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Efficiency in the provision of local public services is a
neglected area of study. Absolute and relative increases in expen-
ditures by the local public sector emphasize the increased impor-
tance of the study of efficiency. A look to the future sees even
greater resource allocation by the local public sector. Increasing
affluence will increase demands for all goods and services including
those provided by local governments.

This cross-sectional study attempts to identify significant
economic and demographic factors that influence expenditures by
local government units. The expenditure categories analyzed in-
clude general government, public works, police protection and fire
protection for all incorporated Oregon cities. The factors of pri-
mary importance in explaining expenditure variations are population
density, assessed property value, receipts from other governments

and population change. These factors when subjected to regression analysis explained from nearly 50 to approximately 80 percent of the expenditure variation for Oregon's largest cities. These results compare favorably with previous studies of national scope. This and other studies illustrate that a great deal is left unexplained and emphasize the need for further research.

Efficiency of Social Capital Expenditures in Oregon

Towns and Cities

by

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CHAPTER I

INTRODUCTION

The tools of the economist have been applied in many quarters,
but it appears that they have neglected local government relative to
other areas of study. Spending by the local government sector as
well as the number of financial difficulties they face is increasing.
It is thought by many that local government is the focal point of fi-
nancial need and structural reform in the intergovernmental sphere
(4 , 27). The efficiency of the public sector, and more specifically,
efficiency in the provision of selected municipal services by Oregon
towns and cities is the topic of this study.

The Problem

Both rapid increases and wide variation in per capita expendi-
tures for municipal government services are current characteristics
of Oregon communities. The search for reasons behind these in-
creases and variations represents topics of increasing importance.
The wide variation in per capita expenditures is brought to light
from communities ranging in size from 1, 000 to 10, 000. The low

figure (1963-64) for total per capita municipal operating expenditures from this group was $6.76, and the high was $80.64 (28). On a national scope and similarly in Oregon, numerous examples exist in which per capita municipal service expenditures for a recent ten-year period have increased from more than 50 to over 100 percent. The quality of services provided may not move directly with expenditure levels. It may not be entirely unrealistic in some situations to assume that the variation in service quality is of a similar magnitude to the variation in per capita expenditures between communities.

The size distribution and changes in size over time of incorporated Oregon communities suggest problems. Of 224 incorporated communities in the state of Oregon, 161, or more than 70 percent, had less than 2,500 inhabitants, and over 50 percent of them had less than 1,000 inhabitants in 1964. Part time officials, out-of-date facilities and very limited resources are characteristic of many of these small communities. Also of concern is that 54 of them experienced a net decline in population from 1950 to 1966 (28). In the case of decreasing cost public services increased tax burdens may result on the remaining population base. The multiple problems facing these communities are further complicated by the fact that many local governments are still operating under a structure designed to meet simpler needs of the past. For considerations of

economic efficiency as well as general social welfare, it may be well to study factors related to the efficiency of the local public sector.

Measurement problems abound with both the quantity and quality aspects of public services, this is especially true with the latter. It is felt that even though expenditures are quite far removed from any actual output in terms of municipal service, analysis of expenditures may shed light on the ultimate provision of the services themselves.

It is essential to clear away needless detail and get at some basic relationships. An extremely important issue is that there is no direct relationship between what a taxpayer pays and what he receives in terms of services. This is complicated by our layer system of government that make tracing expenditures nearly impossible.

Whatever course political processes may set for society, knowledge of basic cost-service relationships can help achieve these goals, once established. Various political leaders have expressed a need for this type of information. Questions are numerous regarding the optimum size and scale of public services. Sargent (35, p. 36) even poses the question, "Are towns obsolete?"

A study focusing on the reasons for observed expenditure variations could serve as an important base in determining the appropriate

levels of expenditure for various municipal services. It would

seem useful to develop a framework in which the costs and service

relationships could be established for the various public services.

This framework would be of assistance if we wished to observe the

changes in costs of public services as characteristics of the urban

area changed through such things as rapid expansion of unincorpor-

ated area, changes in zoning procedures, or with the addition or

deletion of industry.

A framework of this type could serve as: 1) basis for local

government allocation decision, 2) basis for comparing standards

of living among cities since the cost of public services are an im-

portant determinant of a cost of living index in local areas, [1]/

3) for considerations of general economic efficiency and social wel-

fare, and 4) prove useful as communities attempt to change zoning

practices, attempt to attract industries and in general, attempt to

maintain themselves or grow.

Evaluation of quantitative information would be useful for im-

proving the efficiency of operation at present levels of service and

for levels of service that might be desired in the future. The ex-

panding role of government activities substantiates the increased

[1]/ Thompson (42, p. 90) feels that public sector services are an
important part of a cost of living index. Further, he says that
urban efficiency might well bridge the gap between money income
and real income.

need for concerns of efficiency. The percent of the GNP spent by

state and local governments has increased substantially over

the years, from 5 percent in 1902 to 11.7 in 1962 (24).

Several researchers have made estimates of future government acti-

vity other than national defense. Some feel that Adolf Wagner's

hypothesis, often called "the law of increasing state activity, " is

substantiated by developments in the U. S. Moser, et. al. (24,

p. 20) stated that increased public expenditures can be expected

due to increased urbanization, industrialization, demands for higher

standards of service and new kinds of public services. Pidot (32,

p. 6) makes the prediction that per capita expenditures for local

government services will increase at a rate of seven percent per

year. Herber (12, p. 141) projects absolute growth for public sector

spending. He attributes this to projected population growth and a

resulting increase in demand for educational services.

In former years, both nationally and in Oregon, the local gov-

ernments have spent the largest share of the total expenditures by

state and local governments. While this is still generally the case,

in most recent times this trend is reversing itself with expenditures

by state governments increasing and expenditures made by local

governments decreasing (28). This trend is more evident in Oregon

than nationally. Moreover, in Oregon for the years 1957, 1964, and

1965, the state originated revenues have exceeded locally generated

revenues (28, p. 11). This trend differs markedly from the U. S. in general. Both of these factors indicate the relatively weaker financial position of local governments and provides further impetus to study the cost-output relationships of local governments in Oregon.

Intergovernmental transfer of funds is expected to increase in the direction of local governments. Some feel that the amount and kind of transfers will be dependent on local government's demonstrated ability to manage their fiscal affairs. Efficiency in the provision of municipal services is an important aspect of this "management".

Objectives

Our concern is with the efficiency of social capital. The objectives of this study are to identify and analyze factors important in explaining differences in expenditure levels for municipal services provided by local governments in the state of Oregon. The purpose is to contribute toward a more general objective which is greater efficiency in the allocation of resources by the local public sector. This is important for at least two reasons: 1) it might allow taxes to be reduced, and 2) for service levels to be improved. It is not at all inconceivable that both of these could be accomplished jointly.

The specific objectives of this study are:

1. Estimate expenditure functions for selected public services

in Oregon towns and cities. Estimate the elasticities associated with expenditures and community characteristics.

2. Identify significant influences on expenditure levels in and between communities.

3. Identify problem areas that might be amenable to further research and draw implications from economic analysis done in 1 and 2.

Procedures

A comparison will be made of expenditure levels between communities for the provision of selected public services within the state of Oregon. A simple comparative analysis of per capita expenditures for cities in eight size groups will be made for each of the expenditure categories studied.

A larger part of the analysis will be a discussion of regression analysis results. Multiple regression analysis will be used in an attempt to identify some preliminary relationships between expenditure categories and various economic and demographic factors. The expenditure categories to be used as dependent variables are: general government, public works, and police and fire protection. Independent variables include: age distribution, population, population change and density, assessed property value, percent of local receipts from taxes, percent of local receipts from other

governments, operation and maintenance of public facilities, capital and debt service expenditures by local governments and the percent of families with a gross annual income of less than $3,000.

Simple correlation coefficients between all the variables will be tabulated to assist in explaining the regression results and are presented in appendix A. Variables entering the equations, signs of the regression coefficients, their significance levels and elasticities will be analyzed as progressively smaller cities are added to each expenditure category. Elasticities measured at the mean will be calculated for each independent variable entering the equations. They measure (within a short range of the dependent variable) the percent change in the dependent variables (expenditure categories) resulting from a one percent change in a particular independent variable.

Organization of thesis

To outline this study, Chapter II contains a brief review of literature relating to the nature of the problem facing local governments, problems associated with measuring quantitative and qualitative aspects of government services and scale economies, a review of some empirical studies, and lastly some general suggestions pertinent to local government financial problems.

Chapter III presents a brief study of four local government

expenditure categories in Oregon. The statistical framework for the study is followed by a discussion of average per capita expenditures and a multiple regression analysis for each category. Chapter IV contains a note on institutional choice constraints facing local government decision makers and the use of traditional economic theory. In addition, conclusions and a summary from Chapter III and implications for further study are included.

