

A CORRELATION ANALYSIS OF
SELECTED URBAN PUBLIC SERVICE EXPENDITURES AND
SOCIO-ECONOMIC CHARACTERISTICS OF MICHIGAN
CITIES

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ABSTRACT

A CORRELATION ANALYSIS OF SELECTED URBAN PUBLIC SERVICE EXPENDITURES AND SOCIO-ECONOMIC CHARACTERISTICS OF MICHIGAN CITIES

By

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The determination of socio-economic variables which affect urban public service expenditures is a general deficiency in the understanding of public services. Given a long range land-use plan, the spatial distribution of expenditure requirements within urban areas is an essential prerequisite for orderly and efficient growth. Determinants of urban public expenditures help policy makers develop a better anticipation of the actual and future costs of land-use plans.

The need for a theory explaining the variations and difficulties in this formulation, difficulties in the measurement of the quality and level of services, urban-suburban disparities in the consumption of these services and scale economies are the main issues in the study of public services.

Simple correlation and regression analyses are used to analyse the relations of five services- police, fire, sanitation, parks and recreation, highway- and eight

socio-economic characteristics of cities, with 1970 data.

Economic variables are the most significant determinants for urban public services in cities of Michigan. There are few economies of scale, if any; there is a need for more qualitative data for further exploration of these economies. Expenditures vary by function and structure of cities; suburban cities differ from single cities in their allocation and spending.

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INTRODUCTION

Cities are in an age of accelerating change; an increasing migration of people from rural areas to cities is the main characteristic of the movement in communities. Another fact of urban life is technological change that raises standards of living but often creates new challenges in providing such urban services as hospital facilities, air pollution control, water supply and transportation. Another dynamic factor arises with increasing racial and economic disparities between central city and the suburb.

In the face of these changes existing methods of planning or performing public services must be continually appraised and modified to meet new circumstances. Urban communities, in general, suffer from the lack of overall planning. There are certain common services that all municipalities provide as centers of population, industry, and commerce; they include police and fire protection, traffic control, education, sanitation, street cleaning, and others. Economic activities in cities are becoming more service oriented and the demand for urban public services is constantly increasing.

A general deficiency in the understanding of public services is the determination of variables which affect

expenditures. The relationships between socio-economic characteristics and expenditures of the municipality is clearly relevant in this determination. If we know the forces that tend to increase or decrease expenditures and think they are appropriate determinants, we can attempt to change by modifying the characteristics of the municipality or by making policies on the expenditures directly.

Another question in public services that has long been interest to policy makers is whether or not there are economies of scale in the provision of these services. Although it is not the only consideration, it clearly is important in determining whether consolidation or metropolitan growth is desirable.

In the following chapters, we will first introduce the main issues in the study of urban public services. In chapter two, a review of selected studies will be presented; following this, the data and methodology of the analysis and validity of the case study will be explained. Analysis of the expenditures, effects of the independent variables, economies of scale and effects of suburbs on the central city expenditures will be studied in chapter four. The last chapter will include conclusions and some recommendations for further study.

CHAPTER I
ISSUES IN THE STUDY OF URBAN PUBLIC SERVICES

Need for a Theory, Difficulties

The appropriate line dividing public and private provision of goods and services has never been clear. Nevertheless, certain general principles have been used by welfare theorists to justify public as opposed to private supply. First, social, or collectively-consumed goods provide one of the best example for public supply. Social goods are goods which, once supplied, are available to all people, whether or not they have paid for them. They are also goods the consumption of which does not reduce the supply available to others. National defense is usually given as the best example of a pure social good. Another example at the local level, would be the control of air and water pollution. Goods such as these, once supplied to anyone, are equally available to all. Since people can not be excluded from the enjoyment of social goods, welfare theorists argue that people will not engage in voluntary payments for them, which means that the market can not satisfy such wants.¹

The principal problem of a public expenditure theory is to find some method of efficiently allocating community resources between private and public provision of

social goods. There are two related problems in this context. First, since there is no market by which preferences for social goods can be revealed, there is no guide which the government can use to calculate the required amount of goods, i.e., the amount of resources to be withdrawn from private use for public purposes. Second, social goods are consumed in equal amounts by all members of the community; therefore, there is no single most efficient solution to the complex problem of satisfying social wants.

One different approach to the theory of public expenditure in an urban area is that of C.M. Tiebout. In it, "The consumer-voter may be viewed as picking that community which best satisfies his preference pattern for public goods", having been offered a range of choices among jurisdictions, each of which has its "revenue and expenditure patterns more or less set."² Thus the problem of getting individuals to reveal their preferences is solved, much as it is in the private market sector, provided that there are enough communities from which to choose and the other assumptions of Tiebout's theory hold. These other assumptions are: full mobility, including the absence of restraints associated with employment opportunities; full knowledge on the part of "consumer-voters"; no intercommunity external economies or diseconomies associated with local public services; some factor limiting the optimum size of each community,³ given its set pattern of services

and communities constantly seeking to reach or maintain this optimum size.³

All of these approaches represent efforts of formulating a public expenditure theory for urban services. Indeed, several students of urban public expenditure such as Siegel, Bahl, Wilensky, Brazer, etc., have mentioned the lack of an adequate theory in explaining the variations of expenditures from one urban area to the other.⁴ In opposition, they do argue also that in formulating these theories their assumptions become unrealistic and many times they are no more than "an exercise in abstraction".⁵ Brazer for example, in his article argues that "Tiebout's model can not be said to be even a rough first approximation of the real world. The most pressing fiscal problems of metropolitanism arise precisely because of the very factors he denies in his assumptions. Even if individuals had full knowledge of differences among communities in revenue and service patterns and were willing to move in response to them and their own tastes, income, zoning, racial and religious discrimination and other barriers to entry to various communities would restrict their mobility."⁶ Another fact is that families and individuals do extend their activities, in working, shopping, and playing across community lines, so that there is no clean-cut coincidence between one's place of residence and the place in which services are consumed and taxes paid. Employment opportunities

do condition the choice of community of residence, particularly for lower income families, and for all families commuting costs, like all transport costs, restrict choices.

Another major limitation is that it seems impossible to separate clearly the demand from the supply side in an examination of the activity in the public sector. For example, the level and distribution of incomes can be viewed as a demand factor in that the quality and quantity of public services that a family desires is thought to be directly related to their level of income. On the other hand large proportions of low income residents may necessitate more police protection. Even more complicated is the fact that higher income levels generally mean higher revenue levels, giving the city government a greater capacity to supply public services.

Measurement of Urban Public Services

Government provides urbanites with tangible and intangible services. Direct government participation in rendering tangible services involves building and operating public facilities. Among building or investment decisions are what plant to build; how, where and when to build it; among the operating decisions are what quantity and quality of services to render, how, where and whom they should be rendered?

Our interest in public services is in those activities whose objective is to satisfy urbanites' desires

and thus enhance their welfare. Both pecuniary and non-pecuniary benefits of government services must be considered. The latter relate to cultural and artistic values of natural and man-made beauty. Although in the study we are dealing with the measurable services, the prevalence of non-measurable services must be recognized.

A few services have a basic output unit with well-defined physical characteristics. The best example is water, where the basic output unit is a cubic foot of water delivered to the place of use having a certain set of socio-economic characteristics. Street cleaning, police protection, fire protection services offer more or less the same degree of quality for different urban places. The municipal area served is the basic unit to be considered.

Hospital services and education are not easy to measure because of the complexity and number of quality dimensions associated with the units; standards are very different from one municipality to the other. Peculiar services exclusive to few cities, such as museum, arboretum, zoo, would not be appropriate for determinant analyses. For these peculiarities and for the difficulties of measurements, such services are excluded from the study.

Intrametropolitan Disparities

Local government, like the firm, benefits not only from its own actions but also from the actions of other governments. If no compensations is required, benefits resulting from actions of other governments may be classified as positive externalities.

The nature and magnitude of the intrametropolitan externalities is one problem of the central city. The flight of higher income families and some industries to the suburbs has diminished the fiscal capacity of the central city. In addition, the suburban residents through an interaction with the core city, draw heavily on public services and multiply such city problems as traffic congestion and air pollution. The exporting of the tax base from the central city and the importing of service costs find much support in empirical research.⁸ Hawley found an inverse relationship between per capita expenditures by the central city and the proportion of Standard Metropolitan Statistical Area population living inside the central city. Brazer, in examining 1953 expenditure data of the central city and overlapping government units found evidence to support Hawley's work. More recently, Kee has concluded that spending by the central city is significantly and positively related to the ratio of the fringe area to the total Standard Metropolitan Statistical Area population.⁹

There are two obvious types of exploitation which can occur. Suburbanites may impose costs on the city in their role as workers-commuters; they may also impose costs by their use of the city's facilities for shopping, entertainment, and so forth. In both cases, the increased costs are likely to be in terms of roads, traffic control, police protection.¹⁰

A third exploitation is possible; this can be by discrimination. Central cities tend to have increasingly greater concentrations of low income, poorly-educated residents, which increase demands for welfare, health, public housing and police protection, etc. To the extent that suburbs force or reinforce this concentration by zoning regulations or discriminatory practices in real estate transactions, suburbs can be regarded as exploiting the central city.¹¹

From the revenue side, commuters are likely to contribute in the following ways: non-residents income taxes, user fees; sales taxes, either directly or by the tax on output produced by commuters in resident industry and commercial establishments and increases in property taxes from resident industries and commerce which employ commuters. Other non-resident users may indirectly contribute to the city's taxes by increasing the value of city property and also, directly contribute to taxes via sales taxes or user charges.

Economies of Scale

The question as to whether or not there are economies of scale in the provision of public services has long been of interest to policy makers. Although it is not the only consideration, it is important in determining whether metropolitan growth in general, is desirable.

As you will see in the next chapter, several of the determinant studies have reported finding no observable economies of scale. Scale economies exist when an increase in output is associated with a decline in the average cost per unit of output. This occurs whenever an increase in output allows for a more efficient combination of inputs than was previously possible. Some capital equipment, for example, may be extremely efficient if their utilization is very high. Thus, the negative relationship between per capita expenditures and population with scale economies is the following: as population increases, output must be increasing and if this increase is associated with a reduction in cost (i.e., per capita expenditures), there is evidence of scale economies. However, this reasoning might be misleading. Population and per capita expenditures may not be a good determinant for per unit costs. We could think that if there were scale economies present, we would not necessarily expect expenditures to decline. On the contrary, they may well increase instead if it happens that the demand for the particular service is elastic, i.e.,

decreased costs per unit of output could lead to increased per capita expenditures for that particular service.

