	12.49	14.87	20.92	3.95	68.68	14.71	13813
1302	13.49	16.71	16.88	1.47	76.50	20.30	14731
1303	12.03	18.63	15.86	2.80	76.55	20.52	15314
1304	15.01	16.86	13.12	4.17	65.96	11.30	11975
1401	17.31	17.58	9.95	4.28	59.79	6.08	10743
1402	14.37	19.68	9.46	3.34	62.29	8.88	11986
1403	15.71	19.27	13.99	6.90	54.40	7.61	11722
1404	13.16	17.98	12.79	2.83	64.41	7.71	12000

TRACT NUMBER	NWH	SPAN	AUTO	UNEMP	DROP	POP
1	2.04	6.08	367.90	4.28	7.30	3962
2	1.36	0.44	293.00	3.89	5.50	9245
3	0.93	1.60	348.10	3.65	3.20	6842
4	3.26	2.41	328.00	3.39	4.50	8352
5	4.08	1.26	720.50	3.61	3.60	7836
6	5.70	0.66	265.60	4.66	6.70	9276
7	4.56	3.52	178.90	3.03	5.50	9076
8	6.09	2.93	425.70	7.66	7.20	8429
101	4.40	0.36	95.70	2.58	6.80	10244
102	7.46	2.71	251.00	5.01	5.40	7312
103	21.61	0.64	86.50	5.18	5.30	6250
104	10.60	0.67	126.19	4.76	4.80	9627
105	30.35	6.99	110.89	12.86	5.60	2632
106	12.58	1.46	329.40	2.61	5.40	1915
107	3.38	1.45	241.29	2.74	5.50	7266
108	2.56	1.22	269.29	2.91	3.60	6277
201	1.67	0.34	324.60	1.91	2.90	5443
202	6.38	0.00	218.59	5.42	3.80	3055
203	5.83	2.20	264.10	1.93	6.30	4305
301	0.49	0.00	142.60	5.71	6.70	3264
302	0.00	0.93	110.70	6.96	5.70	1924
303	2.17	0.00	264.10	0.77	1.70	939
304	1.02	0.69	135.10	9.28	7.80	3033
305	0.99	23.03	141.20	5.31	11.70	2010
401	1.76	8.37	263.29	2.67	8.00	1815
402	3.39	0.77	128.80	6.29	10.00	2323
403	0.52	1.29	182.69	5.45	8.10	3623
404	1.52	3.18	194.00	7.96	13.90	1565
405	1.55	4.86	173.10	3.65	7.90	1992
406	0.00	4.25	255.00	11.72	11.50	400
407	0.00	0.00	230.10	2.44	6.60	2242
408	3.04	3.37	125.00	5.22	5.20	1512
501	0.25	0.00	202.60	4.60	7.40	3574
502	0.33	0.00	207.19	4.89	9.00	4453
503	9.93	6.60	76.10	5.77	15.20	1772
504	0.70	0.00	153.50	6.76	11.40	2117
505	0.38	0.00	160.89	5.71	8.50	1821
506	0.00	1.64	232.30	8.00	5.20	1459
507	0.31	0.95	177.69	7.16	14.20	1575
508	2.09	0.00	146.10	4.25	9.40	2483
509	0.11	1.28	208.10	4.23	5.80	4366
510	0.50	0.56	253.29	3.15	5.60	5112
511	1.65	1.71	255.50	3.17	5.80	6724
512	0.00	4.22	196.09	6.23	14.10	3074
601	0.00	0.00	230.00	3.83	5.70	4117
602	0.00	2.02	254.80	2.07	8.70	2664
603	1.46	0.93	225.79	4.33	4.90	4083
604	0.67	0.32	207.00	3.63	8.10	6061
605	0.62	0.60	164.20	5.09	8.90	4639