CHAPTER II

LITERATURE REVIEW

Introduction

The purposes of this literature review are severalfold: 1) out-
line some of the more important aspects of the financial problems
facing local government units, 2) discuss some of the difficulties in-
volved in measuring local government output, 3) note earlier discus-
sions on economies of scale in the provision of various public ser-
vices, 4) review some empirical studies on the variation of expen-
diture levels between communities and 5) mention some ideas put
forth by various researchers that might provide some insight into
the problems facing local government units.

The Nature of the Problem

Per capita expenditures for municipal services have been in-
creasing rapidly in U.S. cities. For example, in the decade from
1953 to 1963, average per capita expenditures for police rose from
$6.16 to $12.36, fire from $4.02 to $6.38, sanitation from $6.52 to
$11.83 and parks and recreation from $2.61 to $5.34 (48, 49). In
one decade, the increase in per capita expenditures for these selected
services ranged from more than 50 to over 100 percent. The mag-
nitude of the change is large and even if adjusted for price level

changes it would not be substantially reduced.

There is a wide range in per capita expenditures for municipal services between cities. This is suggestive of differences in efficiency in providing these services even assuming variations in service levels. As an example, from the state of Oregon in towns ranging upward from 1,000 in population, the total per capita expenditures varied from a low of $6.76 to a high of $80.64 for the year 1964 (28)[2/]. The amount of total resources allocated by the public sector has grown significantly over the years. In 1902 the average annual per capita expenditures in current dollars, by state and local governments were $14.00 and by 1964 they had expanded to $372.00 (12, p. 130).[3/]

To account for these changes in expenditures, Baumol (2) notes significant changes in the private sector. He breaks these changes into four categories: 1) growing productivity and wealth, 2) rising urban population, 3) technological change and 4) movement to the suburbs associated with urban blight. The demand for all goods and services increases, including those provided by the public sector, as per capita incomes rise. Population and technological

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2/ Total refers to services in the following categories: 1) general government, 2) public works, 3) police, 4) parks and recreation, and 5) library.

3/ For a theoretical analysis of public sector growth, see Herber (12, p. 145-159).

change both give rise to external effects that require further public

intervention. Population movement to the suburbs makes it more

difficult for municipal governments to obtain needed funds while at

the same time this movement tends to increase governments' ex-

penditures (2, p. 8).

Local government expenditures are rising. In addition to the

factors mentioned above, the Committee for Economic Development

(4) states that part of the problem is due to inefficiency. The inade-

quacies of the more than 80, 000 separate local government units,

noted by the CED, reflects the increasing strain on these units. The

inadequacies noted by the CED (4, p. 11) are as follows:

"1) Very few local units are large enough--in population, area,
or taxable resources--to apply modern methods in solving
current and future problems.

2) Overlapping layers of local government--municipalities
and townships within counties, and independent school dis-
tricts and special districts within them--are a source of
weakness.

3) Popular control over local government is ineffective or
sporadic, and public interest in local politics is not high.

4) Policy-making mechanisms in many units are notably weak.

5) Antiquated administrative organizations hamper most local
governments.

6) Positions requiring knowledge of modern technology are
frequently occupied by unqualified personnel. "

In regard to point four, Mosher, et. al. (24, p. 8), points out

that the various levels of government interweave their financing and

intermingle their responsibilities so that it is virtually impossible to trace a tax dollar from its source to an ultimate function.

A primary need for reform lies within the rural sections. According to the CED (4, p. 40), rural areas contain 30 percent of the nation's population, live on 90 percent of the land, have per capita incomes below the national average and they support four-fifths of all local governments. These problems exist in Oregon's rural areas as well. It is felt that the focal point of financial need and structural reform rests with local government units (27). Problems with urban government units are noted also. Urban governments in Oregon are faced with increased service demands, and are hampered by un-coordinated taxing units levying on the same limited property tax base.

Measurement Problems

The efficiency of the local public sector has been said to be the "meat" of urban analysis, however difficult it is to quantify (42, p. 62). A preliminary review of the literature indicates that little quantitative work has been done in evaluating the efficiency of public expenditures.

Attempts to evaluate efficiency in service provision by local government units are hampered by the inability to quantify output. This makes it difficult to develop an adequate framework in which

costs and service relationships could be established. [4/] In the public

sector inputs can be readily measured in terms of tax receipts or

dollar expenditures. Output measure, on the other hand, is compli-

cated by many factors and contains both quantity and quality dimen-

sions. We will look in turn at some factors involved in quantity and

quality as elements of output measure.

Measuring the output of public services is a neglected area. The

studies that have been made are generally those in which output has

clearly defined enumerative properties. An example of this is an

empirical study by Hirsch (13) of refuse collection. Cost studies are

facilitated by the fact that this services' output and quality charac-

teristics lend themselves to quantification and that it has relatively

few external effects. In regard to the provision of police and social

services, little work has been done in identifying reasonable meas-

ures of output (19, 42).

The concept of a service is difficult to define, but yet we assume

that the provision of service is the ultimate goal of government units.

Our concern is with dollars expended, a most distant measure of

service extended (32, p. 37). The provision of services is related

to want satisfaction and is far along the chain of causation from the

expenditure of dollars.

[4/] Economic efficiency is defined here as the ratio of useful product output to useful input of resources.

An example of this "gap" is provided by Kiesling's (18) findings

from a study of New York school districts. He concludes that there

is only a weak relationship between expenditures and performance (as

measured by achievement tests results, over a three year period).

To further cloud the issue, Fisher (8) notes that even if the deter-

minants of state and local government expenditures were clearly

defined this would tell us nothing about the desirable levels of expen-

ditures.

When considering a methodology of quantitative evaluation, it

must be remembered that inputs and outputs are conceptual aids. [5]/

What we use as inputs and outputs depends on the system under anal-

ysis and how we choose to define them. The evaluation process in-

volves a comparison of these inputs and outputs. At least two things,

according to Ackoff (1), must be done to provide a quantitative evalu-

ation of a service. The first is to identify the participants. The

second is to identify the relevant objectives associated with these

inputs and outputs. Schmandt and Stephens (36) suggests using the

detailed breakdown of municipal functions as a measure of output.

In their study of Milwaukee County, Wisconsin, police protection

was broken down into 65 categories. A service index was constructed

from the number of these service categories performed by each

municipality within the county. Schmandt and Stephens (36, p. 375)

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[5]/ For criteria to use in measuring productivity, see: (45).

say, "High correlation found between the number of activities or subfunctions and such items as population, age of municipality and total expenditures suggests that this variable may be of use as a measure of service output."

The second major aspect of output is the quality dimension. At the outset it can be said that little work has been carried out on the quality of public services. Hirsch (16) points out several reasons why interest should be generated in the study of municipal service quality. Among them is the need for a performance comparison of different governments offering a given service. He also says that much more work is needed in defining service units in real terms, identifying quality characteristics and estimating money cost and value of services.

Many authors have speculated on the omission of quality aspects of municipal services but few attempts have been made in measuring them. Pidot (32, p. 116) notes that quality characteristics are difficult concepts to handle because they involve the measurement of want satisfaction and aesthetic factors. Brazer (3, p. 1) in the introduction to his study of city expenditures, proclaims that he is analyzing expenditures rather than performance or service units. He says, "Efficiency and quality of service both contribute to variations in expenditure levels, but we are a long way from being able to measure either. They have been neglected only because it is not

feasible to do otherwise."

Rather than break into the quality sphere, Kurnow (19) assumes in his study that the greater the per capita expenditures the higher the quality of the service supplied.

Empirical studies of the quality dimension are few due to the fact that quality is an extremely difficult concept to apply to municipal services. Schmandt and Stephens (36, p. 370) comment on an article by Hirsch in which he attempts to construct a service index as an approach to the quality dimension. They quote the following from Hirsch's article:

> "The service index was constructed from items that presumably reflect the quality of the service rendered, such as training and experience of personnel, ratio of personnel to population, amount and kind of equipment and subjective service ratings of various municipal departments by experts in the field."

Schmandt and Stephen's (36) comment is that Hirsch's index is largely a measure of inputs--merely a reconstruction of spending itself rather than a measure of production.

Since the quality dimension of some public services cannot be measured directly, various proxies have been used. Fire insurance rates, as suggested by Vickery (52) could be used as a proxy to the quality of fire protection. Whereas insurance rates might provide a realistic approximation to quality in fire protection, this information, as a proxy to quality, is not available for other public services.