[For the existence or absence of scale economies, it is necessary to estimate the long-run average cost functions for specific government services.¹² The difficulties in making such estimates are considerable. Defining output is the main problem to solve plus the costs of both inputs and outputs. Although output definition for sewerage or refuse collection is not too difficult; output for services such as police, fire, recreation is very difficult to define.] Quality differentials should be taken into account.

Sacks, in his article about scale economies,¹³ puts more emphasis on density rather than per capita expenditures and mentions: "...per capita measures do not show any regularities, may not provide a good method for projecting municipal expenditures in urban areas, the expenditures per square mile may in fact do so."

Another factor that should be taken into consideration is the service level. [When population increases, there is a shift in municipal services in quality, organization and in process. At some instances, scale economies are absorbed by these shifts in the level of services. The introduction of indexes indicating quality and service levels may prevent this disappearance of scale economies.]

[In spite of the conceptual and empirical problems

encountered in estimating scale economies there are quite a few studies done for municipal services. Hirsch studied cost functions for residential refuse collection for St. Louis City-County cities and municipalities. Nerlowe studied electricity and its supply and found evidence of significant scale economies. Will, using a different approach, based his study on engineering specifications which are related to service level and service requirements.¹⁴

FOOTNOTES

1. See for a broader definition of social goods, R.Musgrave, The Theory of Public Finance, Mc Graw Hill, New York 1959, pp.6-12.
2. Charles M. Tiebout, "A Pure Theory of Local Expenditures," The Journal of Political Economy, 54(October, 1956), p.418.
3. The size at which its services can be provided at lowest average cost.
4. B.N.Siegel, "On the positive theory of State and Local Expenditures," Public Finance and Welfare, Kleinsorge Inc., (1965) pp.175-186; R.W.Bahl, Metropolitan City Expenditures, University of Kentucky Press (1968) p.69; G.Wilensky, Financing the Metropolis, Sage Publications (1970); H.E. Brazer. "Some Fiscal Implications of Metropolitanism," City and Suburb, Benjamin Chinitz, editor. Prentice Hall, (1970).
5. Brazer, Opus Cit., p.132.
6. Ibid., p.133.
7. W. Hirsch, "The Supply of Urban Public Services," Issues in Urban Economics, John Hopkins Press, Baltimore, (1968) p.477.

8. Amos Hawley, "Metropolitan Population and Municipal Government Expenditures in Central Cities," Journal of Social Issues (1951); H. Brazer, City Expenditures in the U.S., National Bureau of Economic Research occasional paper No. 66, (1959).
9. Gail Wilenski, "Determinants of Local Government Expenditures," Financing the Metropolis, edited by J. Crecine, Sage pub. (1970) p. 213.
10. Ibid., p. 214.
11. Noll and Riew, Financing The Metropolis, Opus Cit., pp. 481-515.
12. W. Z. Hirsch, "Cost functions of an Urban Government Service," Review of Economics and Statistics (February, 1965) pp. 87-92.
13. Seymour Sacks, "Spatial and Locational Aspects of Local Government Expenditures," Public Expenditure Decisions in the Urban Community, John Hopkins Press (1963) p. 180.
14. Hirsch, Opus Cit., p. 90; M. Nerlove, Returns to Scale in Electricity Supply, Palo Alto Institute for Mathematical Studies in Social Sciences (1961); R. E. Will, "Scalar Economies and Urban Service Requirements," Yale Economic Essays, V (Spring, 1965).

CHAPTER II

REVIEW OF SELECTED STUDIES

The purpose of this chapter is to review some of the most salient studies dealing with the relationship between municipal expenditures and socio-economic determinants. Interest in these determinant studies is a relatively recent phenomenon. Before 1950, the subject had been generally ignored,¹ since that time the number of article has been augmented. The intention, here, will be to review only those articles or studies which are pertinent to the present study. It is hoped that the review will contribute to a better understanding of problems associated with the study of the variation of municipal expenditures and their relationship with selected factors.

British Studies

The earliest study about municipal expenditures and services has been done in Britain. In 1910, C.A.Baker was interested in the cost of city management and population size. A second study on the question of municipal efficiency and scale economies was prepared by Local Government Committee of the London County Council in 1914.²

Long after Baker's and London County Council's study, in 1942, H.S.Phillips and K.S.Lomax dealt with the sub-

ject of municipal expenditures within the context of economies of scale. Phillips tried to determine what was efficient about municipal size in the light of broad industrial, social considerations. Lomax studying per capita expenditures, found that these are, primarily, a function of the population³

Studies in the United States before 1945

Two important studies have been prepared by Davenport in 1926 and by Ridley and Simon, in 1938⁴. The first was an analysis of per capita operational expenditures for local governments within the State of New York. Ridley and Simon, who undertook a major investigation of municipal activities measurement provide a striking exception. Rather than being an actual study in the expenditure patterns of various municipalities this was a survey of suggested criteria for appraising city administrations. Their observations shed new light on the whole area of municipal activities.

A group of economists, interested chiefly in public finance, has concentrated on the fiscal aspects of municipal government⁵. Mabel Walker's study attempts to get at the municipal scale economies. The emphasis is on the proportional distribution of the budget among the municipal departments of 175 cities above 30,000 population. Walker takes the average percentage of the total budget received

by each department in all cities and relates this to a few important influences, including time, wealth and population.⁶ The emphasis on actual expenditures has continued in contemporary urban economists and gained much interest of students of municipal activities after 1945. The best known researchers are the followings.

Hawley

Another new approach to the problem came about in 1951 with an article by Amos Hawley.⁷ The purpose of the Hawley's study was to test a hypothesis regarding the interdependence of populations lying within and without urban centers. He was concerned with discerning what variables had the greatest association with variations in municipal expenditures.

The procedure he used to measure the degree of association was a correlation analysis, and in general Hawley's findings indicated "...that the municipal government costs of metropolitan centers vary with the sizes of their satellite populations.....indeed, the association with satellite population is closer than with size of population in the cities concerned. That is true, moreover, of virtually every population variable employed, as well as of such nondemographic factors as number of houses and housing density."

Hawley's paper raised many provocative questions, most of which have been considered further and its major

assumptions have served as a basis for other studies.

Scott and Feder

In 1957, the study for 196 California cities over 25,000 population by Scott and Feder⁸ consists of a multiple regression analysis of per capita expenditures. As independent variables they used per capita property valuation, per capita retail sales, percent population increase and median number of occupants in dwelling units. As scale diseconomies they found that expenditures tended to increase as population rose but at the same time the use of total, rather than departmental, expenditures limits the significance of diseconomies and obscures the relationship between specific services and city socio-economic characteristics.

Brazer

The most comprehensive nationwide study on city expenditures was undertaken by H.E. Brazer who employed five different samples of 1951 data; the large sample contained 462 cities, 3 smaller statewide groups, and a smaller number of very large cities, including the overlying government unit. The analysis was made not only for total general operating expenses, but also for police protection, highways, recreation, sanitation, general control and others. Among the independent variables tested were: population density, median family income, intergovernmental

revenues, population size, population growth rate and manufacturing. It was primarily the first three variables that were found to be statistically significant.⁹

Fabricant, Fisher, Sacks and Harris

The above four students of public economy presented fruitful expenditure determinant studies in a consecutive way.¹⁰ Using cross-section data for 1942, Fabricant found current expenditures of local governments strongly related to population density, urbanization, and income. Significant correlations were also found when these three variables were related to school, highway, public welfare, health and hospital, police, fire protection and general control expenditures. Fisher repeated the Fabricant analysis with 1957 data, and found that the same variables no longer accounted for as much of the variation in spending.

Sacks and Harris modified the Fabricant approach by adding federal and state aid as additional independent variables. They found that level of income and aid payments explained a large part of the variation in spending, leaving the other variables insignificant.

In 1964, Fisher categorized the determinants under three major headings: (1) economic variables-per cent of families with less than \$2000 income, and yield of representative tax system as percentage of the U.S. average, (2) demographic variables-population density, urbanization,

percentage of population increase, (3)socio-political variables-index of two-party competition, percentage of population over 25 years of age with less than five years schooling. Two of his conclusions were:

"...variations in the state expenditures are the result of various political decisions: current decisions and decisions of the past which have become embodied in constitutions, charters, statutes, ordinances, etc..... Level of expenditures, as measured by per capita, for 12 of the 13 categories are very significantly correlated with the seven independent variables."¹¹

Hirsch

Werner Z. Hirsch is, perhaps, the most productive student of urban public economy and services. His several studies¹² dealing with urban public economy and services supply, cost function studies for education and refuse collection, scale economies and government consolidation for public services provide broad explanation of the variations in governmental expenditures for specific functions. In his very recent study, he mentions: "...expenditure determinants studies, while not yielding bonafide cost functions, can advance our understanding of why expenditure levels differ among communities and among services. In some cases, predictions based on these studies can turn out to be reasonably correct."¹³

The data which Hirsch compiled indicated that larger cities spend more on governmental services and that per capita government expenditures increase with an increase

in population. However, neither economies or diseconomies of scale appeared and when correlation analysis was employed to measure the degree of association between population size and per capita expenditures it was discovered that population alone is not a particularly a strong factor in accounting for variations in per capita spending for most services.

Pidot, Bahl

G. Pidot analyzed expenditures for the 81 largest metropolitan areas. His study is unique in that he used a principal component analysis to create six independent measures which were then assumed to describe basic characteristics of a metropolitan area. He found that the "degree of metropolitan development", "the level of general wealth", "and an "index of size" were important and in general were positively related to expenditures. He also found that state aid was significant for some functions, it was less important and less consistent in its effect.¹⁴

Roy W. Bahl did a study similar to Brazer's using 1950 and 1960 data for 198 central cities and in general adopted three different groups of determinants: demographic, economic and financial ability. He found the same variables to be important as in Brazer's analysis.¹⁵ Data were analyzed cross sectionally for 1950 and 1960, and for the changes in per capita expenditures between 1950 and 1960. The conclusions were, in general, quite simi-

lar to those reached in the earlier studies: the level of per capita central city expenditures is closely related to the size of the central city population, relative to that of the entire Standard Metropolitan Statistical Area.