TRACT NUMBER	NWH	SPAN	AUTO	UNEMP	DROP	POP
606	1.50	0.00	98.00	16.90	6.30	928
607	6.29	5.25	62.90	7.56	21.70	3589
608	0.35	0.00	143.50	6.92	16.00	1421
609	0.00	0.00	151.20	4.71	11.80	2500
610	2.39	0.00	109.39	4.46	9.30	3709
611	3.65	0.00	131.20	6.27	9.00	2050
612	0.00	0.00	190.39	7.34	15.50	1435
613	5.60	0.00	141.10	6.01	10.90	857
614	3.05	0.00	200.30	8.67	14.10	524
701	28.74	3.61	135.89	4.91	6.20	1162
702	59.66	0.00	103.00	3.89	9.30	1718
703	18.50	6.07	184.00	5.65	8.70	2979
704	76.09	0.00	94.19	4.67	16.00	1740
705	37.46	8.82	107.10	6.82	15.60	4807
706	29.77	0.97	195.89	4.24	13.20	2465
707	69.54	0.00	196.79	8.13	13.90	696
708	82.86	0.00	106.09	7.90	11.50	2533
709	83.13	4.91	167.50	4.29	7.80	1992
710	21.98	4.34	140.89	6.63	13.00	1242
711	14.73	2.97	168.50	2.69	15.00	706
712	54.24	15.58	44.19	10.47	15.20	2393
801	33.29	12.85	142.60	10.40	7.30	778
802	47.00	13.66	105.60	3.68	14.30	1968
803	77.92	7.67	70.89	9.14	22.50	3265
804	89.53	28.43	42.80	6.45	15.90	1681
805	100.00	3.20	50.19	9.25	6.80	1372
806	93.38	0.00	61.60	16.27	22.50	1764
807	76.65	0.00	84.69	0.00	17.50	484
808	41.25	6.53	86.19	7.34	18.30	3013
809	9.40	14.48	255.70	5.12	7.70	3210
810	9.78	2.60	232.19	3.80	7.50	5068
811	12.66	2.87	222.00	2.95	5.90	2954
812	59.23	5.40	65.30	4.62	19.40	5048
813	69.19	7.58	141.30	5.57	12.20	4048
814	54.23	1.73	168.79	8.51	10.60	2244
815	80.41	6.77	126.19	6.94	10.90	2906
816	80.10	1.79	147.00	0.93	8.80	945
817	94.41	10.37	127.00	5.77	14.50	4831
818	89.08	9.23	129.80	8.01	15.90	3811
819	92.12	3.86	171.70	6.95	7.10	4191
820	91.51	2.23	143.90	5.81	7.60	3537
821	94.56	0.30	153.50	6.40	10.60	5523
901	96.33	4.40	156.40	6.60	9.60	6377
902	94.91	3.90	141.89	5.32	16.00	2558
903	96.95	2.63	113.50	5.58	14.30	3189
904	79.82	11.58	172.19	4.99	9.60	2468
905	53.56	14.41	114.69	9.50	13.90	2345
906	37.77	10.64	112.89	3.70	21.00	2602
907	0.00	2.45	193.10	2.96	6.70	3790

TRACT NUMBER	NWH	SPAN	AUTO	UNEMP	DROP	POP
908	0.80	0.00	159.80	2.65	5.80	1614
909	61.16	14.32	32.59	10.02	18.50	4650
910	1.83	7.95	223.39	6.06	6.20	3560
911	0.92	0.00	218.50	3.94	6.70	6251
912	1.14	3.50	259.00	2.85	6.00	3571
913	17.08	6.43	130.39	4.95	11.80	2780
914	44.01	16.10	124.10	7.75	15.30	3535
915	7.79	1.97	167.30	4.67	11.60	5660
916	0.78	0.00	215.50	5.01	11.50	3586
917	0.57	1.93	196.29	4.31	8.80	3815
918	8.20	0.00	249.50	5.15	11.60	4729
919	65.60	1.90	147.20	7.89	13.00	5298
920	3.49	2.21	201.00	1.97	4.80	6541
921	1.04	0.00	230.60	3.38	6.20	6992
922	1.90	0.00	229.80	3.74	6.70	4315
923	54.82	6.54	160.30	7.10	9.10	3741
924	86.75	2.93	137.40	4.17	10.60	7489
1001	74.55	0.74	128.10	8.32	9.70	7623
1002	69.60	2.35	152.30	3.05	9.20	4340
1003	11.58	7.10	209.50	3.42	5.60	4591
1004	0.11	2.42	280.70	2.49	6.00	5233
1005	13.45	1.82	203.70	3.32	10.60	7396
1006	1.17	0.95	224.10	2.93	6.20	9637
1007	1.02	0.00	287.50	2.61	3.10	5348
1008	0.76	0.00	270.60	3.70	4.40	6114
1009	0.48	0.46	279.20	2.14	4.60	4540
1010	5.45	1.63	312.30	3.99	7.20	11250
1011	49.96	2.98	213.39	2.70	9.80	9423
1101	7.24	1.35	186.29	4.69	6.00	8048
1102	2.45	0.74	298.40	3.89	7.60	2255
1103	0.36	0.00	303.79	1.70	2.90	2722
1104	0.32	0.00	274.90	4.68	4.70	8134
1105	0.35	0.43	277.80	3.04	3.40	8813
1106	0.54	0.00	303.79	2.91	3.80	9973
1201	2.87	2.12	272.70	2.64	4.60	7659
1202	4.48	2.17	232.39	2.99	7.20	4418
1203	8.98	7.52	166.09	5.05	8.90	5567
1204	0.93	0.58	222.00	3.63	4.10	7306
1205	5.78	26.46	172.60	1.09	10.40	2369
1206	1.69	11.73	207.30	5.88	8.30	3478
1207	2.29	7.85	318.90	6.54	4.80	2483
1301	0.49	0.00	356.40	2.90	2.90	6111
1302	1.25	0.00	338.00	2.86	3.70	6235
1303	0.24	0.00	325.20	2.94	4.50	6210
1304	0.77	0.42	327.89	2.47	6.20	12628
1401	2.60	0.66	283.90	3.33	3.90	14963
1402	0.73	0.14	295.79	3.45	4.00	9688
1403	0.99	0.00	285.70	3.79	5.30	6253
1404	1.23	1.38	330.90	3.69	3.60	7360