Economies of Scale

Measurement problems remain an obstacle in determining an optimum scale for the provision of local government services. Researchers have hypothesized the existence of "U" shaped cost curves but numerous cross-sectional empirical studies have failed to reveal significant economies or diseconomies of scale.$\underline{6/}$ Brazer (3, p. 18) holds that this does not mean they do not exist. His thought is that economies of scale in large cities may be offset by more performance or that higher per capita expenditures may be purchasing more services. Hirsch (14) in a study of St. Louis, found that a group of public services accounting for 80 to 85 percent of total public expenditures are subject to constant costs.$\underline{7/}$ Demands for increased service can be met simply by replication of existing service units. He states further that only water and sewer facilities, accounting for only 8 to 10 percent of total expenditures, exhibit falling costs up to a very large size. He concludes that with the exception of sewer and water facilities, economic efficiency may be highest in medium-size communities of 50, 000-100, 000 residents.

$\underline{6/}$ Some of the more important empirical studies are outlined in the following section.

$\underline{7/}$ Members of the group referred to include: fire and police protection, public education, and refuse collection.

Along the same lines, Warren (54) finds it is not obvious that a size efficient for one municipal service will be the efficient size for another. A statement of an optimum size of municipal governments would likely be a compromise among efficient output levels for various services. The CED (4), in its recommendations for large scale consolidation of local government, assumes economies of scale exist for larger units; however, no range of size is postulated.

In Oregon (28, p. 72) it was found that both the high and low extremes in per capita operating expenditures were for small cities. This demonstrates the extreme variation that exists within small cities (less than 500). In general, it is reported that larger Oregon cities require higher per capita operating expenditures. Shapiro (38) in another study concluded that local governments in the smallest and largest county areas within different states tend to have the highest per capita revenues and expenditures.

Shoup (39), although referring to distribution rather than economies of scale, assumed in his study that police protection is an increasing cost industry. This is contrary to Hirsch's findings mentioned earlier in which constant costs were found.

Thompson (42, p. 22) says that at a certain range of urban scale growth, mechanisms come into being, locking in past growth and preventing contraction. He advances five reasons for the existence of what he calls a "ratchet effect." Interestingly enough, efficiency

in the provision of municipal services is not one of them.

Public education is an area where a usable measure of product (achievement test scores) has been available for some time. Nevertheless, opinion differs as to the existence of economies of scale in education. Hanson (10) in a study of 574 school districts in nine states concluded that economies of scale exist for school districts over 1, 500 pupils. Average unit cost declines up to 50, 000 pupils in average daily attendance. [8/] Kiesling (18) in a comprehensive study of New York school districts found a weak relationship between expenditure levels and performance. He says no evidence has been found to support the existence of economies of scale in school district performance. From a more general context, Tiebout (43) says that economies of scale are extremely difficult to measure even when the product is readily identifiable.

Empirical Studies

Often relationships exist between variables that are too complicated to grasp or describe simply. An example appropriate to this literature review is the relationship between expenditures on municipal services via tax dollars and the ultimate production of municipal services. Because of this indirect relationship, it is often

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[8/] Hanson used and assumed adequate quality criterion developed by James H. Thomas (41).

useful to approximate a relationship with a mathematical function.

Regression analysis is a technique of function construction used by

many researchers in the analysis of municipal service expenditures.$\underline{9}/$

Before outlining the findings of some of these studies, it might

be helpful to point out some problems in using regression analysis.

First, it should be noted that regression analysis does not neces-

sarily indicate a causative relationship among variables. Secondly,

as noted by Pidot (32, p. 69), few of the assumptions in regression

analysis are satisfied in reality so we must be careful in interpreting

the results.

One of the more complete nationwide studies on city expenditure

was made by Brazer (3) using 1951 data. Analysis was made of

total general operating expenses, police protection, fire protection,

highways, recreation, sanitation, and general control. Of the inde-

pendent variables tested, population density, median family income,

and inter-governmental revenues were found to be statistically

significant. The R^2's ranged from a low of 6 to a high of 57 per-

cent. $\underline{10}/$ One of his more important conclusions is that there is

little relationship between population and per capita expenditures

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$\underline{9}/$ For detailed information on regression analysis see: (7).

$\underline{10}/$ R^2 is the proportion of the original variation that is explained by the regression equation.

when other variables are considered and the sample is large.

Brazer (3, p. 68) also notes what is implied in the findings of

other researchers: "...there is no facile means of explaining the

tremendous range of differences in the levels of city expenditures."

A more recent and detailed analysis of expenditures for muni-

cipal services (in standard metropolitan statistical areas) was made

by Pidot (32) using 1962 data. Of 32 independent variables studied,

those significantly related to municipal expenditures were the level

of personal income, the size and commercial industrial nature of

the property base, the amount of state aid received, population size

and the presence of renter-occupied housing, capital projects, and

population growth. Approximately half (R^2 = 50%) of the variance

is accounted for by the above variables.

A multiple regression analysis was made by Scott and Feder

(37) on per capita expenditures in 196 California communities with

populations over 25, 000. Capital property value, per capita retail

sales, percent population increase, and median number of occupants

in dwelling units were used as independent variables. The first two

variables, reflecting fiscal capacity, accounted for most of the ex-

plained variation in expenditures.

Fisher (9) used seven independent variables to analyze varia-

tions in municipal expenditures between states. The variables used

were: the percent of population earning less than $2, 000 in 1959,

yield of tax system as a percent of U.S. average, population density,

percent population in urban places, population change from 1950-

1960, index of two party competition and the percent of population

over 25 with less than five years of education. The amount of

variation explained by 13 expenditure categories ranged from a high

of 79 percent for police protection to a low of 19 percent for public

welfare. Kurnow (19) comments on Fisher's article and found that

population density and the degree of urbanization were highly corre-

lated and concluded that no advantage would be gained from using

both of these variables in the regression equation. He also notes

that a joint rather than an additive regression equation increases

R^2.

Fisher (8) in another study found that variation in population

density, degree of urbanization and per capita income explain a con-

siderable amount of the variation in per capita state and local gov-

ernment expenditure among states. In agreement with his other

study, the amount of explanation for public welfare expenditures

was low.

Sacks and Harris (34), in a study supplementary to Fisher's

work, found that the addition of state and federal aid to municipal

governments as independent variables significantly increased the

amount of variation explained. The use of state and federal aid re-

ceived has been questioned as an independent variable in an

expenditure equation. However, Pidot (32, p. 68) reports that aid is an exogenous variable largely beyond the control of local decision makers and that there is nothing automatic about its effect.

Hawley (11) using 1940 data from 76 cities with populations over 100, 000 studied the effective population (those receiving services and contributing to revenue sources for the services) of urban areas. The independent variables used were population size, density and growth, number in the labor force, number of white collar workers, housing numbers and density and area in square miles. These variables were analyzed separately in the central city and in the remainder of the district. The percent of the population living outside the central city explained significantly more than the size of the outside population. All the variables taken together explained 57 percent of the variation in municipal service expenditures.

In 1963, Spangler (40) studied population change as a factor in explaining state and local government expenditures. Population change was used as the dependent variable and eight expenditure categories were used as independent variables. His findings were that all expenditure categories except public welfare were positively associated with population growth. Schmandt and Stephens (36), in a study of Milwaukee, Wisconsin, attempted to test the hypothesis that population size is unrelated to per capita expenditures for municipal services. The results of this study are supported by Hirsch's

findings that population size _per se_ has little effect on per capita municipal expenditures.

Suggestions for Improvement

In addition to the results of regression studies, numerous authors have offered suggestions for city government financial problems. Hirsch (15) suggests the development of regional accounts analogous to the national income accounts as an aid to government efficiency. Further, he says that additional statistical information needs to be generated to serve as guidelines for local public officials. Maass (21) estimates that the development of benefit-cost techniques would add substantially to the efficient allocation of public sector resources.[11] Some researchers think the allocation of resources in the local public sector could be improved by greater reliance on user charges and benefit-type taxation (27, 17).

Hirsch (17) asserts that changes in intergovernmental fiscal relationships offer partial solution to the efficiency of resource allocation. His first suggestion is that the Federal government should shoulder an increasing burden of local government finance. Pidot (32, p. 7) concurs with this and adds that the nature of this increased responsibility might well be in the form of Federal

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[11] For a review of cost-benefit analysis, see: (33).

administration and collection of taxes which are subsequently passed

to local government units for distribution. Further, Hirsch suggests

that much needed comprehensive urban planning be supported by

state and federal funds. Other proposals are that a more flexible

federal and state grant-in-aid program may be needed and that

federal legislation that can have adverse effects on urban govern-

ment services should be guarded against.

Hirsch (17, p. 164) discusses another idea with possibilities. This

is the creation of federal corporations for the provision of municipal

services in metropolitan areas without taxing power but endowed

with federal funds to be sustained by user charges.