FOOTNOTES

1. Up to 1950, studies were concerned with economies of scale, but later the effects of socio-economic characteristics have been recognized.
2. See C.A. Baker, "Population Costs in relation to City Management," Journal of the Royal Statistical Society, (December, 1910) p.73-79; and Comparative Municipal Statistics 1912-13, London County Council, (1915).
3. Hugh S. Phillips, "Municipal Efficiency and Town Size" Journal of the Town Planning Institute, XXVIII (May-June, 1943); and K.S. Lomax, "The Relationship between Expenditure per head and Size of the population," Journal of the Royal Statistical Society, CVI (1943) pp.51-59.
4. Clarence E. Ridley and H.A. Simon, Measuring Municipal Activities, International City Managers Assn., (1938).
5. Gerhard Colm, "Public Expenditures and Economic Structure in the U.S.," Social Research Vol.3 (February 1936); and Hansen and Perloff, State and Local Finances, Norton Co. (1944).
6. Mabel Walker, Municipal Expenditures, John Hopkins Press (1930).
7. Amos Hawley, "Metropolitan population and Municipal Government Expenditures in Central Cities," Journal of Social Issues (1951) pp.100-108.
8. Stanley Scott and Edward L. Feder, Factors associated with Variations in Municipal Expenditure Levels, University of California Bureau of Public Administration (February 1957).

9. Harvey E. Brazer, City Expenditures in the U.S., National Bureau of Economic Research, occasional paper No.66 (1959).
10. Solomon Fabricant, The Trend of Government Activity in the U.S. since 1900, National Bureau of Economic Research Inc. (1952); Gleen W. Fisher, "Determinants of State and Local Government Expenditures," National Tax Journal, XIV (December 1961) pp.349-355; S. Sacks and R. Harris, "The Determinants of State and Local Government Expenditures," National Tax Journal XVII (March 1964) pp.75-85.
11. Fisher, Opus Cit., p.354.
12. W.Z. Hirsch, "The Supply of Urban Public Services," in Issues in Urban Economics, John Hopkins Press (1968) pp.477-527, and "Expenditure Implications of Metropolitan Growth and Consolidation," Review of Economics and Statistics (August 1959) pp.232-241.
13. Hirsch, Issues in Urban Economics, Opus Cit., p.501.
14. G. Pidot, "A principal Component Analysis of the Determinants of Local Government Fiscal Patterns," Review of Economics and Statistics (May 1969) pp.176-188.
15. R.W. Bahl, Metropolitan City Expenditures, University of Kentucky Press (1969).

CHAPTER III

SETTING FOR THE ANALYSIS

Before going into Michigan's Municipal expenditures let us have a brief look to the United States' aggregate budget in order to have an idea of the distribution of revenue for diverse municipal functions.

Revenue of all city governments during 1969-70 totaled \$32.7 billion, up \$3 billion or 10.2% from the previous year total. City expenditures totaled \$34.2 billion in 1969-70, as against \$30.5 billion in 1968-69. General expenditure -i.e., spending other than for utility and employee retirement purposes- totaled \$27.7 billion in 1969-70 for the U.S. General expenditure for state and local government in 1969-70, totaled \$190.8 billion. Thus, municipal expenditures constitute, approximately, 80% of the total general expenditure.¹

The five general expenditure groups that were studied: police and fire protection, parks and recreation, highways, sanitation represent 34.9% of the expenditures in the U.S. average for 1969-70. In the next page, you will find a summary of functional distribution of municipal governments general expenditures for fiscal year 1969-70.

Function	Amount (millions \$)	Percent	Per cap. dollars
Total General Exp.	27.6	100.0	209.8
Education	4.5	16.4	34.4
Police protection	2.9	10.8	22.7
Highways	2.4	9.0	18.9
Fire protection	1.7	6.4	13.3
Sewerage	1.4	5.3	11.0
Public welfare	2.2	8.0	16.7
Hospitals	1.4	5.3	11.1
Parks and Recreation	1.3	4.7	9.9
Sanitation other than sewerage	1.0	4.0	8.3
Others	8.3	30.1	62.9

Table 1. MUNICIPAL EXPENDITURES IN THE U.S. IN 1969-70

Methodology and Scope of the Analysis

Intercity variations in per capita expenditures of municipal services are studied in the following chapters using a cross-section approach with 1970 data. Some recent studies have used county aggregates, placing the emphasis on the differences in per capita expenditures among county areas and ignoring overlapping political units.² This approach is less useful to the planner because it treats the expenditures of city and county governments as aggregates. The problems central to this study are directly related to the problems of coordinating fiscal and physical planning, and the objective of the statistical analysis is to identify, where possible, those factors that contribute to differential per capita expenditures among city governments. Although the analysis centers on the actual expenditures of city governments, it is based on a recognition that economic and social areas, not corporate boundaries, represent the most appropriate planning units.

Some early students of municipal expenditures pointed out that the administration of a governmental unit, no matter how small involves some over-head costs which are relatively fixed and unavoidable.³ They suggested that incorporated municipalities required a minimum of 10,000 persons for efficient performance of municipal services. For this reason, and because of the lack of data for smaller communities, this study involves only cities with

10,000 population or more. All of these municipalities are 82 in total but the lack of 1970 data for socio-economic characteristics limited us to a number of 58 cities for consistency in the analysis.

Thus, the purpose of the following analysis is to investigate primarily the expenditure determinants of selected urban public services in 58 municipalities of the State of Michigan. While identifying these socio-economic determinants and their correlations we will search for any observable economies of scale.

As you will observe in the analysis part of the study the expenditures of five different groups of city have been taken into consideration. First, cities larger than 10000 which include 58 municipalities in Michigan. Second, cities larger than 50000 representing the aspects of middle size cities because they are different from small cities by their economic, social and political structure.⁴ Third, eight cities larger than 100000 represent the metropolises of Michigan which are: Ann Arbor, Dearborn, Detroit, Flint, Grand Rapids, Lansing, Livonia, Warren. At the fourth sample we tried to isolate the "single" or independent cities which are simply those that are not located within a standard metropolitan area and stand by themselves without any dependence to another city. These 28 isolated cities are: Adrian, Alpena, Ann Arbor, Battle Creek, Bay City, Benton Harbor, Detroit, Escanaba, Flint, Grand Rapids, Holland, Jackson, Kalamazoo, Lansing, Marquett, Midland, Monroe,

Mt. Clemens, Mt. Pleasant, Muskegon, Niles, Owosso, Pontiac, Port Huron, Saginaw, Sault St. Marie, Traverse City, Ypsilanti.

As the fifth sample we took suburban cities; these are those cities located within a standard metropolitan statistical area but is not a core city. These, respectively are: Allen Park, Berkley, Birmingham, Center Line, Dearborn, E.Detroit, E.Lansing, Farmington, Ferndale, Garden City, Grosse Point Woods, Hamtramct, Harper Woods, Hazel Park, Inkster, Lincoln Park, Livonia, Muskegon Heights, Plymouth, Roseville, Royal Oak, St. Clair Shores, Southfield, Southgate, Trenton, Troy, Warren, Wayne, Wyandotte, Wyoming. All of these suburban cities are 30 in total.

After these categories of observation for variation of expenditures in different structures of city, several groups of city have been examined for economies of scale in each 10000 population bracket. Figure on the next page summarizes the distribution of different city sizes. The data restrictions diminished the number of cities within 10000-20000 population bracket. We took this into consideration in our analysis while making generalizations.

Another sampling was for the measurement of suburban exploitation on the central city services which we will explain in the next chapter. This sample consisted of the expenditures of central cities and socio-economic characteristics of its surrounding areas such as:

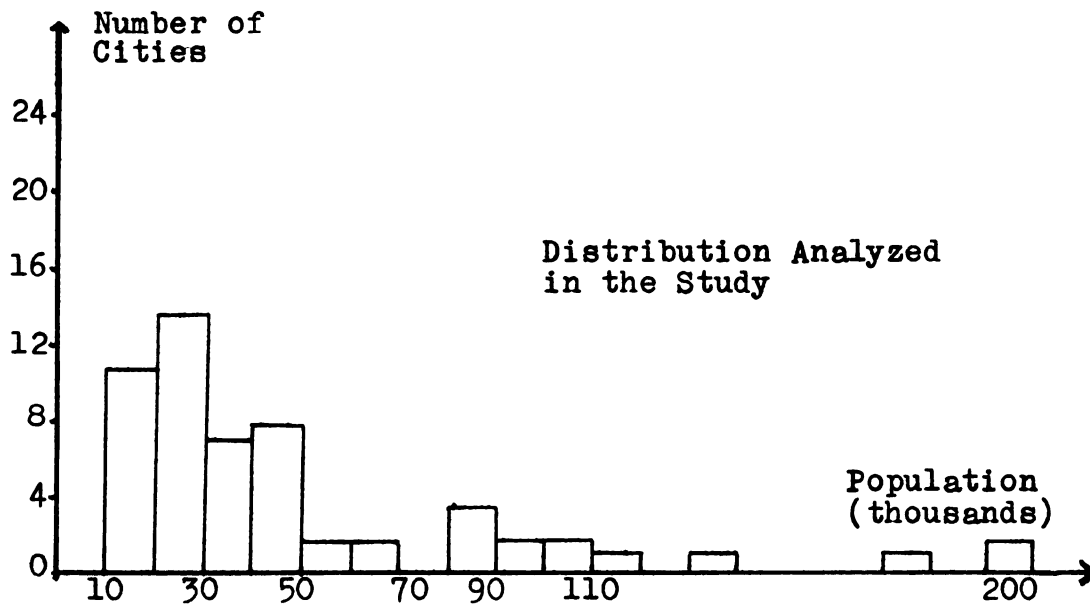
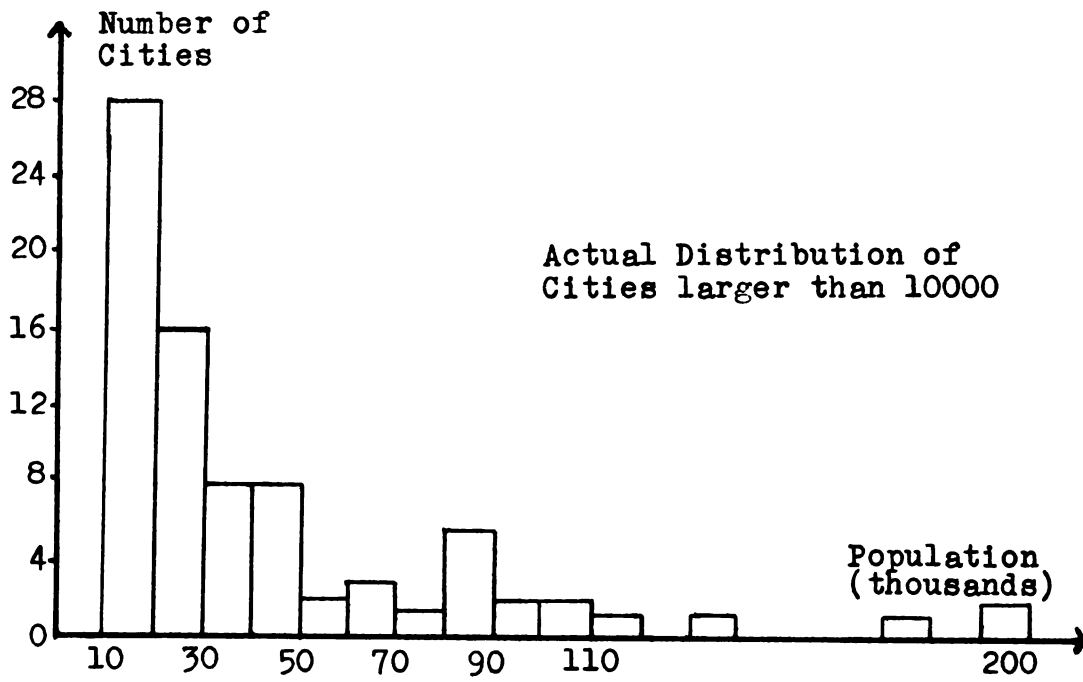