TRACT NUMBER	AHU	AHUO	SUB1	SUB3	SUB2
1	90.58	90.97	2.98	10.52	17.91
2	73.54	73.46	1.29	4.70	4.60
3	64.20	65.03	0.45	2.70	2.15
4	75.14	75.41	1.09	3.95	3.71
5	81.59	81.65	0.63	4.37	3.74
6	56.86	57.07	1.06	4.80	4.80
7	78.58	79.03	1.12	3.11	2.94
8	78.50	78.48	4.13	10.12	9.36
101	91.54	91.42	14.55	21.27	16.37
102	91.73	92.20	4.80	7.92	6.25
103	51.35	50.15	4.60	7.30	6.49
104	93.40	92.78	3.17	11.65	9.49
105	96.20	95.89	19.22	31.09	21.72
106	37.27	38.16	9.66	12.37	10.33
107	96.70	96.74	15.46	22.01	13.15
108	91.45	90.67	13.80	18.47	15.36
201	91.24	91.36	8.49	11.57	10.01
202	98.10	97.98	13.25	21.62	19.96
203	47.63	45.91	20.23	25.77	22.96
301	95.76	95.47	46.38	77.47	77.47
302	96.92	96.69	35.08	82.56	81.94
303	73.09	73.59	6.59	12.69	9.95
304	98.10	97.99	42.97	73.04	73.04
305	99.48	99.44	48.96	86.34	86.34
401	99.23	99.15	9.66	33.53	32.97
402	73.43	72.75	6.53	21.83	21.83
403	78.57	78.03	6.03	31.10	30.76
404	94.78	96.69	13.96	55.12	54.37
405	99.36	100.00	3.48	34.81	32.91
406	96.73	96.29	9.15	23.52	20.91
407	98.00	97.87	5.26	36.13	35.56
408	34.62	35.15	0.00	5.92	3.88
501	98.93	98.87	2.81	36.27	34.82
502	97.55	97.29	6.08	47.52	46.51
503	48.79	45.93	3.32	23.71	23.71
504	98.86	98.71	11.32	70.69	69.68
505	95.78	95.32	33.69	78.31	78.31
506	96.24	96.59	14.13	73.53	73.53
507	97.68	97.47	5.61	71.94	71.28
508	100.00	100.00	13.92	78.05	77.42
509	98.95	98.91	3.81	45.14	45.14
510	74.40	74.20	1.39	15.07	13.98
511	69.89	70.28	1.00	9.22	8.99
512	97.07	96.78	15.15	63.12	60.90
601	79.93	79.77	4.42	31.29	31.29
602	94.33	95.17	1.57	36.58	35.22
603	96.86	97.08	5.36	39.58	38.18
604	90.09	89.68	4.38	40.59	40.12
605	96.04	95.58	9.21	55.82	55.65

TRACT NUMBER	AHU	AHUC	SUB1	SUB3	SUB2
606	100.00	100.00	13.71	57.27	57.27
607	28.47	27.53	1.34	14.37	14.10
608	80.23	82.37	10.22	58.43	57.92
609	100.00	100.00	8.46	57.55	57.55
610	60.50	60.19	4.27	17.46	17.24
611	77.31	77.50	0.34	4.81	4.23
612	84.27	84.24	4.47	38.41	25.41
613	91.72	92.70	11.25	61.25	61.25
614	94.41	94.08	10.23	49.76	49.76
701	55.32	58.03	12.05	23.89	15.23
702	84.26	85.98	16.58	37.39	25.25
703	98.11	98.65	27.56	34.69	32.01
704	5.63	3.37	1.82	13.39	12.46
705	93.86	96.80	28.11	35.56	34.37
706	98.85	98.70	22.54	24.94	23.11
707	100.00	100.00	6.43	13.36	12.62
708	97.73	97.41	23.19	30.26	28.07
709	95.60	95.34	29.04	38.42	37.92
710	98.52	100.00	37.64	54.99	54.99
711	93.77	94.14	45.91	71.01	51.75
712	46.47	43.12	3.52	20.58	19.88
801	80.62	82.55	5.00	49.37	49.37
802	93.47	93.42	5.36	30.57	30.57
803	59.38	58.05	5.23	13.26	12.72
804	44.80	44.22	2.55	22.76	21.67
805	69.76	66.88	1.72	18.03	18.03
806	43.17	37.37	1.00	17.27	17.27
807	93.06	89.44	4.48	45.71	45.71
808	28.50	27.54	0.98	4.92	4.54
809	74.61	74.77	3.48	18.42	17.72
810	81.80	81.02	2.59	8.89	8.64
811	69.05	70.05	1.81	8.85	8.66
812	36.09	39.70	2.21	14.95	14.01
813	60.72	59.16	0.97	13.02	12.25
814	94.43	93.03	5.14	27.49	25.94
815	46.04	47.13	2.05	19.63	18.70
816	82.01	88.74	3.70	29.04	28.04
817	51.99	50.13	1.71	16.32	15.03
818	91.17	90.55	5.07	20.66	19.85
819	76.86	75.69	1.39	9.05	7.93
820	85.99	85.68	2.78	9.60	9.15
821	60.76	60.76	0.57	3.66	3.19
901	83.70	83.33	0.79	11.47	10.92
902	79.44	78.33	0.55	7.11	6.33
903	93.76	92.23	1.12	9.15	8.25
904	87.36	85.65	6.64	21.22	19.53
905	94.38	95.23	1.40	26.56	25.92
906	77.68	81.61	3.54	45.17	44.74
907	95.34	95.12	2.64	20.30	19.34