Some writers promote centralization and others decentraliza-

tion in the provision of local public services as partial solutions to

the problems of local government units. Hirsch (17, p. 164) com-

ments that it is likely that large scale consolidation in metropolitan

areas will occur. Hawley (11) concludes that a strong case can be

made for the establishment of a single metropolitan government

from the standpoint of fiscal efficiency. Along the same lines,

Sargent (35, p. 36) notes that even though everyone does not agree

about the desirability of consolidation, steps in this direction are

inevitable. One of the most sweeping statements about consolidation

is made by the CED (4, p. 17). They state in the form of a recom-

mendation that "the number of local governments in the United States,

now about 80, 000, should be reduced by at least 80 percent."

Empirical and theoretical studies do not all support the recommendations for consolidation mentioned above. Curran (6) notes that the position of central cities is steadily worsening. Results of his study suggest little foundation for expecting metropolitan area fragmentation to be reduced. Tiebout (43) ascertains that integration cannot be justified on purely economic grounds. This is based on his thought that unless a social welfare function is known it will not be possible to determine whether municipal integration will result in more of one service without a reduction in another. To what some infer as an attempt to rationalize decentralization of local government units, Tiebout (43) stated that consumers could pick the community that satisfies their preferences for public services. The greater the number of communities, of course, the greater the range of choice open to consumer units. The act of moving or failing to move is said to replace the usual market test of consumer satisfaction. Warren (54) presents a case for decentralization which has often been an opposed goal in metropolitan development. He finds that healthy government units can exist independent of centralization analogous to independent firms operating in the market system. Further, the author notes that a system of this type more nearly represents what exists today when compared to a model of centralization.

An example of the market alternative can be found in the Lake-
wood or Contract Plan and was started with the incorporation of the
city of Lakewood, California, in the early fifties. The city con-
tracts all of its municipal services from the county. This system
spares the city large capital investments and gives them the advan-
tages of large scale facilities while they still retain the powers and
responsibilities of a local government unit. Since the Lakewood Plan
was started there has been considerable extension in the contracting
of municipal services.

Frequently local government units have attempted to attract
industry with the idea of ultimately reducing their financial ills.
Numerous incentives such as special zoning consideration, tracts
of land at much reduced prices and tax concessions have been of-
fered as inducements. The feasibility of this approach is ques-
tioned by several writers. Cumberland and Van Beck (5, p. 259)
conclude that there is no a priori reason to assume "industry pays
its way" and is therefore not a panacea for local financial difficul-
ties.

The findings of a study by Margolis (23) cast doubt on the ration-
ality of programs to encourage industrial land use in the suburbs.
He reports that accompanying the business use of land there will be
changes in the nature of residential uses and an expansion of public
services so that tax costs per dollar of property value will increase.

A case study approach to determine the effects of a new industry on a rural community was used by Wadsworth and Conrad (53). Policy implications from the findings of this study (if industrial growth is a community goal while confining the benefits to the community itself) are that it may be less costly to encourage the development of local industry or attempt to attract new industry at a reasonable cost. Benefits derived from new industry must be defined relative to a specific area. Generally, benefits of industry are more significant on a regional rather than a local basis. Wadsworth and Conrad (53, p. 12) state that the probability is overwhelming that a community may never receive any new industry or economic gains.

What then are the economic prospects for town and city governments? Thompson (42, p. 34) estimates that the economic prospects for small towns may not be good. The author advances three reasons for his conclusion: 1) the precariousness of specialization in an affluent society, 2) the problems associated with attempting to support a community on the base of a "worker-less" plant, and 3) the trend toward more integrated industrial complexes. Thompson notes that an exception may exist in small and medium size urban areas connected via a good transportation system to a network of labor markets. Hirsch (17, p. 161) points out that the key problem with urban governments is that they are underfinanced. He also concludes that what lies ahead for urban governments is largely a

function of the objectives and initiative of influential groups in society. Ending on a somewhat optimistic note, Pidot's (32, p. 7) principal conclusion is that metropolitan areas contain most of the resources necessary to solve their own problems. What is needed, he says, is greater cooperation between government jurisdictions to bring about the necessary changes.

Summary

Expenditures for local municipal services have been increasing much faster in recent years than studies to analyze these increases. Little work has been done in studying the efficient use of resources by the local public sector. Major obstacles to efficiency analysis have been measurement problems in determining quality and even the quantity of services produced. A general methodology has been developed but it is only applicable to the more easily quantifiable public services. Most researchers have chosen to ignore or assume a constant quality dimension. Measurement problems have contributed to difficulties in appraising economies of scale. Opinion differs as to the extent of scale economies in the provision of public services.

The few empirical studies have been largely multiple regression analyses. Virtually all of these expenditure variation studies have been confined to standard metropolitan statistical areas and based

on U. S. Bureau of Census data. Although results vary there seems
to be a general agreement on the following as important explanatory
variables: per capita income, population density, population change,
and state and federal aid to local governments. Of the expenditure
categories studied the least explanation was offered for public wel-
fare. Consideration has been given to various organizational
changes as partial answers to local government financial problems.
Changes in intergovernmental fiscal arrangements have been sug-
gested with emphasis on federal collection and local allocation of
tax revenues. Arguments are advanced both for and against con-
solidation of local government units. Other suggestions include
greater reliance on user charges and benefit taxes, contracting
services from other government units, attracting industry, and the
development of federal service corporations.

CHAPTER III

ANALYSIS OF FOUR LOCAL GOVERNMENT
EXPENDITURE CATEGORIES

Introduction

This chapter contains a brief discussion of four local govern-
ment operating expenditure categories. They include per capita
expenditures for 1) general government, 2) public works, 3) police
protection, and 4) fire protection and will be considered in the same
order.

General comments on the nature of each expenditure category
are followed by a brief consideration of average per capita expen-
ditures by population size group. A larger portion of the chapter
centers on a study of the regression analysis results.

The discussion starts with an explanation of how the model
was handled for all expenditure categories. Following this is a
brief description of the statistical framework used and criteria for
bringing variables into the regression equations. Directly preceding
the discussion of the first expenditure category the independent
variables will be defined and some of their characteristics impor-
tant to the analysis will be considered.

Model Characteristics

The statistical analysis is based on cross-sectional data on all incorporated Oregon cities for the 1963-64 fiscal year. Data on per capita expenditures for the four categories studied was available for all incorporated cities. Data was not available on all cities for some of the independent variables. The availability of data was used to limit the number of observations in the regression equations to four size groups. It should be noted that observed changes in per capita expenditure equations are due to the addition of more cities to the previous group of cities. For example, group three with 94 cities contains all the cities in group two (55 cities) and group two contains those in the first group (14 cities).

Data on variable X_{14} (the percent of families with a gross annual income of less than \$3,000) was available for only 14 cities. Therefore, the first regression equation containing this group has 14 observations. This group contains the largest cities in the state; population for the smallest member is 9,672. Land area within city limits was available for 55 cities so population density (X_{10}) could be computed for only this number of observations. This group of 55 was used for the second regression equation. Successively smaller cities are included in group two with the smallest member containing 2,677 people. The age distribution of city population (X_1, X_2,

X_3, X_4) was available for 94 cities. The group containing these
94 observations was used for the third regression equation. Popu-
lation of the smallest member of this group was 569. Data on the
remainder of the independent variables was available for all incor-
porated cities. The group containing these comprise the fourth re-
gression equation. Some of the variables in the second group are
combined and manipulated in various ways and used in regression
equations five and six.

Data limitations have resulted in groups of cities with heteroge-
neous population sizes. For example, group three contains a range
of city population from over 500,000 to less than 600. An averaging
effect could cause misleading results. Per capita expenditure fig-
ures for the dependent variables were used in an attempt to reconcile
part of this difficulty. It should be noted that both the numerator and
denominator in a per capita figure are sources of variation. The re-
sultant variable could change as a result of changes in either of them.
This interaction is not separated in the analysis and per capita figures
include variation contributed from both.

Statistical Framework

The statistical analysis is of the relationship between expendi-
ture categories and selected independent variables for Oregon towns
and cities. The method used is least squares multiple regression

analysis. Regression describes the average relationship between dependent and independent variables and assumes certain relationships hold. [12] Equation selection is based on the following criteria: 1) fewest number of parameters, 2) smallest mean square for residuals and 3) the largest R^2.

Regression results are presented in terms of R, t, R^2 and elasticity coefficients. The multiple correlation coefficient (R) is a measure of the general success in explaining variation using all the independent variables. The Student's t statistic is used to test the hypothesis that this coefficient is significantly different from zero. The proportion of the total variation about the mean explained by the regression equation is measured by R^2.