Figure 1. City Size Distribution in Michigan

Detroit-E.Detroit	Lansing-E.Lansing
Detroit-Livonia	Gr. Rapids-Wyoming
Detroit-Dearborn	Muskegon-Muskegon He.
Detroit-Grosse Pt.Woods	Pontiac-Birmingham

The statistical technique used in this analysis is the simple correlation between per capita expenditures of public services and socio-economic characteristics of cities. Along with this search of linear relationships among variables, we also undertook a linear regression analysis in an attempt to determine the degree of predictability of the independent variables⁵

The terms "independent variable", "determinant", "socio-economic characteristics" are used interchangeably. In general, where simple correlation coefficients are subject to analysis "independent variable" or simply "variable" is the preferred term; when analyzing regression coefficient "determinant" or "proxy variable" has been used.

Validity of a Cross-section Case Study

Most of the students of urban public services concentrated their efforts in Interstate Variations of Expenditures. Roy W. Bahl, in his book⁶, suggests that: "One method of approach to certain of these questions is to abandon the macro statistical approach in favor of intensive case studies of specific states, or, better yet, metropolitan areas." He further mentions that: "The advantages of a case study are numerous: a. quality variations within a given

metropolitan area or state are smaller; b. externalities associated with the public sector such as the urban-suburban exploitation hypothesis, may be examined more intensively; c. more accurate data for longer periods of time may be collected from local sources; d. the problems in the data created by differing intergovernmental fiscal arrangements may be eliminated by confining the analysis to a particular state or Standard Metropolitan Statistical Area."

The primary advantage of limiting the analysis to cities within a state is that it eliminates much of the statistical "noise" due to differences in functional responsibilities, and to historical or geographical peculiarities. Gail Wilensky mentions: "...case study apparently limits the generality of the findings. This is unfortunate, but if the determinants of local expenditures are, in fact, specific to a particular state this information is useful."⁷

FOOTNOTES

1. City Government Finances in 1969-70, Bureau of the census U.S. Dept. of Commerce, (1971)
2. H.J. Schmandt and G. Ross Stephens, "Measuring Municipal Output," National Tax journal, (December, 1960) pp.369-375.
3. Hansen and Perloff; Opus Citation, see p.21.
4. W. Thomson, Introduction to Urban Economics, John Hopkins press.(1965) p.24.
5. Heath and Downie, Basic Statistical Methods, Harper and Row Inc.,(1970) chapter 7; and see Appendix C for more information about statistical method used in the analysis.
6. Roy W. Bahl,(1969) p.137; Opus Citation see p.21.
7. G. Wilensky,(1970) p.202; Opus Citation see p.13.

CHAPTER IV

ANALYSIS

Urban Public Services Expenditures

[In the analysis capital outlays are eliminated, operating expenditures are expressed on a per capita basis except for police and fire protection expenditures. These are more relevant than the aggregated expenditure figure, because it measures the normal day to day expenditures on a per capita basis.

The five common functions those supported more or less to the same extent by all cities included in the study are: police protection, fire protection and other current expenses for sanitation, parks and recreation, and highways services. These municipal functions are expressed on individual bases to analyze more clearly the effects of the explanatory variables.

It should be noted that any comparison of dollar figures may not represent the true variation in per capita service among cities. Factors such as wage-rate variations and quality differentials may hide the true intercity differences in per capita levels.] These differentials are maximum when comparing cities' expenditures of different states. In our study concerning with one state this variation is

minimum; however, such a variation even very small exists.

Intercity comparisons of quality levels is beyond the scope of this work, although adjustment for quality differentials would greatly enhance the interpretation of the results of any interarea analysis of public expenditures.¹

Police protection expenditures

The police protection expenditures category includes both current and capital expenditures for the preservation of law and order and traffic safety, including highway police patrols, crime prevention activity, police communications, detention and custody of persons awaiting trial and the like.² The average amount spent per city resident for police protection for 58 cities of Michigan was \$ 22.36 in 1970.

As outlined on the following pages the correlated variables are: population density, total retail sales, percentage of negro head of household, intergovernmental revenue and property taxes. Total retail sales, intergovernmental revenue and property taxes variables are the most prevalent since their correlations exist in every set of observation. Percentage of negro is the second most significant variable; it is highly correlated (.9026) with the expenditures of cities bigger than 100,000. This result is consistent with the general trend of negro population location since the average percentage of negro

head of household living in big cities is the highest (9.96%), comparing to the average of the 58 cities which is 4.48%, the lowest. Population density variable is significant in single (isolated) cities and cities bigger than 100000 population.

[The importance of the non-white population and density in explaining variations in police expenditures may result from the relatively lower economic status of residents in the more crowded urban areas or of the negro population. Further, higher population densities may lead to greater vehicular and pedestrian traffic control problems, thereby requiring a higher level of per capita expenditure for police protection.]

OBSERVATION GROUPS

VARIABLES	CITIES ^a >10.000	CITIES ^b > 50.000	CITIES ^c >100.000	SINGLE ^d CITIES	SUBURBAN ^e CITIES
Population Density	.2214	.3359*	.7611*	.5917*	.2034
% of Household income <\$3.000	.0748	.5512*	.6078	-.0892	.0857
Total Retail Sales	.3070*	.7318*	.7881*	.4682*	.3499*
Household Buying Income	.1723	-.3011	-.5402	-.2768	-.1168
Median Home Values	.1654	-.2522	-.7790*	-.1310	-.1792
% of Negro Head of Household	.4942*	.8754*	.9026*	.8193*	.2978
Intergovernmental Revenue	.3058*	.6884*	.7914*	.4265	.3894*
Property Taxes	.3061*	.6831*	.7492*	.4286	.3912*

a. 58 cities in total.

b. 18 cities in total.

c. 8 cities in total: Ann Arbor, Dearborn, Detroit, Flint, Gr. Rapids, Lansing, Livonia, Warren.

d. 28 cities in total, exclude all Detroit suburbs and some dependent cities such as E. Lansing, Muskegon Heights, etc.

e. 30 cities in total, include all Detroit suburban cities and some dependent cities mentioned above.

* Denotes significance at the .05 level.

Table 2. SIMPLE CORRELATION COEFFICIENTS OF POLICE PROTECTION EXPENDITURES AND INDEPENDENT VARIABLES.

OBSERVATION GROUPS

VARIABLES	CITIES ^a >10.000	CITIES ^b > 50.000	CITIES ^c >100.000	SINGLE ^d CITIES	SUBURBAN ^e CITIES
Population Density	.0006 (10.86)	.0009	.0018	.0019	.0005
% of Household income <\$3.000	.0686 (12.71)	.6146 (8.96)	.7361 (10.99)	-.2035 (8.23)	.0846
Total Retail Sales	.0000	.0000	.0000	.0000	.0000
Household Buying Income	-.0004	-.0009	-1.1030 (1257)	-.0011	-.0002
Median Home Values	-.1675 (10.56)	-.2417 (10.20)	.4244 (18.85)	-.2293 (9.53)	-.1850 (10.23)
% of Negro Head of Household	.2723 (19.15)	.4664 (15.69)	.0001	.4595 (15.27)	.1624 (2176)
Intergovernmental Revenue	.0001	.0001	.0001	.0001	.0001
Property Taxes	.0001	.0001	.0001	.0001	.0001

a.58 cities in total.

b.18 cities in total.

c.8 cities in total: Ann Arbor, Dearborn, Detroit, Flint, Gr. Rapids, Lansing, Livonia, Warren.

d.28 cities in total, exclude all Detroit suburbs and some dependent cities such as E. Lansing, Muskegon Heights, etc.

e.30 cities in total, include all Detroit suburban cities and some dependent cities mentioned above.

Table 3. SIMPLE REGRESSION COEFFICIENTS OF POLICE EXPENDITURES
AND INDEPENDENT VARIABLES

(Standard error of estimate is in paranthesis where
regression coefficient is significant)

Fire protection expenditures

Per capita fire expenditures include current outlays for "fire fighting organization and auxiliary services thereof, inspection for fire hazards, and other fire prevention activities. Also included are costs of fire fighting facilities, such as fire hydrants and water, furnished by other agencies of the city government."² Average per capita fire protection expenditure in 1970 within 58 cities of Michigan is \$15.45.

Significant correlations between the city expenditures groups and other socio-economic variables are summarized on tables in pages 38, and 39. Expenditures in cities bigger than 100000 exhibit higher correlation and regression coefficient with fire expenditures than smaller cities. On the contrary, suburban municipalities do not exhibit any significant correlation. This is, perhaps, due to the diversity of the single city functions such as; dormitory, industrial, touristic cities, etc.

In general, the most important variables seem to be the wealth variables: percentage of households having an income of less than \$3000 and buying income per household. The former positively but the latter is negatively related to the expenditures. This negative relationships exists also for the median home values and fire expenditures which means that rich municipalities spend little for this service. This correlation becomes stronger in big central

OBSERVATION GROUPS

VARIABLES	CITIES ^a >10.000	CITIES ^b >50.000	CITIES ^c >100.000	SINGLE ^d CITIES	SUBURBAN ^e CITIES
Population Density	-.0390	-.1392	-.1360	.0395	.2996
% of Household income <\$3.000	.4220*	.7245*	.8923*	.2120	.1686
Total Retail Sales	.0382	.1106	.1835	-.0658	-.0556
Household Buying Income	-.3316*	-.4254*	-.8678*	-.6168*	.0459
Median Home Values	-.4058*	-.3344	-.8043*	-.4739*	-.0952
% of Negro Head of Household	.1777	.4102	.4865	.1912	-.0523
Intergovernmental Revenue	.0070	.0666	.1142	-.1125	-.2953
Property Taxes	.0110	.0506	.0554	-.1026	.0444

a. 58 cities in total.

b. 18 cities in total.

c. 8 cities in total: Ann Arbor, Dearborn, Detroit, Flint, Gr. Rapids, Lansing, Livonia, Warren.

d. 28 cities in total, exclude all Detroit suburbs and some dependent cities such as E. Lansing, Muskegon Heights, etc.

e. 30 cities in total, include all Detroit suburban cities and some dependent cities mentioned above.