TRACT NUMBER	AHU	AHUO	SUB1	SUB3	SUB 2
908	94.85	94.56	1.78	40.39	40.29
909	6.94	8.41	1.31	4.16	2.91
910	86.49	86.26	4.14	17.24	16.84
911	95.35	95.24	0.79	18.42	18.42
912	86.66	87.16	4.89	6.70	6.40
913	85.24	87.67	4.09	28.27	27.86
914	87.32	87.52	3.57	17.89	17.14
915	91.39	91.43	2.09	12.50	10.29
916	93.70	93.24	1.53	21.61	19.57
917	97.22	97.16	0.53	7.96	7.96
918	93.97	95.12	2.48	12.39	11.33
919	84.73	84.41	0.59	10.35	9.80
920	95.44	95.23	1.42	7.35	5.24
921	92.47	92.28	1.91	16.07	15.82
922	91.47	92.81	0.93	4.38	4.36
923	87.70	87.02	1.45	10.76	10.24
924	75.82	75.53	0.93	7.20	6.27
1001	67.21	66.38	1.53	12.25	10.48
1002	70.05	73.77	2.14	8.88	8.52
1003	76.95	77.30	0.34	8.16	7.26
1004	83.21	83.28	0.52	4.13	3.67
1005	86.38	86.63	2.48	14.35	13.53
1006	82.51	83.22	1.09	8.70	8.36
1007	84.92	84.70	0.00	3.99	3.69
1008	77.80	77.50	1.34	5.08	4.55
1009	65.91	66.15	1.43	5.93	5.31
1010	38.23	38.32	0.82	3.99	3.84
1011	76.20	76.57	0.64	8.33	7.72
1101	75.45	75.28	0.53	4.39	3.86
1102	48.38	48.90	0.33	3.33	2.66
1103	65.25	66.02	0.53	2.23	1.05
1104	79.92	79.50	1.08	6.88	6.32
1105	88.32	88.08	1.09	5.60	5.39
1106	80.62	80.65	1.42	4.68	4.24
1201	69.52	69.36	1.70	7.58	6.83
1202	81.11	81.28	5.59	17.18	16.66
1203	92.85	93.12	2.25	15.70	15.25
1204	90.92	90.75	4.17	13.70	12.85
1205	95.44	95.15	4.79	39.20	39.20
1206	96.90	97.16	3.18	14.45	13.51
1207	63.59	64.22	1.17	13.15	12.07
1301	61.08	61.02	0.25	1.79	1.79
1302	75.06	75.84	0.86	2.31	2.04
1303	76.66	76.53	1.00	2.35	2.35
1304	29.35	29.27	0.94	4.46	4.25
1401	42.44	42.17	1.06	6.74	5.89
1402	50.63	49.98	1.26	6.72	6.33
1403	74.72	74.62	2.05	7.40	6.90
1404	49.52	49.16	1.43	6.62	6.45