Elasticities are independent of the units in which the original values are expressed and may be more useful for comparison purposes. Elasticity is the ratio of the percent change in the dependent variable associated with a one percent change in the independent variable. It is calculated by multiplying b_i by the ratio of the means of the independent and dependent variable. [13] It provides a measure of sensitivity but is valid for only small changes in the independent variable.

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[12] Assumptions in regression analysis: 1) model is linear in the parameters, 2) independent variables are measured without error, 3) residuals NID.

[13] When per capita independent variables are used the contribution to the elasticity should be considered from both the numerator and denominator. Partial derivatives can be used to isolate the contribution by each variable.

Problems in regression analysis should be noted and taken into consideration when analyzing results. A regression equation is no more than a statistical relationship with an attached probability, an estimate of a functional relationship. Secondly, few of the assumptions made in using regression analysis hold in reality. Thirdly, significant intercorrelations exist between the variables.

Variables in the equations will be viewed in the order of their contribution to the explanation. The contribution a variable makes in reducing the variance is considered for all variables in the equation. The variable which most significantly reduces the variance is then added to the equation. Variables are considered for inclusion in the regression results until the standard error of the dependent variable starts to increase. Beyond this point additional variables are insignificant.

Discussion of Independent Variables

Fourteen independent variables were regressed against the expenditure categories as already noted. Not all variables were used in each equation. These variables are identified below and will be considered in turn.

X_1 Number of total population under 5 years of age

X_2 Number of total population in age range 5 to 24

X_3 Number of total population in age range 25-64

X_4 Number of total population in age range 65 and over

X_5 1964 population

X_6 Population change from 1950 to 1966 (%)

X_7 Assessed property value (in hundreds)

X_8 Percent of total local government receipts from local tax sources

X_9 Percent of total local government receipts received from other governments

X_{10} Population density (population per square mile)

X_{11} Expenditures for operation and maintenance of public facilities

X_{12} Capital outlays by local governments for streets, utilities and other

X_{13} Debt service expenditures by local governments

X_{14} Percent of families with a gross annual income of less than $3, 000.

The number of city population in various age groups are represented by variables X_1, X_2, X_3 and X_4 (28). These factors could influence various types of local government expenditures. For example, X_2 (number of population in age group 5 to 24) is likely to influence education expenditures. Those over 65 (X_4) are largely retired and may dampen expenditures for some functions.

The explanation offered by population size (X_5)could be misleading in that characteristics of the population rather than population per se are likely to offer greater explanation power (25).

Direct relationship with expenditure categories may be superficial.

For one thing city population and the population serviced may not be

the same because those living outside the city limits often receive

services provided.

Population change (X_6) [14/] in percent from 1950 to 1966 varies

with the size group considered. The first group contains some of

the faster growing cities. Cities added in groups two and three are

experiencing what might be described as an average growth rate.

Out of 116 cities added in group four, 40 experienced a decline in

population for the time period specified. Others in this group are

growing at a slow rate. Absolute population change might not be as

important as the rate of sustained growth and how well city planners

have anticipated and acted to meet growth needs. Larger districts

might build facilities with large initial excess capacity or of flexible

design that requires low marginal costs to service a larger populace.

Smaller communities with an "average" growth rate may not be well

enough financed to build for future growth needs. Also in small

commuities people could live within the city limits and use only

part of the facilities provided. This could deflate actual costs or

decrease the importance of the population change variable. In

contrast, virtually all residents in larger cities would be using

public facilities.

14/ Compiled from (26).

Assessed property value in hundreds (X_7) (30, p. 14-24) takes into consideration the tax assessment ratios which range from 19 to 33-1/3 percent. The size of the property tax base is associated with the availability of expenditure funds. Property taxes are the single most important source of local government revenue.

Local taxes (X_8) provide 56 percent of the revenue received by Oregon cities (28, p. 79-84). Property taxes supply 81.6 percent of this local tax revenue. This variable might be more of an indication of local fiscal capacity for small communities because a large percent of their total receipts are received from other governments. Receipts from other governments (X_9) (28, p. 79-84) are generally for special functions. Commonly receipts from the federal government are used for health, education and welfare. The receipts may be an important spending stimulus and could free local funds for other uses.

The sources of receipts from other governments to cities in Oregon are listed below. (Table 1)

This source of funds constitutes approximately 19 percent of total receipts by all Oregon cities. Smaller communities receive a much higher percent of their total revenues from other governments. This is illustrated by the following table. (Table 2)

The units of population density (X_{10}) [15] are in people per

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[15] Compiled from published population figures (26) and land area figures (47).

Table 1. Percent of local receipts from other governments by
source, 1963-64. 1/

State highway revenues	9.4
State liquor revenues	4.2
Gasoline tax refund	0.3
County general road tax	0.4
Federal allocations	3.1
Rural fire protection district	1.4
	18.8

1/ Source of data: (28, p. 77).

Table 2. Receipts from other governments as a percent of
total receipts. 1/

City size	Percent of receipts from other government units
Under 500	45.5
1,000- 1,500	30.2
1,500- 2,500	29.9
2,500- 5,000	26.5
5,000-10,000	32.1
10,000-25,000	21.9
25,000-100,000	22.7
Over 100,000	12.2

1/ Source of data: (28, p. 79-84).

square mile. This may not be appropriate except for very large

cities. Excluding the cities in the first group the range in square

mile area is from 6.7 to 0.9. For smaller towns, population may

be as good a predictor as density. Data to test this was not avail-

able since area figures within incorporated city limits exists for

only 55 of the largest cities. It seems reasonable to assume expenditures for police and fire protection would vary with density of population. Also it would be expected that the association between density and public works and general government expenditures would be less direct.

Variables X_{11}, X_{12} and X_{13} (28, p. 109-114) are expenditure categories themselves. It would be anticipated that they appear as significant variables because they are included in the left hand side of the regression equation. However, the type and incidence of these as independent variables differ from community to community. Their appearance in the regression equations could add important information on the types of expenditures made by different size cities. This is true especially since the authors of the source for the dependent variables assumed that their definitions are self-evident and supplied no explanations of what is included in each of the expenditure categories.

Expenditures for the operation and maintenance of public facilities (X_{11}) include the summation of operating and maintenance expenditures for streets, utilities, airports and cemeteries. Utilities account for roughly 60 percent of the total for this category and 26 percent of total government expenditures. Expenditures for capital outlays (X_{12}) are for streets, utilities and other. They constitute approximately 22 percent of total local government expenditures.

Debt service expenditures (X_{13}) account for 9.5 percent of total

local public service expenditures in Oregon. This variable may be

indicative of past growth and the type of financing used.

The percent of families with a gross annual income of less than

$3,000 (X_{14}) was used as an approximation for a poverty index (25).

This information was available for the first group only.

The regression analysis is confused by intercorrelations among

the independent variables. [16] Particularly, the correlations between

X_1, X_2 and X_5 have clouded the relationships.

Problems of multicollinearity also obscure relationships for

police and fire expenditures. Further, the relationships between

the dependent and independent variables are no more than approxi-

mations. Reporting errors may exist in both the dependent and

independent variables.

General Government Expenditures

General government includes costs of administering a variety

of activities which can be expected to vary widely from community

to community. Expenditures in this category accounted for 16.3

percent of total per capita city operating expenditures in Oregon

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[16] See Appendix A for a table of simple correlation coefficients.
Further reference to appendix A reveals that the expenditure cate-
gories (dependent variables) are not highly correlated with each
other. This indicates that similar factors are not responsible for
variations in expenditures.

for 1963-64. The average per capita expenditure for the state was $7.55, the low was $0.62 and the high was $34.69. Both the extremes were in communities with less than 2,500 residents.

The average per capita figure for the state is much more representative of all cities for general government than with any of the other three expenditure categories. The only exception is in the 25,000-100,000 population group and observations are too few to attach much importance to this deviation. It is interesting to note that all four cities in this group have city manager governments. Other cities in the state have city managers also but most have a mayor-council system.

Table 3 shows that average per capita expenditures for general government do not vary notably with city size. With the exception of the 25,000-100,000 group, city size and expenditures move together. No economies of scale appear obvious for this function. Inquisitiveness on why costs appear constant relative to size might be fruitful.

Results of the regression analysis for general government expenditures are presented in Table 4. When the number of observations increases to 55, the amount explained by the regression equation (R^2) is markedly reduced. Population density explains more and has a higher level of significance in equation I than in II. Per capita expenditures are negatively related to density and this implies

Table 3. Per capita general government operating expenditures for Oregon cities, 1963-64. 1/

Population size group	Number of communities	Average annual per capita expenditure
Under 500	64	7.46
500- 1,000	60	8.31
1,000- 2,500	38	9.44
2,500- 5,000	30	7.11
5,000- 10,000	13	10.01
10,000- 25,000	13	7.52
25,000-100,000	4	4.31
Over 100,000	1	8.28

1/ Source of data: (28, p. 103-108).

that as population density rises external economies increase. This is contrary to the nearly constant per capita costs shown in Table 3 above.