* Denotes significance at the .05 level

Table 4. SIMPLE CORRELATION COEFFICIENTS OF FIRE PROTECTION EXPENDITURES AND INDEPENDENT VARIABLES.

OBSERVATION GROUPS

VARIABLES	CITIES ^a >10.000	CITIES ^b > 50.000	CITIES ^c >100.000	SINGLE ^d CITIES	SUBURBAN ^e CITIES
Population Density	-.0001	-.0003	-.0002	.0000	.0007
% of Household income <\$3.000	.3583 (7.85)	.7312 (5.20)	.7343 (4.74)	.3333 (5.10)	.1462 (9.95)
Total Retail Sales	.0000	.0000	.0000	.0000	.0000
Household Buying Income	-.0007	-.0001	-.0021	-.0017	.0000
Median Home Values	-.3807 (9.24)	-.2900 (8.31)	-.7738 (8.18)	-.5720 (7.95)	-.0866
% of Negro Head of Household	.0907	.1978 (12.47)	.1554 (12.98)	.0739	-.0288
Intergovernmental Revenue	.0000	.0000	.0000	.0000	-.0018
Property Taxes	.0000	.0000	.0000	.0000	.0000

a.58 cities in total.

b.18 cities in total.

c.8 cities in total: Ann Arbor, Dearborn, Detroit, Flint, Gr. Rapids, Lansing, Livonia, Warren.

d.28 cities in total, exclude all Detroit suburbs and some dependent cities such as E.Lansing, Muskegon Heights, etc.

e.30 cities in total, include all Detroit suburban cities and some dependent cities mentioned above.

Table 5. SIMPLE REGRESSION COEFFICIENTS FOR FIRE EXPENDITURES AND INDEPENDENT VARIABLES.
(Standard errors of estimate are in parantheses where coefficients are significant)

cities (regression coefficient is .7343 with standard error 4.74) which are mostly the settlements of poor people and lower grade housing.

Sanitation expenditures

The per capita sanitation expenditures include operating expenditures for sewage disposal, street cleaning, waste collection, and payments to other local governments for such services. Sanitary engineering, smoke regulation, and expenditures for other health activities are not included in the analysis. For 51 cities of Michigan per capita sanitation current expenditures are distributed about a mean of \$7.59. This average is slightly higher than 1960 average of 198 cities of the United States which was \$7.40.³

Among the eight determinants, percentage of Negro head of household is the most significant one for five different observations. The highest correlation, .57 at the 5% significance level (see page 42), is with cities having a population more than 50000. The regression coefficient is .2616 with a standard error of 6.06. The importance of this variable is not at the same degree for other observations, it is significant however, for single isolated metropolitan cities and cities bigger than 100000. As you might examine from the table in the page 42, the other most important variables are intergovernmental revenue and property taxes. The highest correlation (.6016 and .6423)

exists again between these variables and expenditures of cities bigger than 50000, the regression coefficients are not very high, however. This means that the explanation as a proxy variable is less stronger than in the previous observations.

Total retail sales is another important variable which does show some correlation with expenditures of suburban cities. This is consistent with the existing conditions, for there is relatively less commercial activity in these suburban cities than the single central cities.

Bahl and Brazer, in their study have found that per capita expenditures are positively related to population density⁴. In our study we found also important relationships to population density with .5330 correlation coefficient except in the observation of suburban cities' expenditures. The absence of correlation in this case probably stems from the diversity of settlement patterns, tastes of the residents and less densely populated character of these cities. The high correlation between density and single central cities proves this hypothesis.

OBSERVATION GROUPS

VARIABLES	CITIES ^a >10.000	CITIES ^b > 50.000	CITIES ^c >100.000	SINGLE ^d CITIES	SUBURBAN ^e CITIES
Population Density	.3753*	.5330*	.4285	.4632*	.3228
% of Household income <\$3.000	-.1791	-.1268	.1698	-.3025	-.1900
Total Retail Sales	.3242*	.5973*	.8580*	.4465*	-.0598
Household Buying Income	.0554	.1853	-.0103	.0376	.0347
Median Home Values	.1200	.1467	-.1132	.2580	.0102
% of Negro Head of Household	.1267	.5771*	.6813*	.4504*	-.3802*
Intergovernmental Revenue	.3569*	.6016*	.8321*	.4696*	-.1087
Property Taxes	.3876*	.6423*	.8761*	.4897*	.1287

a. 58 cities in total.

b. 18 cities in total.

c. 8 cities in total: Ann Arbor, Dearborn, Detroit, Flint, Gr. Rapids, Lansing, Livonia, Warren.

d. 28 cities in total, exclude all Detroit suburbs and some dependent cities such as E. Lansing, Muskegon Heights, etc.

e. 30 cities in total, include all Detroit suburban cities and some dependent cities mentioned above.

* Denotes significance at the .05 level

Table 6. SIMPLE CORRELATION COEFFICIENTS OF SANITATION EXPENDITURES AND INDEPENDENT VARIABLES.

OBSERVATION GROUPS

VARIABLES	CITIES ^a >10.000	CITIES ^b >50.000	CITIES ^c >100.000	SINGLE ^d CITIES	SUBURBAN ^e CITIES
Population Density	.0007	.0012	.0009	.0011	.0004
% of Household income <\$3.000	-.1262 (6.17)	-.1203 (6.54)	.1795 (6.90)	-.5131 (5.75)	-.1717
Total Retail Sales	.0000	.0000	.0000	.0000	.0000
Household Buying Income	.0001	.0004	-.0000	.0001	.0000
Median Home Values	.0800	.1196 (5.39)	-.1399 (6.76)	.3325 (5.09)	.0056
% of Negro Head of Household	.0500	.2616 (6.06)	.2796 (6.19)	.1895 (6.16)	-.1690 (8.98)
Intergovernmental Revenue	.0001	.0001	.0001	.0001	-.0004
Property Taxes	.0001	.0001	.0001	.0001	.0001

a.58 cities in total.

b.18 cities in total.

c.8 cities in total: Ann Arbor, Dearborn, Detroit, Flint, Gr. Rapids, Lansing, Livonia, Warren.

d.28 cities in total, exclude all Detroit suburbs and some dependent cities such as E. Lansing, Muskegon Heights, etc.

e.30 cities in total, include all Detroit suburban cities and some dependent cities mentioned above.

Table 7. SIMPLE REGRESSION COEFFICIENTS OF SANITATION EXPENDITURES AND INDEPENDENT VARIABLES.

(Standard errors of estimate are in parantheses where coefficients are significant)

Parks and recreation expenditures

The parks and recreation expenditures include operating expenditures for cultural-recreational activities, organized recreation, swimming pools and bathing beaches, municipal parks, and special recreational facilities such as sport arenas, recreation piers, skating rings, golf courses, playgrounds and yacht harbors. Expenditures for cemeteries are excluded because the irregularities of the sizes and expenditures as well as special functions such as auditoriums, museums and state park maintenance.

The most common variable has been total retail sales for three observations. The other most significant variables are: median home values, intergovernmental revenue, property taxes and percentage of household income less than \$3000. Median home values and expenditures have a correlation coefficient of .4444 and a regression coefficient .6219 with a standard error of estimate 4.89 in in single or isolated cities. The same is not true for other observations.

The consistency of data is limited in this function therefore there are not much correlations in the aggregate data. Sales or volume of commercial activity may lead to an acquisition and maintenance of more open space. Quality differentials in maintenance could be explained by the correlation of median home values and expenditures for single (isolated) cities.

OBSERVATION GROUPS

VARIABLES	CITIES ^a >10.000	CITIES ^b > 50.000	CITIES ^c >100.000	SINGLE ^d CITIES	SUBURBAN ^e CITIES
Population Density	-.1310	-.2031	-.3790*	.2523	-.3384
% of Household income <\$3.000	-.0010	.1535	.0156	-.3737*	-.0920
Total Retail Sales	.3550*	.2903	.1126	.3868*	.5074*
Household Buying Income	.0432	.1904	.3591	.1640	.1594
Median Home Values	.1146	.1701	.2119	.4444*	.1792
% of Negro Head of Household	.1376	.2123	-.0538	.1825	-.1911
Intergovernmental Revenue	.2557*	.2197	.0813	.3263	.4929*
Property Taxes	.3050*	.2556	.1199	.3271	.6462*

a. 58 cities in total.

b. 18 cities in total.

c. 8 cities in total: Ann Arbor, Dearborn, Detroit, Flint, Gr. Rapids, Lansing, Livonia, Warren.

d. 28 cities in total, exclude all Detroit suburbs and some dependent cities such as E. Lansing, Muskegon Heights, etc.

e. 30 cities in total, include all Detroit suburban cities and some dependent cities mentioned above.

* Denotes significance at the .05 level.

Table 8. SIMPLE CORRELATION COEFFICIENTS OF PARKS AND RECREATION EXPENDITURES AND INDEPENDENT VARIABLES.

OBSERVATION GROUPS

VARIABLES	CITIES ^a >10.000	CITIES ^b >50.000	CITIES ^c >100.000	SINGLE ^d CITIES	SUBURBAN ^e CITIES
Population Density	-.0003	-.0006	-.0012	.0006	-.0009
% of Household income <\$3.000	-.0008	.2162 (8.87)	.0250	-.6811 (6.25)	-.0788
Total Retail Sales	.0000	.0000	.0000	.0000	.0000
Household Buying Income	.0001	.0007	.0017	.0005	.0003
Median Home Values	.1023 (6.06)	.2059 (8.01)	.3965 (9.52)	.6219 (4.89)	.1681 (5.98)
% of Negro Head of Household	.0200	.1428 (11.67)	-.0334	.0818	-.1030
Intergovernmental Revenue	.0001	.0000	.0000	.0000	.0029
Property Taxes	.0001	.0000	.0000	.0000	.0010

a. 58 cities in total.

b. 18 cities in total.

c. 8 cities in total: Ann Arbor, Dearborn, Detroit, Flint, Gr. Rapids, Lansing, Livonia, Warren.

d. 28 cities in total, exclude all Detroit suburbs and some dependent cities such as E. Lansing, Muskegon Heights, etc.

e. 30 cities in total, include all Detroit suburban cities and some dependent cities mentioned above.