TRACT NUMBER	APART	APARTO	OWNOC	PERNO	RENTL	STAB
1	9.95	9.57	35.35	8.94	[illegible]	45.90
2	18.89	18.93	38.03	6.25	140.19	44.30
3	11.06	10.43	40.93	6.43	201.96	50.20
4	44.22	44.00	25.90	3.09	153.95	33.10
5	89.32	89.14	4.78	1.70	164.96	19.30
6	68.98	68.78	15.94	5.47	134.38	19.60
7	91.02	90.74	4.49	2.92	155.51	14.60
8	49.25	48.93	21.39	6.11	150.09	21.20
101	90.45	89.92	3.84	3.51	165.22	15.60
102	97.33	97.21	1.45	5.25	135.79	16.00
103	96.54	96.14	0.00	9.74	122.01	9.60
104	93.31	92.81	1.96	6.37	125.77	19.10
105	75.92	75.93	4.45	4.45	116.35	25.60
106	93.34	94.08	0.00	2.83	243.50	8.40
107	91.98	91.96	3.60	4.93	178.91	8.00
108	92.62	92.63	5.30	3.53	205.66	10.70
201	73.67	73.65	13.71	1.66	194.64	18.70
202	74.45	74.34	5.96	2.78	144.37	13.50
203	90.91	90.58	2.04	1.40	214.11	7.30
301	57.53	57.53	15.15	10.30	99.46	41.60
302	46.09	47.18	15.95	9.90	101.91	54.20
303	86.97	87.85	4.40	6.33	209.24	6.90
304	54.13	54.12	13.05	7.68	96.77	41.60
305	62.11	60.96	15.03	9.51	91.72	44.60
401	10.42	10.47	41.04	4.22	108.27	50.00
402	55.49	55.94	19.42	13.18	80.01	52.50
403	28.12	28.15	29.71	9.38	91.67	39.10
404	4.65	5.18	32.78	6.01	116.01	44.40
405	3.00	3.23	49.65	7.99	104.24	34.50
406	7.18	8.14	45.92	12.59	114.06	40.10
407	2.70	1.51	50.00	7.12	104.26	50.00
408	100.00	100.00	0.00	12.96	73.14	23.00
501	2.20	2.32	34.21	7.37	100.45	39.00
502	3.63	3.63	32.62	5.35	97.40	42.30
503	70.54	72.13	9.45	10.28	73.09	37.30
504	4.15	4.70	30.38	12.12	90.76	46.70
505	57.56	52.85	23.57	7.62	87.94	41.90
506	13.98	12.94	22.99	6.98	90.33	43.40
507	2.97	1.80	24.00	3.79	96.52	39.50
508	2.21	2.31	32.08	5.18	93.62	54.10
509	2.63	2.31	32.27	10.05	98.60	48.10
510	16.04	16.19	31.12	6.01	118.17	40.30
511	21.79	21.50	36.28	5.78	109.33	45.60
512	10.46	10.72	32.45	9.16	94.84	48.30
601	20.13	20.29	26.26	5.07	125.59	33.50
602	7.75	7.45	33.11	6.35	116.93	39.70
603	5.22	5.46	35.13	5.75	110.83	42.30
604	11.26	11.60	37.56	5.33	99.64	44.10
605	10.91	11.41	27.42	7.50	106.79	43.60

TRACT NUMBER	APART	APARTO	OWNOC	PERRO	RENVL	STAB
606	12.38	14.28	34.50	11.32	93.78	37.60
607	89.49	90.72	2.58	17.97	78.77	19.90
608	2.72	1.79	27.51	9.53	89.13	29.30
609	6.22	7.42	39.05	8.15	100.08	41.50
610	63.76	64.82	12.58	9.78	76.70	27.70
611	82.01	82.23	0.00	11.41	68.92	49.00
612	34.93	36.63	22.30	4.60	85.52	40.30
613	9.60	10.06	33.33	7.29	113.95	36.00
614	25.11	26.60	31.03	10.83	84.97	30.60
701	91.49	90.43	0.00	8.67	203.53	1.00
702	47.54	46.35	12.14	21.68	125.51	21.10
703	59.17	59.64	14.97	6.68	113.46	14.90
704	54.49	54.34	0.00	22.66	112.21	0.00
705	52.48	54.62	13.15	14.67	87.62	21.20
706	38.32	35.49	34.97	11.26	118.19	9.00
707	16.33	11.59	25.36	10.14	113.44	29.40
708	68.77	69.30	8.80	7.20	91.23	23.50
709	60.37	59.72	9.09	4.86	83.39	32.30
710	68.41	64.58	12.08	11.87	82.98	32.70
711	80.15	85.46	0.00	7.15	74.66	33.50
712	76.11	77.08	0.00	14.95	79.32	24.30
801	25.00	21.31	20.93	15.50	81.49	32.90
802	19.13	17.53	21.75	10.79	108.69	26.30
803	55.32	57.64	12.29	14.46	90.39	11.70
804	68.48	69.52	0.00	11.75	79.09	6.00
805	62.33	66.89	7.57	6.91	79.72	27.90
806	67.83	79.01	0.00	9.50	78.15	31.00
807	14.28	11.80	29.19	7.45	83.92	46.40
808	92.49	93.29	3.04	10.73	84.99	16.60
809	40.55	41.13	15.98	5.91	147.51	23.00
810	57.22	58.02	8.91	5.94	136.76	17.50
811	46.03	47.72	11.11	7.19	134.75	29.40
812	72.95	70.90	12.29	16.79	79.92	24.90
813	53.76	53.58	16.33	10.76	114.24	12.50
814	14.83	14.83	22.32	5.54	97.99	26.10
815	42.03	43.64	27.55	7.73	117.56	21.90
816	9.25	9.64	30.22	4.18	108.02	38.70
817	24.37	23.35	18.02	11.18	106.47	16.70
818	26.17	28.16	24.22	6.07	114.24	19.00
819	37.93	36.93	21.73	6.09	117.32	22.80
820	26.21	23.75	26.90	6.77	115.30	25.40
821	77.19	77.08	11.21	8.13	112.22	10.70
901	27.02	27.17	23.49	8.90	119.87	9.70
902	50.00	52.04	13.34	10.56	117.70	10.70
903	29.50	27.01	22.00	8.93	119.06	19.20
904	10.02	9.31	26.62	13.31	115.15	32.30
905	22.86	16.03	25.07	19.52	114.10	23.30
906	9.54	8.08	28.43	11.88	102.47	30.90
907	8.34	8.73	27.73	8.06	119.68	39.20