The increasing significance of receipts from other governments can be explained by reference to Table 2; as the influence of smaller governments is added the importance of this variable increases. Small governments receive a much greater percent of their total receipts from other governments. However, the inverse relationship between receipts from other governments and general government expenditures is not easy to explain. As other government receipts increase the importance of government expenditures decreases. It may be that this variable is a proxy for other variables associated with general government expenditures. Another possible implication

Table 4. Regression analysis results for per capita general government expenditures.

Equation number	Degrees of freedom	b_o					R^2
I	11	18.81	b_{10} -.00148 (-2.46)	b_9 -.24507 (-1.71)			.47
II	51.	12.73	b_{10} -.00079 (-1.73)	b_9 -.08198 (-1.53)	b_6 -.08226 (-1.03)		.13
III	90	12.33	b_6 -.19477 (-2.42)	b_9 -.11099 (-2.40)	b_2 -.000042 (-1.16)		.108
IV	206	11.08	b_9 -.08177 (-4.46)	b_6 -.10748 (-1.67)	b_{12} .0000005 (-1.15)		.09
V	51	10.91	b_{9-10} -.000025 (-2.14)	b_6 -.32810 (-1.76)	$b_6{}^2$ -.00804 (1.43)		.16
VI	50	8.81	b_{9-10} -.00002 (-1.69)	b_6 -.34032 (-1.83)	$b_6{}^2$ -.007968 (1.43)	$b_{\frac{x7}{x5}}$ .14023 (1.22)	.18

Table 4. Continued.

X_2 Number of total population in age range 5 to 24

X_5 1964 population

X_6 Population change from 1950 to 1966 (%)

X_7 Assessed property value (in hundreds)

X_9 Percent of total local government receipts received from other governments

X_{10} Population density (population per square mile)

X_{12} Capital outlays by local governments for streets, utilities and other

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1/ The computed t values are in parentheses below each coefficient.

is that diseconomies of scale exist for this function. Implied is

that as the size and expenditure of government units decrease the

need for outside financial assistance increases.

Population change appears in equations II, III and IV but its sig-

nificance is greatest in III. This relationship, like the one above,

is not easy to explain. It could be that more administration is needed

as population changes rapidly and it seems this would be more im-

portant during growth than during decline. Evidently the admin-

istrative costs of change are highest for the group of cities added in

equation III. This could suggest that some economies of scale exist

for larger governments; however, this is not supported by the

earlier discussion on per capita expenditures and the various city

size groups.

The sign of the regression coefficient for population change is

negative in all cases. This indicates an inverse relationship be-

tween population change and expenditures for general government.

This might be explained by a lag effect between population growth

and expenditures. Reasons for this might be that excess capacity

exists or that expenditures simply do not increase as fast as the

need for them.

Per capita general government expenditures for different size

towns are similar (Table 3). This means that general government

expenditures as a percent of total expenditures changes little but

that total expenditures increase with city size. What this suggests about this expenditure category is that efficiencies are not being encountered in the administration of town and city management.

The amount of general government expenditures explained by the regression equation declines as more and progressively smaller cities are added. This might be partially explained by the increased variance as the number of observations is increased. The following table illustrates this.

Table 5. Number of observations and variations in per capita general government expenditures.

Number of observations	Mean per capita expenditure	Standard deviation of expenditure
14	$8.06	3.79
55	7.06	4.06
94	8.08	4.81
210	7.71	4.88

In equation V population density was combined with the percent receipts from other governments. The result of the interaction of these two variables is more significant than when either of them is used separately in equation II. Something in the nature of these two variables results in an increased explanation when they are combined. The interpretation is made difficult because the effect is a result of the interaction between population density and the percent receipts from other governments.

The total amount explained by the regression analysis is lower for the general government than the other three expenditure categories. Equation I for larger cities explained 47.4 percent of the variation. Two previous national studies on standard metropolitan statistical areas by Brazer (3, p. 25) and Pidot (32, p. 98) explained 31 and 49 percent, respectively, for this expenditure function.

The most important explanatory variables in this study are population density (X_{10}), percent of total receipts from other governments (X_9) and population change (X_6). The first two variables were also found by Brazer (3) to be two of his three most explanatory variables. State aid per capita was an important explanatory variable in the Pidot study. This variable is similar to receipts from other governments (X_9) used in this study and is the only independent variable common to both studies. Both Brazer and Pidot reported per capita income to be an important explanatory variable.

The elasticities of significant independent variables are presented in Table 6. [17/]

These figures represent the expected change in general government expenditures from one percent change in the respective independent variables. The table indicates, for example, that a 10 percent change in population density (X_{10}) in group I would result in approximately a seven percent change in per capita expenditures for general government.

[17/] See page 35 for a brief note on elasticities.

Table 6. General government: elasticities for significant
independent variables in Table 4.

Equation number	I	III		IV	V	
Variable	X_{10}	X_6	X_9	X_9	X_9	X_{10}
Elasticity	.69	.11	.39	.38	.27	

Public Works Expenditures

Generally public works expenditures includes the provision of
water and sewage systems. [18/] However, other and quite different
services are included by some cities making expenditure compari-
sons from city to city difficult. For example, one Oregon city
includes the operation of a bus line and another an electric utility.
The level of service ranges from virtually nonexistent for some
very small communities to large scale operations for metropolitan
areas. In some very small communities these services are pro-
vided by individual landowners. As community size increases a
public provided water works can be expected. [19/] As city size

[18/] Difficulties arise in relating demographic characteristics to
the provision of public works. Boundaries of water and sewer dis-
tricts are seldom the same and some sewer and water facilities
serve multiple communities.

[19/] For an inventory of municipal water facilities in Oregon see (51).
This publication reports that water facilities exist for as few as 30
persons. Other water facilities serve large areas outside city
boundaries: Portland, Salem and Eugene are examples.
    Cost structures for water facilities can be expected to vary

further increases the addition of a municipal sewage system usually

results. [20/]

Public works account for 14.2 percent of the total per capita

operating expenditures for all Oregon cities. [21/] Variation in per

capita expenditures between large and small communities is of such

magnitude that an average expenditure figure for the state carries

little meaning. Reference to Table 7 illustrates this point. The

average annual per capita figure for the state was $6.59; a figure

not representative of more than four communities.

Public works facilities are capital intensive and generally

thought to avail themselves to large economies of scale. In other

words, if similar services were offered per capita costs should de-

crease as size increases. Table 7 shows that per capita expendi-

tures decrease for the first three population groups listed. It

might be reasonable to assume that cities with less than 2,500

residents do provide similar public works facilities. For the next

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with water source, treatment required, treatment applied, size of
plant, pumping requirements and ownership.

[20/] For an inventory of sewage treatment plants in Oregon see (31).
Sewage treatment plants in Oregon (1965) were designated to serve
1,504,080 people, and actually served an estimated 1,088,350. This
represents an excess capacity of 38 percent beyond 1965 use. Inter-
esting questions might be raised about the distribution of this excess
capacity within the state.

[21/] Unless otherwise noted figures refer to 1963-64 fiscal year.

Table 7. Per capita operating expenditures for public works by Oregon cities, 1963-64. 1/

Population size group	Number of communities	Average annual per capita expenditure
Under 500	64	$1.94
500- 1,000	60	1.63
1,000- 2,500	38	1.08
2,500- 5,000	30	1.94
5,000- 10,000	13	2.27
10,000- 25,000	13	3.25
25,000-100,000	4	2.58
Over 100,000	1	14.09

1/ Source of data: (28, p. 103-108).

five groups, per capita costs increase except for the 25,000-100,000 group. Reasons for increased expenditures may be many. Larger communities do supply additional services, such as street cleaning, that can be expected to increase per capita expenditures. Economies of scale may well exist but the provision of additional services and too few observations may cloud the true relationships. In any case, the per capita expenditures for Portland appear to measure something different than the expenditures for the rest of the state.