Table 9. SIMPLE REGRESSION COEFFICIENTS OF PARKS AND RECREATION EXPENDITURES AND INDEPENDENT VARIABLES.
(STANDARD ERRORS OF ESTIMATE ARE IN PARANTHESES WHERE COEFFICIENTS ARE SIGNIFICANT)

Highways and streets

Per capita highway expenditures include operating expenses for major or local streets, maintenance and other auxiliary services such as: guard rails and posts, sweeping and flushing, tree trim and removal, traffic signals and signs, pavement markings, snow and ice removal.⁵ The per capita highway expenditure in 55 cities are distributed about a mean \$12.24 with a standard deviation 5.96.

The significant correlations between highway expenditures and socio-economic variables have been in population density, median home values and percentage of household income less than \$3000 in two observations: cities bigger than 10000 and single(isolated) cities. These negative correlations may mean either (1)that higher densities reflect lower ability to pay, which result in lower per capita expenditures on local roads and streets, or (2)that higher densities reduce the physical mileage per person that must be maintained and therefore per resident expenditures are lower. The negative relation with median home values variable and its high regression coefficient (.6313 with standard error 8.44) defines it as a second determinant. The latter indicates that residents of higher income cities both demand and can afford a higher level of highway services but these services are offered in places where home values and income are low. The average of median home value in 28 single (isolated) cities \$15.35 is

the lowest average. This result suggests that highway maintenance expenditures are more intense in isolated cities than the suburban ones and consequently higher level of operating expenditures are spent for streets and highways of single, isolated cities.

OBSERVATION GROUPS

VARIABLES	CITIES ^a >10.000	CITIES ^b > 50.000	CITIES ^c >100.000	SINGLE ^d CITIES	SUBURBAN ^e CITIES
Population Density	-.4712*	-.2455	-.0750	-.5383*	-.1786
% of Household income <\$3.000	.3363*	.2349	.0697	.0174	.0091
Total Retail Sales	.0974	-.0470	-.1383	-.2609	.1744
Household Buying Income	-.2323*	-.1814	.2332	-.2586	.1070
Median Home Values	-.3558*	-.2933	-.1241	-.3874*	-.0335
% of Negro Head of Household	.0251	.1275	-.0813	-.3447	.2747
Intergovernmental Revenue	-.1006	-.0947	-.1732	-.2241	-.0356
Property Taxes	-.0706	-.0218	-.1193	-.2021	.3161

a.58 cities in total.

b.18 cities in total.

c.8 cities in total: Ann Arbor, Dearborn, Detroit, Flint, Gr. Rapids, Lansing, Livonia, Warren.

d.28 cities in total, exclude all Detroit suburbs and some dependent cities such as E. Lansing, Muskegon Heights, etc.

e.30 cities in total, include all Detroit suburban cities and some dependent cities mentioned above.

* Denotes significance at the .05 level;

Table 10. SIMPLE CORRELATION COEFFICIENT OF HIGHWAY EXPENDITURES AND INDEPENDENT VARIABLES.

OBSERVATION GROUPS

VARIABLES	CITIES ^a >10.000	CITIES ^b >50.000	CITIES ^c >100.000	SINGLE ^d CITIES	SUBURBAN ^e CITIES
Population Density	-.0011	.0005	.0003	-.0016	.0001
% of Household income <\$3.000	.3240 (6.92)	.2331 (6.68)	.0105	.0369	.0713
Total Retail Sales	.0000	.0000	.0000	.0000	.0000
Household Buying Income	.0004	.0004	.0001	.0010	.0007
Median Home Values	-.3257 (8.37)	-.2502 (7.19)	.0234	-.6313 (8.44)	-.1485 (7.06)
% of Negro Head of Household	.0126	.0600	.1149 (10.3)	-.1799 (14.2)	.0320
Intergovernmental Revenue	.0000	.0000	.0001	.0000	.0000
Property Taxes	.0000	.0000	.0004	.0000	.0000

a. 58 cities in total.

b. 18 cities in total.

c. 8 cities in total: Ann Arbor, Dearborn, Detroit, Flint, Gr. Rapids, Lansing, Livonia, Warren.

d. 28 cities in total, exclude all Detroit suburbs and some dependent cities such as E. Lansing, Muskegon Heights, etc.

e. 30 cities in total, include all Detroit suburban cities and some dependent cities mentioned above.

Table 11. SIMPLE REGRESSION COEFFICIENTS OF HIGHWAY

EXPENDITURES AND INDEPENDENT VARIABLES.

(Standard errors of estimate are in parantheses where coefficients are significant)

Effects of Socio-economic Variables

Social Variables

Population density and the percentage of negro head of household are the social variables we adopted in our study. Brazer found that population density was a highly significant factor in measuring the variation in per capita operating expenditures among 462 cities of more than 25000 and achieved similar results when analyzing the forty largest cities.⁶

The results of a two variable correlation analysis indicate that higher population densities are significantly associated with higher per capita expenditures for three expenditure categories. Parks and recreation and fire protection expenditures did not have any significant correlation except the former service has a correlation in cities of 100000. Most correlations are with single cities where density variable follows a certain pattern of variation whereas in suburban cities irregularities in the variation of density do not lead to a correlation.

Second variable, the percentage of negro head of household is related to police expenditures and sanitation expenditures. The strongest relation (.9026) is found in cities 100000 or more; this result is consistent with the actual location of negro population in the United States cities. Larger cities have more percentage

of negro population than the medium size and small cities and their police protection expenditures are relatively higher than others.

Glenn W. Fisher, in his analysis, used the education variable, percentage of population over 25 years of age with less than 5 years schooling, and found significant relations with police and sanitation expenditures of 50 states with 1960 data.⁷ In the present study the variable of percentage of negro head of household indicates the same relations with the dependent variables. Assuming the fact⁸ that negro population in large cities are less educated than the majority our results for Michigan cities follow the general trend found in country-wide studies mentioned above.

Simple regression coefficients indicating the degree of predictability show the same pattern of relation of these social variables with the dependent variables.

Wealth variables

Wealth variables consist of (1)household buying income,(2)percentage of households with an income less than \$3000, (3)median home values, (4)total retail sales. These variables explain the expenditures with higher correlation coefficients than social variables.

Buying income variable affects fire protection expenditures the most; it has a relation to highway expenditures in cities of 10000 or more. Second variable which

is a determinant for the poverty level has effects on fire protection expenditures again and police protection. In spite of the negative relationships of buying income and fire expenditures this second variable has positive correlations. The third variable, median home values, follows the same pattern of variation as the previous variables, it relates to fire and police protection expenditures with a negative coefficient. The fourth variable represents the commercial capacity of the city, its strong relation (in three observations) is with police expenditures. Total retail sales affect also sanitation and parks and recreation expenditures. The capacity of commercial activity is very high in larger cities; we obtained the highest correlation coefficient in the expenditures of large cities. Another consistent result is with sanitation expenditures; the correlation is with ~~the~~ expenditures of all cities except suburban where the level of service is higher and there is less commercial activity than in others.

Capacity to finance variables

Intergovernmental revenue and property taxes are the finance variables that we adopted. Intergovernmental revenue has frequently been found to be an important determinant of local government expenditures. However, one point should be stressed that in these statewide studies, grants to large cities are the backbone of revenue; in our study because the small number of large

cities we excluded the grants made from federal and special funds e.g., highway, bridge construction, state recreational parks. We included only items mentioned in local auditors' report under "Revenues from other governmental agencies" heading which are: state income tax, sales tax, liquor licence tax, motor vehicle operator tax, intangible tax, and dog licence tax. These revenues and property taxes represent in average about 60% of the total revenue of cities smaller than 100000.

Intergovernmental revenue variable is related positively to police protection, sanitation and parks and recreation expenditures. As sales tax is part of this revenue variable, it has the same effects on expenditures as the total retail sales variable. The second variable, property taxes has a high correlation coefficient again with the three public functions stated above. We can infer from this result that wealthy communities pay more for parks and recreation services and central cities with greater commercial activity spend more on police protection and sanitation services.

Effects of Suburbs on Central City Expenditures

Intrametropolitan disparities that we have mentioned in the first chapter may impose costs to the central cities. Suburbs as part of the Standard metropolitan statistical areas may use central city facilities and yet may not contribute to the supply of these services?⁹

In our analysis which consists of eight different suburban characteristics and corresponding central cities' expenditures we did not find any correlation between expenditures and variables but one, percentage of households with income less than \$3000. This variable is significantly correlated (at the .05 significance level) with police, fire protection and sanitation expenditures. The negative correlation with police and sanitation expenditures may mean that the lowest is the percentage of poor people in the suburbs the highest will be the level of expenditure in central city. As you will see in the next pages the regression coefficients corresponding to these correlations are quite high (-1.16; -1.13) thus, the variable is a good determinant for the expenditures studied. Fire expenditures are positively related and the regression coefficients are relatively low for this relation.

Comparing the results of this part of analysis to other urban-suburban exploitation studies we could say that ours is limited. This may be due to the limitations of the sample.

Scale Economies

In spite of the limitations that we have mentioned in the first chapter we can assume that these limitations tend to be minimum when dealing with expenditures of one state. Quality differentials and socio-political variations are less meaningful than comparing interstate variations. Per capita expenditures in the next page present some economies of scale if not many. Police expenditures seem to be minimum at medium sized cities. Fire expenditures variations are not much, however larger cities have least cost per capita. Sanitation expenditures are generally high in large cities but the maximum cost is at the cities 20000-30000 population bracket.

Parks and recreation expenditures do not offer any significant economies of scale; per capita expenditures are rather inconsistent.

In general, small cities have less cost than mid-size or larger cities. This is reasonable since small cities need to a lesser degree parks and recreation facilities. The demand in small places is also less than larger cities. Highway expenditures are diminishing as the size of the city grows. Thus, as you might observe in the following table, scale economies appear at larger sizes.

Cities	Police	Fire	Sanit.	Parks&R	Hwy.
10-20000 (11 cities)	22.22 (7.57)	16.19 (4.56)	4.74 (4.09)	4.61 (2.55)	15.59 (5.25)
20-30000 (14 cities)	23.19 (6.76)	16.35 (5.83)	9.09 (4.9)	8.19 (4.6)	12.41 (6.9)
30-40000 (7 cities)	24.44 (5.8)	15.30 (8.8)	5.78 (4.5)	12.98 (4.1)	9.49 (5.1)
40-60000 (10 cities)	19.37 (4.7)	13.93 (7.1)	4.24 (3.5)	6.13 (2.3)	9.80 (7.1)
60-100000 (10 cities)	21.21 (4.6)	15.00 (4.1)	7.23 (4.3)	8.42 (3.4)	9.89 (4.4)
100000- (5 cities)	24.34 (6.2)	14.81 (4.2)	7.25 (5.4)	15.31 (8.2)	11.33 (5.2)

Table 12. PER CAPITA EXPENDITURES OF PUBLIC SERVICES IN
MICHIGAN MUNICIPALITIES.