TRACT NUMBER	APART	APARTD	OWNOC	PERSO	RENVL	[illegible]
908	7.72	7.11	27.61	13.17	110.44	[illegible]
909	99.58	99.49	0.00	26.17	71.06	23.[illegible]
910	23.27	23.51	30.90	9.01	128.13	36.90
911	5.38	5.34	33.74	7.18	121.37	34.70
912	24.64	24.13	23.23	5.07	114.51	33.20
913	13.93	10.76	27.87	13.51	118.58	[illegible]
914	35.04	35.03	27.85	15.07	112.[illegible]	23.10
915	15.34	14.93	24.90	9.83	124.82	30.90
916	13.87	14.42	26.94	13.42	125.45	37.30
917	1.96	1.73	34.06	9.15	120.71	37.[illegible]
918	4.39	3.48	31.32	11.21	126.90	30.30
919	20.32	20.30	31.09	14.36	131.[illegible]	13.2[illegible]
920	9.37	9.30	34.51	7.25	128.13	32.[illegible]
921	17.35	17.37	33.42	6.56	122.72	35.40
922	12.59	11.39	43.94	6.38	115.60	45.70
923	8.96	9.45	32.16	7.02	132.53	15.70
924	41.06	39.63	18.90	10.84	121.13	8.90
1001	39.18	36.42	18.45	15.20	116.83	7.00
1002	23.63	23.22	24.80	11.05	143.71	12.70
1003	20.89	20.44	36.83	9.35	128.69	25.70
1004	5.82	5.97	46.98	6.62	134.50	40.50
1005	18.08	18.09	32.17	8.42	127.77	32.00
1006	16.42	15.43	38.21	7.84	131.50	34.90
1007	2.86	2.59	56.59	5.74	135.49	51.10
1008	17.20	17.25	46.12	4.75	136.55	41.00
1009	11.58	11.32	55.10	5.97	137.58	46.50
1010	27.19	26.89	41.88	5.39	159.13	31.90
1011	20.07	20.49	29.50	7.25	148.59	15.10
1101	32.71	32.42	27.49	7.84	123.36	31.90
1102	41.26	40.41	32.49	2.98	139.03	21.10
1103	6.57	5.16	60.14	9.12	140.12	38.70
1104	8.52	8.69	51.93	6.28	134.85	38.20
1105	6.84	6.69	55.86	5.54	136.74	49.50
1106	3.12	3.15	64.18	3.87	139.49	54.90
1201	18.34	18.14	51.72	3.33	136.03	40.10
1202	26.75	25.88	20.62	7.17	128.21	32.60
1203	14.68	13.20	28.24	8.15	116.61	33.80
1204	30.13	30.02	29.11	5.08	123.48	38.80
1205	12.47	12.73	23.43	15.03	108.78	38.20
1206	13.16	13.53	29.20	4.60	122.17	33.30
1207	49.65	50.00	18.04	6.08	194.86	26.20
1301	4.62	4.64	78.83	3.35	145.44	57.50
1302	3.06	3.11	73.16	2.40	150.35	51.00
1303	5.49	5.39	75.73	3.40	154.47	49.80
1304	31.10	30.93	52.83	4.41	157.29	27.90
1401	16.59	16.60	54.92	7.92	117.64	36.10
1402	17.60	17.43	53.68	9.67	138.93	40.40
1403	15.86	15.67	47.72	6.53	139.92	42.10
1404	18.55	18.01	60.74	5.54	151.52	42.[illegible]

APPENDIX E

SERVICE EXPENDITURE DATA BY CENSUS TRACT

TABLE E-1

PER CAPITA EXPENDITURES BY NEIGHBORHOOD AND CENSUS TRACT

Neighborhood and Census Tract	COHC	COFF	COPP	COWS	COSE	Total
1	$0.70	$50.85	$99.00	$17.97	$9.29	$177.81
2	0.76	16.50	21.20	15.40	5.50	59.36
3	0.18	22.30	24.50	15.61	4.92	67.51
4	0.84	20.10	20.10	15.58	3.54	60.16
5	2.18	42.85	26.40	10.03	2.32	83.78
6	0.46	21.39	42.30	7.28	3.07	74.50
7	1.59	18.92	26.00	10.91	4.61	62.03
8	0.85	48.52	55.20	8.45	4.67	117.69
Brighton-Allston	0.98	28.31	35.27	12.15	4.42	81.13
101	1.01	19.36	34.20	5.39	1.37	61.33
102	5.71	29.30	44.90	8.17	4.05	92.13
103	0.68	19.53	32.00	2.36	1.16	55.73
104	2.76	17.43	54.60	7.52	3.02	85.33
105	8.75	52.19	75.00	15.39	9.06	160.39
106	6.03	87.67	171.90	22.43	9.47	297.50
107	1.83	21.00	51.30	11.99	5.28	91.40
108	2.59	29.17	55.90	15.45	6.94	110.05
Back Bay	2.89	26.11	51.51	9.11	3.96	93.58
201	0.75	25.23	61.10	15.56	2.19	104.83
202	2.62	27.71	28.70	19.10	3.90	82.03
203	0.89	95.72	116.50	11.40	7.95	232.46
West End	1.33	48.25	69.53	15.25	4.50	138.86