Regression analysis results for public works expenditures are shown in Table 8. They indicate that assessed property valuation (X_7) is the most important explanatory variable. Property value would generally be thought of in relation to the tax base it represents. However, since most public works are rendered on a user-fee basis, the relationship between assessed valuation and per capita

Table 8. Regression analysis results for per capita public works expenditures [1]/

Equation number	Degrees of freedom	b_o					R^2
I	11	4.91	b_7 .0000016 (6.66)	b_{10} -.00059 (-1.69)			.81
II	50	1.17	b_7 .0000016 (6.15)	b_6 .09381 (2.51)	b_8 .02261 (1.05)	b_{10} -.00023 (-1.00)	.51
III	89	.96	b_1 .00352 (2.95)	b_6 .09218 (3.24)	b_5 -.00029 (-2.60)	b_2 .000088 (1.96)	.48
IV	207	.27	b_7 .0000016 (4.28)	b_8 .02942 (2.29)			.11
V	51	2.26	b_7 .0000016 (6.86)	b_6 .08598 (2.44)	b_{9-10} -.000008 (-1.52)		.50
VI	50	-1.13	b_7 .0000014 (5.92)	b_6 .06066 (1.71)	$b_{7/5}$ .31138 (1.49)	$b_{7/5^2}$ -.0058 (-1.13)	.52

Continued

Table 8. Continued.

X_1 Number of total population under 5 years of age.

X_2 Number of total population in age range 5 to 24

X_5 1964 population

X_6 Population change from 1950 to 1966 (%)

X_7 Assessed property value (in hundreds)

X_8 Percent of total local government receipts from local tax sources

X_9 Percent of total local government receipts received from other governments

X_{10} Population density (population per square mile)

1/   The computed t values are in parentheses below each coefficient.

public works operating expenditures is not direct. Both assessed

property valuation and total public works expenditures increase with

city size and the level of service provided might be more a function

of need as dictated by size than property valuation per se. The size

of the property tax base, or property base, may indicate the type of

public works facilities that are needed and, hence, the per capita ex-

penditure required. This may be what is reflected by the assessed

valuation variable. Assessed property value may also be an indica-

tion of ability to pay user-fees. Although this is no indication of

cost incidence, it may nevertheless indirectly influence decision

makers and have a positive effect on expenditures.

In Equation I, assessed valuation accounts for 75.9 percent of

the variation. As additional observations are added, in equation II,

the amount explained by this variable is reduced but it is still highly

significant. This variable does not appear in equation III but re-

appears as the most important variable in equation IV.

A look at the simple correlations between variables indicates a

high positive correlation between variables, population under five

years (X_1), population in age range 5 to 24 (X_2), population (X_5)

and assessed property value (X_7). [22/] Population density (X_{10})

appears in equations I and II. In the absence of X_{10} in equation III,

variables X_1, X_2 and X_5 appear in place of X_7. The absence of

X_{10} in equation III, or the characteristics of observations added in

[22/] See Appendix A.

III, may account for X_7 not appearing in III. The absence of var-iables X_1 and X_2 in equation IV might also explain why X_7 is again significant.

Population density (X_{10}) and per capita public works expendi-tures are inversely related. As population density increases per capita public works expenditures decrease. This might indicate the existence of economies of density associated with public works for larger cities.

Population change (X_6) appears in both equations II and III, but does not appear in either I or IV. The explanation for the selective appearance of the population change variable could be related to the degree of built-in excess capacity in the design of public works facilities by various size cities.

If it is assumed that public works facilities for medium size governments have less built-in excess capacity or flexibility and that per capita expenditures reflect amortization for capital expen-ditures, population change could be more important in explaining public works expenditures for medium than for large local govern-ment units.

Where economies of scale exist (providing the cost curve still has a negative slope) it costs something less than a proportional amount to increase the capacity. The largest economies may exist for very large units not feasible for construction by medium size

city governments. A large increase in capacity reflecting growth

needs may have more of an impact on per capita expenditures in

medium size governments. These factors might partially explain

why population change appears in II and III but not in I. Actual pop-

ulation growth in the small towns added in IV, as noted earlier, is

very slow and in many cases negative. If there is no growth there

may be no need for a change in operating costs and the absence of

an important population change variable is reasonable. In the case

of negative growth there would be no change in per capita expendi-

tures if costs varied directly with output, i.e., a horizontal cost

curve. This assumes that virtually all costs are variable; this

however, is inconsistent with the existence of large economies of

scale in the provision of public works. Large economies of scale

in the operation of public works facilities would indicate that the

greatest portion of operating costs are fixed and that total costs

decrease as output increases.

Communities with declining populations (added in IV) might

experience higher per capita costs than if existing facilities were

operated at an optimum level. This might be revealed by strati-

fying communities into suitable size groups.

The percent of local government receipts from tax sources (X_8)

appears in II but is significant only in IV. It seems reasonable that

this variable, reflecting local fiscal capacity, should contribute to

the explanation. [23/] With the addition of smaller communities, the importance of receipts from taxes increases. Problems of inter-correlations might partially account for the absence of this variable from equation III. Since public works are usually supplied on a user-fee basis this relationship is not easily explained.

The total amount explained by the public works regression equation is high, especially for the largest size group considered (equation I). This general expenditure category has not been analyzed recently on a national scale but Brazer (3, p. 25) and Pidot (32, p. 99) have done related work. In studies of large cities they analyzed a sanitation expenditure function (street cleaning and garbage collection). For this function they explained 30 and 54 percent, respectively. Pidot analyzed sewer expenditures separately and explained only 24 percent.

The important explanatory variables in this study are assessed property valuation (X_7) and population change (X_6). Pidot found population change (in logarithmic form) to be an important variable in his work on sanitation expenditures. Both Brazer and Pidot found receipts from other governments to be an important explanatory variable for this same expenditure function.

[23/] As noted earlier, the total variation increases with the number of observations and explains the reduced ability of the model to account for variance as the variation increases.

The elasticities of significant independent variables are presented in Table 9. [24]/

Table 9. Public works: elasticities for significant independent variables in Table 8.

Equation number	I	II		III			IV		V		VI
Variable	X_7	X_7	X_6	X_1	X_6	X_5	X_7	X_8	X_7	X_6	X_7
Elasticity	.33	.18	.21	1.7	.23	1.6	.07	.76	.17	.19	.15

These figures represent the expected change in public works expenditures from a one percent or specified change in the respective independent variables. Elasticities for two demographic variables in group III are greater than unity. They indicate that a ten percent change in the number of people under five years of age (X_1) and total population (X_5) would result in a 17 and 16 percent change, respectively, in per capita public works expenditures. Another high elasticity was found for receipts from taxes (X_8) in group III. Indicated is that a ten percent change in this variable will result in a 7.6 percent change in public works expenditures.

Police Expenditures

The output from police protection expenditures is less subject

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[24]/ See page 35 for a brief note on elasticities.

to quantification than many other public services and this makes
efficiency analysis more difficult. However, the services that are
supplied by expenditures for police protection are likely to be rea-
sonably uniform for cities of similar size.

It seems reasonable to assume that crime prevention is an in-
creasing cost industry. As crime is reduced it becomes increasingly
more difficult to prevent one more crime.[25/] Police protection in-
volves the provision of personal services and therefore is highly
labor intensive. Only certain aspects might lend themselves to
scale economies. Service levels can be expected to vary from
small to large communities. A minimum for around-the-clock sur-
veillance would be three policemen. It can be easily seen that this
level of protection is not provided by small communities. A look at
total expenditures and population makes this evident.

Police protection represents the largest single operating ex-
penditure category for all Oregon cities taken together. Police
expenditures account for 24.4 percent of total annual per capita

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[25/] If the assumption is made that the main purpose of police pro-
tection is crime prevention, some indication of victim risk rate can
be approximated from the uniform crime reporting program (50).
Communities are rated on the number of occurrences per 100,000
population of seven offenses. The crimes on which communities are
rated are: murder, forcible rape, robbery, aggravated assault,
burglary, larceny ($50 and over), and auto theft. Some weighting is
performed and these individual figures are aggregated into a single
figure ("crime index") for each community. It is suggested that in-
formation in this publication be used as a starting point to determine
deviations of individual cities from national averages. The

operating expenditures in Oregon cities (1963-64). The average per

capita expenditure for all Oregon communities was $11.32. Wide

variation exists as illustrated by Table 10 below.

Table 10. Per capita operating expenditures for police protection
by Oregon cities, 1963-64. 1/

Population size group	Number of communities	Average annual per capita expenditure
Under 500	64	$ 3.21
500 - 1,000	60	5.97
1,000- 2,500	38	8.97
2,500- 5,000	30	8.84
5,000- 10,000	13	9.83
10,000- 25,000	13	9.75
25,000-100,000	4	8.60
Over 100,000	1	15.79

1/ Source of data: (28, p. 103-108).