If we analyze standard deviations we could find the maximum reliability in the police expenditures. We should mention that by reliability term we mean higher coefficient of variation which, itself is equal to:

$$\frac{\text{standard deviation}}{\text{expenditure average}}$$

Fire protection expenditures is the second to offer low coefficient of variation. Sanitation, parks and recreation and highway expenditures have higher coefficients of variation.

	Min. coef. of variation for expenditures
police protection	<u>.2215</u>
fire protection	.2778
sanitation	.6003
parks and recreation	.3870
highways	.3369

FOOTNOTES

1. W. Hirsch, "Cost functions of an Urban Government Service," Review of Economics and Statistics, (February, 1965) pp.87-93.
2. Compendium of City Government Finances in 1960, Bureau of the census U.S. Dept. of Commerce, (1962)
3. R.W. Bahl, (1969) p.73; Opus Citation see p.21.
4. Ibid., p.120.
5. For complete list of maintenance items see State Auditors' Reports for Michigan municipalities. Dept. of Municipal Finance, Lansing Michigan.
6. H. Brazer, City Expenditures in the U.S., Opus Citation see p.13.
7. Fisher, "Determinants of State and Local Government Expenditures," Opus Citation, see p.22.
8. Theodore R. Sizer, "The schools in the City," The Metropolitan Enigma, Anchor pub. (1967) pp.360-362.
9. See p.9 of this study for further explanation.

CHAPTER V

CONCLUSIONS

Michigan Cities and Urban Public Services

[In small cities, e.g., within 10-30000 population bracket, economic variables have greater influences than social variables on expenditures. Total retail sales, median income, home values are significantly affecting the level of expenditures in all functions except parks and recreation service. There is no significant relation between expenditures and socio-economic variables. This result may be explained that in small cities parks and recreation need is less than other cities. Another observation is that these cities are generally located in rural areas and not in the proximity of metropolitan settlements.

Middlesize cities¹ in Michigan offer stable variations in expenditures. Within the independent variables economic characteristics are the most significant ones. Population density becomes significant variable yet percentage of Negro head of household affects to a lesser degree the expenditures. Property taxes are related to parks and recreation and highway expenditures; they are more significant in larger cities since commercial activities become more intense, property taxes augment.

A major source of analytical difficulty in the metropolitan area arises as a consequence of differences among local communities in the characteristics of their populations. As the Advisory Commission on Intergovernmental Relations noted recently: "Population is tending to be increasingly distributed within metropolitan areas along economic and racial lines. Unless present trends are altered, the central city may become increasingly the place of residence of new arrivals in the metropolitan areas, of non-whites, lower income workers, younger couples, and the elderly."² The justification of this statement for Michigan cities is apparent, in the table on page 35, by the correlation of percentage of negro head of household with police protection, sanitation expenditures of larger cities and single cities.

Q The Detroit Area Study's findings on the income experience of whites and nonwhites and residents of the suburbs and the central city, for the period 1951-59 reveal some contrasts. Median family income rose by 9% in the central city but 47% in the suburbs. At the same time, the median income of white families increased by 33% for the area as a whole compared to only 8% for nonwhites. The movement of white, higher income families to Detroit's suburbs, coupled with their replacement in the central city by low-income newcomers.³ Similarly sharp contrasts, emphasizing the diversity among municipalities in structure may be seen in the Detroit area. In 1958, the assessed value of

residential property in thirty-four cities, villages, and townships comprised 42% of total assessed valuation in these communities. For the city of Detroit the ratio was 40%, whereas for such industrial enclaves as River Rouge, Trenton, Hamtramck, Highland Park, and Warren it was less than 20 percent; while at the same time, in the Grosse Pointe communities and in Dearborn township, the ratio was 85 percent or higher.

Such extreme inequalities as those in the distribution within metropolitan areas of socio-economic groups of population and the property tax base give rise to wide differences in expenditures and tax rates. Tax rates and per capita expenditures both tend to be highest in central cities, but ranks with respect to tax rates and expenditures diverge for communities outside the central city.]

Data presented in the Appendix A indicate that there are substantial differences between the central city and the rest of the metropolitan area in the amounts spend per capita in total and for the separate major services. Part of such differences stems from the fact that the area outside the central city is less fully urbanized, but a large part is undoubtedly attributable to the differences in demographic and other characteristics outlined above. Highway expenditures tend to be inversely associated with population density (see page 49), so that we should we expect them to be higher outside the central city.

Implications for Planning Policies

One great shortcoming in the problem-solving efforts of metropolitan areas is the planning of the allocation of physical and financial resources. The urban finance problem, perhaps the most complex of all urban problems, presents a need for the coordination of fiscal and physical planning. For example, an understanding of the implications of a given longrange land-use plan for the spatial distribution of expenditure requirements within the standard metropolitan statistical area or among independent cities is an essential prerequisite for orderly and efficient urban growth. For this latter goal, coordination of the efforts of planner and fiscal economist is crucial.

The planner is primarily interested in designing the integrated city. Structural expenditure analysis aids by facilitating the designation of problem areas in relation to certain expenditure levels. Bahl mentions that: "The effectiveness of the planner's contributions to a coordinated approach to the urban problem may be greatly enhanced if he can recognize and anticipate these problem areas and their longrange implications for efficient metropolitan government."⁴

If a large labor-intensive plant is being considered for a central city location, the planner must anticipate the possible problems created by this particular location. Probably, greater sanitation expenses, the development of

high density housing, increased traffic congestion will evolve as the main problem areas.

The planner must anticipate also the general effects of the metropolitan land-use plan on the city budget. A plan that does discourage residential migration to suburbs is almost certain to enhance the fiscal resources of the central city, but is not as certain to reduce expenditure requirements.

Depending on the extent of anticipated residential dispersion and the degree to which the SMSA is politically fragmented, physical and fiscal planners might look far ahead to potential adequacy of various kinds of non property taxes.

On the other hand, many long range land-use plans provide not only the outward movement of central city residents but also, by industrial parks in the urban fringe and an adequate transportation network, the diffusion of commercial and industrial activity within the standard metropolitan statistical area.

Of course, suburbanization has a lot more social implications than fiscal, but the cost of suburbanization in terms of expenditure is very important either from social or physical point of view and should be taken into consideration in the land-use planning stage.

Summary and Recommendations for Further Study

Recognizing that the analysis presented here is confined to data for a limited number of cities, extended generalizations are not justifiable. Certain results and trends have emerged from the study, however. The following comments must be taken as being relevant only for fifty-six cities which were analyzed and only for the time period, e.g. 1970, which was considered.

Conclusions that are relevant enough to be mentioned here are the following:

1) For police protection and sanitation expenditures the determinants, starting by the most important, are: total retail sales, percentage of negro head of households, property taxes, intergovernmental revenue, population density. For fire protection expenditures, buying income, median home values and percentage of household with an income less than \$3000 are the main determinants. For parks and recreation expenditures, total retail sales, property taxes; and for highway expenditures, population density and median home values are the significant determinants.

2) Expenditures are varying by the type of service or structure of the cities. Suburban cities are differing from single (isolated) cities in their allocation and spending for urban public services.

3) For better exploration of economies of scale, quality and service level measurements should be developed.

4) Determinants of Urban public service expenditures help policy makers for a better anticipation of the future cost of urban areas to the municipalities.

Limiting the present study to cities within the State of Michigan had both advantages and disadvantages. The governmental and financial structure was similar for all cities included in the study. Disadvantages were noted, however, in the size of the samples and in the distribution of cities within the size categories selected. Another limitation of the study as it stands is that it is based on data provided for only one year. A study would be more representative if data were averaged over a period of many years.

After a review of the results of this study, some general recommendations can be made for future research. First, there should be more variables to determine the level of expenditures, more social and political variables. Secondly, and probably most important of all, the question of what quality and quantity of service can be bought for a given price needs to be answered. Statistical analysis would be more accurate using multiple regression analysis and partial correlation coefficients would explore to a greater degree the accuracy of the determinants.

FOOTNOTES

1. By middle size cities we mean cities having a population of 30000-60000.
2. Government Structure and Planning in Metropolitan Area, a report by Advisory Commission on Intergovernmental Relations, Government Printing office, Washington D.C. 1961.
3. C. Doxiadis, Emergence and Growth of an Urban Region, Vol.1, Detroit Edison Company, (1966).
4. Roy W. Bahl. Metropolitan City Expenditures, University of Kentucky Press (1969) p. 131.

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✓ Duncan, O. Dudley. "The optimum Size of Cities," Reader in Urban Sociology, edited by Hatt and Reiss, Free Press 1951. pp. 632-645.

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APPENDICES

APPENDIX A

Table 13. 1970 EXPENDITURES IN MICHIGAN CITIES OF 10000
OR MORE.(Dollar amounts in thousands)

Source: State Auditors' Reports, Bureau of Municipal Finance
State of Michigan, Lansing. Michigan (1970).