Neighborhood and Census Tract	COHC	COFF	COPP	COWS	COSE	Total
301	1.09	19.05	16.60	19.92	6.63	63.29
302	2.14	31.73	73.80	12.76	22.90	143.33
303	1.05	633.92	543.80	95.42	55.75	1,329.94
304	1.95	35.22	19.00	16.19	14.36	86.72
305	1.47	22.78	66.20	21.37	17.54	129.36
North End	1.57	78.31	80.74	24.30	17.68	202.60
401	$1.28	$84.09	$71.90	$25.70	$13.42	$196.39
402	0.11	26.22	36.40	12.13	4.90	79.76
403	0.79	42.12	25.20	11.18	6.30	85.59
404	1.37	121.69	117.00	34.25	18.94	293.25
405	0.67	53.63	19.60	13.56	5.98	93.44
406	1.12	610.52	407.90	67.51	73.87	1,160.92
407	0.28	142.96	116.40	25.18	18.96	303.78
408	0.11	201.89	237.40	1.62	10.28	451.30
Charlestown	0.66	99.00	84.68	18.15	12.10	214.59
501	0.55	47.27	29.50	25.35	13.11	115.78
502	0.32	27.42	20.80	25.08	12.11	85.73
503	0.35	163.65	67.60	23.55	10.24	265.39
504	0.12	28.83	7.70	42.90	17.39	96.94
505	0.68	16.76	8.90	14.15	14.52	55.01
506	0.67	62.76	11.20	42.06	25.23	141.92
507	0.39	29.07	10.30	11.69	12.51	63.96
508	0.39	30.73	6.50	16.81	15.87	70.30
509	0.71	52.43	53.60	16.31	13.06	136.11
510	0.24	68.67	44.70	20.41	8.21	142.23
511	0.18	56.74	40.50	20.44	14.11	131.97
512	0.46	89.37	159.60	31.54	11.80	292.77
East Boston	0.40	55.03	42.12	23.17	13.19	133.91

Neighborhood and Census Tract	COHC	COFF	COPP	COWS	COSE	Total
601	1.08	66.73	52.10	27.73	7.05	154.69
602	0.87	17.18	17.50	20.73	9.15	65.43
603	1.33	18.69	12.40	53.81	14.73	100.96
604	0.22	12.59	11.60	44.96	9.58	78.95
605	1.62	48.03	42.10	21.43	8.27	121.45
606	3.18	476.96	399.90	83.32	43.01	1,006.37
607	0.37	12.75	21.70	6.50	4.04	45.36
608	3.65	25.77	96.20	32.82	21.16	179.60
609	1.21	24.42	70.30	31.91	15.55	143.39
610	0.87	16.46	7.30	15.88	8.94	49.45
611	0.00	44.67	47.60	.60	2.02	94.89
612	0.31	10.63	2.70	12.83	5.78	32.25
613	$1.15	$89.04	$91.10	$48.69	$33.27	$263.25
614	3.08	349.53	447.30	67.93	33.63	901.47
South Boston	1.04	44.31	46.18	29.65	11.02	132.20
701	0.61	788.10	1,165.50	105.63	71.37	2,131.21
702	1.61	230.98	323.00	29.29	11.16	596.04
703	3.46	66.62	145.00	30.91	13.23	259.22
704	0.00	131.57	88.40	7.05	9.53	236.55
705	3.56	85.72	16.40	18.13	12.94	136.75
706	4.69	30.95	67.60	21.41	10.30	134.95
707	9.27	153.50	239.70	58.19	23.83	484.49
708	7.61	42.17	104.00	19.38	16.58	189.74
709	10.56	40.33	116.00	14.27	14.52	195.68
710	4.04	36.86	106.00	26.68	10.02	183.60
711	5.20	86.47	186.50	13.91	20.56	312.64
712	1.23	121.18	110.00	10.26	6.07	248.74
South End	4.10	119.81	161.02	24.72	15.34	324.99

Neighborhood and Census Tract	COHC	COFF	COPP	COWS	COSE	Total
801	0.57	294.27	659.40	53.64	47.31	1,055.19
802	2.23	31.02	57.70	21.83	13.43	126.21
803	1.11	27.87	39.00	16.07	5.05	89.10
804	1.12	63.55	115.80	18.98	10.79	210.24
805	2.87	55.62	134.80	24.15	15.11	232.55
806	1.50	34.22	127.30	26.14	20.63	209.79
807	6.66	94.60	368.80	60.86	5.36	536.28
808	0.47	10.13	26.90	4.07	1.72	43.29
809	0.69	14.26	15.10	19.12	4.68	530.31
810	1.36	24.09	28.80	15.02	4.19	73.46
811	1.54	22.73	32.90	19.11	6.32	82.60
812	0.17	6.04	22.50	12.89	3.29	44.89
813	1.55	30.16	61.60	16.37	6.15	115.83
814	1.67	27.20	76.60	31.18	9.47	146.12
815	0.80	26.26	64.70	18.16	3.39	113.31
816	1.42	48.45	85.80	15.59	15.91	167.17
817	0.18	37.91	73.90	13.47	7.51	132.97
818	1.19	28.03	59.60	13.85	9.52	112.19
819	$1.21	$10.92	$48.00	$14.35	$ 6.93	$81.41
820	2.86	17.26	55.00	12.15	8.35	95.62
821	1.67	11.05	32.30	10.22	3.10	58.34
Roxbury	1.28	27.61	61.86	16.45	7.24	114.44
901	1.46	9.57	51.30	14.63	6.42	83.38
902	3.75	33.41	31.70	7.68	10.94	87.48
903	4.97	23.93	61.00	25.02	12.03	126.95
904	1.77	18.55	52.60	20.89	12.81	106.62
905	2.82	13.01	41.50	23.55	13.48	94.36
906	1.03	23.46	74.80	33.96	12.55	145.80
907	1.65	44.29	20.60	26.23	8.07	100.84
908	1.88	18.91	38.20	23.57	9.96	92.52
909	0.09	19.69	53.10	0.26	2.34	75.48

Neighborhood and Census Tract	COHC	COFF	COPP	COWS	COSE	Total
910	2.10	25.02	78.70	26.16	12.32	144.30
911	1.27	9.72	16.30	21.69	7.10	56.08
912	2.05	25.64	14.90	25.43	7.69	75.71
913	2.96	21.96	35.00	23.40	8.02	91.34
914	4.05	22.88	48.60	19.51	8.24	103.28
915	3.08	16.17	26.90	17.57	6.50	70.22
916	1.60	21.28	28.70	19.17	6.79	77.54
917	1.12	16.00	26.90	14.16	8.42	66.60
918	3.35	12.91	34.80	15.05	9.98	76.09
919	1.55	14.40	59.70	18.07	6.46	100.18
920	0.63	16.33	22.00	18.58	6.74	64.28
921	1.74	24.01	47.10	29.84	7.34	110.03
922	1.26	28.29	38.10	20.48	6.97	95.10
923	1.41	24.47	69.80	33.79	6.51	135.98
924	3.87	19.15	44.40	14.91	5.19	87.52
North Dorchester	2.08	20.02	41.32	19.98	7.80	91.20
1001	$2.69	$14.01	$34.10	$ 8.37	$ 4.42	$ 63.59
1002	3.71	10.55	32.80	15.55	8.60	71.21
1003	1.64	9.97	20.70	27.27	6.21	65.79
1004	0.30	14.58	27.60	27.44	4.06	73.98
1005	1.09	14.44	25.90	23.40	5.68	70.51
1006	0.95	26.92	27.70	21.65	7.32	84.54
1007	0.63	19.97	23.00	28.69	8.63	80.92
1008	0.87	17.47	23.50	27.70	14.84	84.38
1009	1.20	30.25	45.00	21.63	9.59	107.67
1010	1.35	43.41	26.40	20.84	11.06	103.06
1011	3.12	12.95	11.80	17.58	5.66	51.11
South Dorchester	1.62	39.62	26.26	21.23	7.81	96.54

Neighborhood and Census Tract	COHC	COFF	COPP	COWS	COSE	Total
1101	0.37	62.58	74.20	15.10	6.44	158.69
1102	0.90	40.07	77.20	15.58	9.07	142.82
1103	1.08	33.64	40.40	31.56	11.62	118.30
1104	0.53	22.37	24.30	26.70	8.55	82.45
1105	0.38	19.05	9.40	17.41	8.29	54.53
1106	0.08	35.19	24.90	18.21	5.72	84.10
Roslindale	0.42	34.70	35.37	19.90	7.60	97.99
1201	0.56	31.88	58.30	30.29	6.84	127.87
1202	1.42	10.36	30.30	14.47	8.33	64.88
1203	1.85	32.90	36.10	25.80	4.90	101.55
1204	0.77	11.28	42.80	18.31	6.74	79.90
1205	0.60	19.32	53.10	19.17	8.32	100.51
1206	0.46	13.16	30.30	17.65	2.98	64.55
1207	0.57	19.67	46.50	7.91	3.97	78.62
Jamaica Plain	0.93	20.91	43.32	21.02	6.20	92.38
1301	0.08	32.46	35.30	18.88	10.52	97.24
1302	0.14	7.34	15.90	17.91	7.15	48.44
1303	0.02	22.12	18.70	18.38	8.51	67.73
1304	0.34	18.12	26.30	19.93	9.52	74.21
West Roxbury	0.19	19.58	24.50	19.01	9.04	72.32
1401	$0.35	$32.64	$26.60	$24.03	$ 6.34	$ 89.96
1402	0.40	25.20	29.10	17.10	8.35	80.15
1403	0.51	34.17	29.20	24.34	10.28	98.50
1404	0.52	31.10	27.00	27.18	9.65	95.45
Hyde Park	0.43	30.71	27.78	22.93	8.13	89.98
Boston	1.38	36.19	48.13	19.15	8.09	112.94