Cities	Police	Fire	Sanit.	Parks&R.	Hwy.
ADRIAN	373	316	300	118	316
ALBION	281	292	146	129	229
ALLEN PARK	838	413	369	234	135
ALPENA	267	286	-	96	367
ANN ARBOR	2273	1289	917	1698	477
BATTLE CREEK	1344	1155	361	616	356
BAY CITY	1022	1272	-	182	902
BENTON HARBOR	619	357	152	82	229
BERKLEY	384	245	285	64	217
BEVERLY HILLS	400	-	202	11	333
BIG RAPIDS	153	143	84	23	190
BIRMINGHAM	787	660	74	248	439
CENTER LINE	375	191	128	107	78
CLAWSON	322	42	166	86	254
DEARBORN	2362	1263	1171	2840	2411
DEARBORN HEIG.	1057	633	584	202	750
DETROIT	55877	23410	28854	25766	13170
E.DETROIT	1105	413	-	288	503
E.GRAND RAPIDS	213	167	79	92	185
E. LANSING	633	523	240	114	304
ECORCE	800	444	537	352	689
ESCANABA	270	301	94	101	200
FARMINGTON	174	100	79	35	143
FERNDALE	893	742	399	142	419
FLINT	5665	3804	1401	1827	2764
FRASER	384	92	130	26	32
GARDEN CITY	596	312	330	449	127
GRAND HAVEN	259	198	-	107	297
GRAND RAPIDS	4639	3565	717	2021	2534
GRANDVILLE	146	43	12	19	38
GROSSE PT.FARMS	485	316	-	118	-
GROSSE PT.PARK	445	292	146	129	229
GROSSE PT.WOODS	412	178	213	140	172
HAMTRAMCK	810	694	327	-	130
HARPER WOODS	552	347	264	133	272
HAZEL PARK	524	314	93	124	196
HIGHLAND PARK	not available				
HOLLAND	601	356	-	259	516
INKSTER	912	320	-	234	399
JACKSON	1303	1121	235	216	1082

Appendix A (continued)

KALAMAZOO	1840	1657	60	850	1151
KENTWOOD	183	106	13	23	268
LANSING	3262	2782	470	3265	1013
LINCOLN PARK	927	444	373	287	325
LIVONIA	1600	1062	610	2506	1722
MADISON HE.	not available				
MARQUETT	283	307	75	340	631
MELVINDALE	372	201	154	13	151
MENOMINEE	117	146	50	27	94
MIDLAND	549	499	247	465	631
MONROE	571	497	308	315	423
MT. CLEMENS	605	360	325	119	120
MT. PLEASANT	206	126	96	77	277
MUSKEGON	968	961	357	330	683
MUSKEGON HE.	407	210	-	23	343
NILES	316	207	36	34	218
NORTON SHORES	173	113	3	22	85
OAK PARK	not available				
OWOSSO	334	391	7	85	268
PLYMOUTH	228	125	76	30	160
PONTIAC	2448	1738	1393	921	1709
PORTAGE	467	225	-	96	444
PORT HURON	753	686	95	250	320
RIVER ROUGE	881	567	90	178	186
RIVERVIEW	350	180	74	7	65
ROSEVILLE	991	530	306	211	453
ROYAL OAK	1453	1089	953	424	532
SAGINAW	2017	1539	593	1277	645
ST. CLAIR SHORES	1314	775	469	399	799
ST. JOSEPH	331	225	158	142	240
SAULT ST. MARIE	302	228	6	42	338
SOUTHFIELD	1514	1146	460	641	708
SOUTHGATE	688	314	-	165	-
STERLING HE.	1167	573	41	97	511
TAYLOR	977	503	-	276	319
TRAVERSE CITY	256	258	154	55	210
TRENTON	777	592	285	416	296
TROY	1067	100	327	211	257
WALKER	148	50	1	8	57
WARREN	3402	2403	1386	841	1489
WAYNE	634	347	207	216	-
WESTLAND	1131	713	546	262	727
WYANDOTTE	830	658	-	386	-
WYOMING	725	310	17	313	616
YPSILANTI	810	494	185	311	167

APPENDIX B

Table 14. SOCIO-ECONOMIC CHARACTERISTICS OF CITIES

- Ch.1: Population Density per sq. mile; source: 1970 U.S. Census
 Ch.2: Population Number (by thousands); source: 1970 U.S. Census
 Ch.3: Percentage of Households with an Income of less than \$3,000; source: Sales Management Magazine, 1970 Survey of Buying Power.
 Ch.4: Total Retail Sales (by millions); source: Sales Management Magazine, 1970 estimates.
 Ch.5: Effective Buying Income per Household (Dollars by Thousands); source: Sales Management Magazine, 1970 Survey of Buying Power.
 Ch.6: Median Value of Houses (Dollar value by thousands); source: 1970 U.S. Census Reports General Housing Characteristics.
 Ch.7: Percentage of Negro Head of Household; source: 1970 U.S. Census Reports General Housing Characteristics.
 Ch.8: Intergovernmental Revenue (Dollar value by thousands); sources: 1970 U.S. Census Reports of City Finances, and Official Reports of Municipal Finance Bureau, State of Michigan, Lansing 1970.
 Ch.9: Property Taxes; source: 1970 U.S. Census Reports of City Finances, and Official Reports of Bureau of Municipal Finance, State of Michigan Lansing.

Cities	Ch.1	Ch.2	Ch.3	Ch.5	Ch.6	Ch.4
ADRIAN	3514	20.3	21.3	9.9	14.9	69.6
ALLEN PARK	5506	40.7	18.1	10.1	22.1	93.9
ALPENA	1866	13.8	17.5	9.8	11.9	53.2
ANN ARBOR	4578	99.7	15.9	14.0	27.7	244.3
BATTLE CREEK	3299	38.9	22.5	9.2	11.4	144.4
BAY CITY	4945	49.4	17.3	9.5	12.7	137.7
BENTON HARBOR	4578	16.4	23.3	8.6	11.3	98.6
BERKLEY	8699	22.6	4.4	13.2	19.1	27.2
BIRMINGHAM	5816	26.1	5.7	21.0	31.9	137.6
CENTER LINE	6105	10.4	6.3	12.6	19.8	35.3
DEARBORN	4253	104.2	6.4	14.6	22.8	383.1
DETROIT	10953	1511.5	13.5	11.0	15.6	2400.1
E.DETROIT	9004	45.9	3.9	13.1	20.4	97.3
E.LANSING	5282	47.5	13.8	17.9	29.3	47.8
ESCANABA	1220	15.4	19.6	8.6	12.7	49.9
FARMINGTON	5130	13.3	3.7	16.5	31.8	89.9
FERNDAL	7910	30.9	6.6	12.1	16.6	91.7

APPENDIX B (continued)

Cities	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6
FLINT	5894	193.3	13.6	489.9	10.5	14.6
GARDEN CITY	6541	41.8	2.4	62.9	11.9	19.6
GRAND RAPIDS	4402	197.6	17.2	458.4	13.9	14.8
GROSSE PT.WOODS	6630	21.9	3.8	23.3	22.2	34.5
HAMTRAMCK	12974	27.2	15.0	53.6	10.6	10.1
HARPER WOODS	7764	20.2	4.7	121.9	13.7	22.3
HAZEL PARK	8494	23.8	7.5	38.1	11.6	15.5
HOLLAND	1908	26.3	13.3	76.2	11.2	14.9
INKSTER	6126	38.6	8.1	46.0	9.8	17.6
JACKSON	4251	45.5	17.5	160.8	13.3	11.8
KALAMAZOO	3492	85.5	16.7	259.5	11.6	14.3
LANSING	3939	131.5	14.3	383.7	10.4	16.3
LINCOLN PARK	8831	53.0	4.8	170.7	12.1	17.4
LIVONIA	3050	110.1	3.4	302.1	14.7	27.1
MARQUETT	1997	22.0	17.7	49.2	11.4	16.1
MIDLAND	1413	35.2	12.8	100.3	14.2	22.1
MONROE	2507	23.9	14.2	77.7	11.8	17.8
MT.CLEMENS	5250	20.5	13.9	94.3	12.2	18.3
MT.PLEASANT	4020	20.5	18.9	48.6	14.5	17.3
MUSKEGON	3433	44.6	18.0	122.2	9.1	11.3
MUSKEGON HEIGHTS	5244	17.3	16.4	28.4	8.5	9.8
NILES	2498	13.0	16.3	56.0	10.9	13.1
OWOSSO	3655	17.1	18.3	60.8	9.9	13.9
PLYMOUTH	5112	11.7	7.4	57.4	13.2	23.8
PONTIAC	4329	85.2	11.5	217.6	10.6	15.4
PORT HURON	4773	35.8	19.6	95.8	9.7	12.3
ROSEVILLE	6176	60.5	5.7	153.6	11.6	18.9
ROYAL OAK	7308	85.5	5.4	192.8	14.2	21.3
SAGINAW	5309	91.8	16.4	226.0	9.8	13.7
ST.CLAIR SHORES	7403	88.1	4.2	110.1	13.3	22.5
SAULT ST.MARIE	964	15.1	19.8	37.9	8.6	8.7
SOUTHFIELD	2501	69.3	4.5	343.7	16.4	36.0
SOUTHGATE	4710	33.9	3.9	128.1	12.1	19.4
TRAVERSE CITY	2314	18.0	18.8	103.9	11.7	15.4
TRENTON	3260	24.1	3.8	35.3	14.4	26.0
TROY	1177	34.9	5.0	88.4	14.2	29.8
WARREN	5242	179.2	5.0	321.9	11.8	23.4
WAYNE	3509	21.0	6.6	72.5	12.2	18.2
WYANDOTTE	7896	41.6	7.6	78.4	11.5	16.9
WYOMING	2318	56.5	7.7	160.4	10.7	14.4
YPSILANTI	7204	29.5	15.9	90.9	13.3	20.7

APPENDIX C

SIMPLE CORRELATION AND REGRESSION ANALYSIS

Source: N.M. Downie and R.W. Heath. Basic Statistical Methods, Harper & Row, New York (1970). Chapter 7 and 9.

The size of the Pearson product-moment correlation coefficient (r) used in the study varies from $+1$ to -1 . Most correlation coefficients tell us two things. First we have an indication of the magnitude of the relationship. A correlation of $-.88$ is the same as one of $+.88$. The sign does give only information about the direction of the relationship. When two variables are positively related, as one increases, the other increases, too. In everyday usage an r of $.80$ and above is considered a high coefficient, an r around $.50$ is considered moderate; and an r of $.30$ and below is considered a low coefficient. It should be stated that a Pearson r is not a measure of causality, although in some cases causal relationships may exist between the two variables.

The formula used in the study is:

$$r = \frac{\sum XY - [(\sum X)(\sum Y)/N]}{\sqrt{\{\sum X^2 - [(\sum X)^2/N]\}\{\sum Y^2 - [(\sum Y)^2/N]\}}},$$

where:

Y: 1970 expenditures for public services

X: Socio-economic characteristics of cities

The term "regression analysis" refers to the methods by which estimates are made of the values of a variable from a knowledge of the values of one or more other variables, and to the measurement of the errors involved in this estimation process; although correlation analysis refers to methods for measuring the strength of the association among variables.

Linear regression means that an equation of a straight line of the form $Y = a + bX$, where a and b are numbers, is

used to describe the average relationship that exists between the two variable and to carry out the estimation process. The factor whose values we wish to estimate is referred to as the dependent variable and is denoted by the symbol Y , representing urban public service expenditures in our study. In other terms, values of expenditures are dependent upon the values of X , socio-economic data of Michigan cities. In the analysis chapter of the thesis, coefficients b for each relation are given in tables followed by their standard error of estimation.

Both analyses are programmed for computer, CDS 6500, by: Eva Clark . Correlation and Regression analysis, Michigan State University, Computer laboratory. Sept. 25, 1961. CO-OP ID: G2 UCSD BIMD in FORTRAN.

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