It appears on the surface at least, that per capita expenditures

increase with city size. An apparent exception exists in the 25,000

to 100,000 population size group; however, two of the four cities have

universities within their city limits. The universities provide a por-

tion of the police service at no cost to the city. The presence of the

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publication lists 11 factors affecting the amount and type of crime,
most of which can be expected to vary from community to community.
In order to compare economic differences between communities in
the provision of police protection, adjustments would need to be made
for all of these factors. Some assumption would need to be made
about the relevance of the "crime index" in serving as a starting
point or as a significant indicator of differences in protection levels.

universities adds to the population base but not materially to city

police expenditures and hence deflates the per capita figure for the

four city groups.

This direct relationship between population size groups and ex-

penditures is not confirmed by regression results. From the regres-

sion analysis that follows, characteristics of population rather than

population per se explain the variations that exist.

Regression analysis results (Table 11) of per capita police

expenditures indicates that many factors are involved in deter-

mining expenditure levels. This is revealed by the total amount

explained and the lack of consistency in appearance and order of

specific variables as more communities are added.

Assessed valuation (X_7) accounts for 36.9 percent of the vari-

ation and is highly significant in equation I. This variable does not

appear in equation II or III but reappears in IV with the sign of its

regression coefficient changed from positive to negative. Equa-

tions V and VI are for the same observations as II and show as-

sessed valuation with a positive sign. Property valuation is thus

positively related to per capita expenditures in larger size towns

and becomes inversely related to expenditures as smaller towns

and rural communities are added. This might be partially ex-

plained by the fact that smaller towns rely less on local taxes and

more on receipts from other governments to finance their

Table 11. Regression analysis results for per [1] capita police expenditures.

Equation number	Degrees freedom	b_o									R^2
I	10	15.00	b_7 .000000099 (3.26)	b_{10} -.000998 (-2.49)	b_9 -.09601 (-1.03)						.69
II	51	11.32	b_{11} .0000004 (2.16)	b_6 -.11346 (-2.56)	b_9 -.05687 (-1.78)						.25
III	89	12.83	b_9 -.11712 (-3.82)	b_6 -.09582 (-1.78)	b_{11} .000002 (1.25)	b_5 -.000047 (-1.01)					.20
IV	207	11.43	b_9 -.13813 (-7.96)	b_{11} .000003 (1.55)	b_7 -.0000037 (-1.24)						.27
V	46	10.99	b_{9-6} -.01507 (-4.02)	b_{62} .00756 (2.62)	b_7 .000026 (2.30)	b_5 -.00027 (-2.20)	b_{52} -.0000000006 (2.08)	b_{9-10} .00004 (1.89)	b_9 -.10786 (-1.44)	b_{102} -.0000001 (-1.22)	.44
VI	47	.38	b_7 .0000003 (9.53)	b_6 -.36822 (-3.49)	b_{62} .00708 (2.27)	b_9 -.04008 (-1.26)	b_{7-5} .60763 (2.34)	b_{7-52} -.01325 (-2.08)	$b_{10}logs$ .77780 (1.03)		.40

X_5 1964 population.
X_6 Population change from 1950 to 1966 (%).
X_7 Assessed property value (in hundreds).
X_9 Percent of total local government receipts received from other governments.
X_{10} Population density (population per square mile).
X_{11} Operation and maintenance of public facilities.

[1] The computed t values are in parentheses below each coefficient.

expenditures than do large cities.

Population density (X_{10}) increases the explanation in equation I to 65.9 percent. This variable does not reappear as smaller size cities are added in equation II. The inverse relationship between density and expenditures as well as its selective appearance in group I may indicate that some economies of density exist for larger cities.

Equations V and VI represent the same group of cities covered in equation II; the difference is that nonlinear and combined variables are used. The total amount explained is increased over the straight linear form in II but many more variables appear as significant. The observations added in equation II increase greatly the variation and decrease the explanation offered by regression.

The operation and maintenance of public facilities (X_{11}) appears as the most important variable in equation II.[26] It also appears in equations III and IV. It is interesting though not readily explainable, why this variable did not appear as significant for per capita public works expenditures. As previously mentioned, police protection is highly labor intensive and operation and maintenance are but a small percent of total police operating expenditures. The only obvious recurrent expenditure is for transportation, keeping police units mobile. The relationship could exist because

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[26] See page 10.

expenditures appear on both sides of the equations even though operation and maintenance might account for a small part of total expenditures. Part of per capita expenditures for police are the expenditures for operation and maintenance of police facilities. The relationship between this variable and police protection is likely spurious.

The percent receipts from other governments (X_9) appears in all regression equations for police expenditures. It is the most important variable in equation III and IV. The importance of this variable increases as smaller government units are added.

The sign on the regression coefficient indicates an inverse relationship between receipts from other governments and per capita expenditures for police. This implies that as per capita expenditures for police protection increase the receipts from other governments for this function decrease. Intuitively this relation- ship might be reasonable for large governments. They have the highest per capita expenditures and the lowest percent of total re- ceipts from other governments. Receipts from other governments are far more important to small cities. [27] As more money is re- ceived from other governments the lower the percent spent for police protection. It would seem that expenditures would vary

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[27] See Table 2.

more directly with receipts from other governments if this source

of funds is important in determining police expenditures.

Population change (X_6) appears in equations II and III. This

variable does not appear in equation I containing the largest cities

or equation IV containing the addition of the smallest communities.

The sign of the coefficient is negative indicating an inverse relation-

ship between population change and per capita expenditures. If as

population increases per capita expenditures go down and, conversely,

as population decreases per capita expenditures go up, economies

of size might be indicated for cities added in equations II and III.

It is possible that service levels, as indicated by expenditures,

vary inversely with population change also.

The absence of this variable (X_6) in equation I might be ex-

plained by a greater relative excess capacity in large cities with

respect to the provision of this service. The reason this variable

does not appear in equation IV may be that protection provided by

small cities added in IV may be inflexible to population change.

Even though many of the cities added in this group are experiencing

a near zero or negative population change there may be a lag in re-

ducing protection.

Equations V and VI emphasize that there are many factors

shaping police expenditures. In equation V the interaction and

squaring of terms results in six variables entering, all significant

at the ten percent level or better. The combination of all eight variables entering accounts for 44.4 percent of the variation.

Equation VI presents an example of multicollinearity between variables. When assessed valuation entered the equation initially it was significant at the 2-1/2 percent level. As other variables were introduced, assessed valuation becomes nonsignificant.

Previous work of national scope on police expenditures has been conducted by Brazer (3, p. 25) and Pidot (32, p. 100). In their analysis of large cities they explained 51 and 77 percent, respectively, compared with 69 percent for equation I in this study.

The most important explanatory variables for police expenditures in Oregon cities were assessed property value (X_7), receipts from other governments (X_9) and population change (X_6). Of these, receipts from other governments was found to be significant in the studies by Brazer and Pidot. Both researchers found population density to be an important variable.

The elasticities of significant independent variables are presented in Table 12. [28]

These figures represent the expected change in per capita police expenditures from a one percent or specified change in the respective independent variable. For example, if population density

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[28] See page 35 for a brief note on elasticities.

Table 12. Police expenditures: elasticities for significant independent variables from Table 11.

Equation number	I	II	III	IV	V	VI
Variable	X_7 X_{10}	X_{11} X_6	X_9	X_9	X_9 X_6 X_6^2 X_7 X_5	X_7 X_6 X_6^2 X_7/X_5
Elasticity	.01 .46	.02 .07	.36	.72	.23 .06 .05 .5	.008 .22 .06 .83

(X_{10}) in equation I or population (X_5) in equation V changed ten

percent the indicated change in police expenditure would be approxi-

mately five percent.

Fire Expenditures

Fire protection expenditures are the second most important

operating expenditure category for Oregon cities. Per capita ex-

penditures for fire protection account for 21.2 percent of total

operating expenditures. The average per capita expenditure for

all Oregon cities was $9.86 (1963-64). Variations by city size are

listed below.

Table 13. Per capita operating expenditures for fire protection by
Oregon cities, 1963-64. 1/

Population size group	Number of communities	Average annual per capita expenditure
Under 500	64	$1.38
500- 1,000	60	2.03
1,000- 2,500	38	2.54
2,500- 5,000	30	3.86
5,000- 10,000	13	7.06
10,000- 25,000	13	9.02
25,000-100,000	4	9.50
Over 100,000	1	15.23

1/ Source of data: (28, p. 103-108.)

Expenditures for fire protection are the most likely to gen-

erate similar types of services (for cities of similar size) of the

four expenditure categories in this study. However, measurable

product is not easy to relate to per capita expenditures for fire

protection. Reference to Table 14 shows more variables enter the

equations than with any of the previous expenditure categories

analyzed. Similar to the case for police expenditures problems of

multicollinearity obscure relationships. As with previous per capita

expenditure categories the first equation, including the larger

cities, offers the most explanation. The percent receipts from

other governments (X_9) by itself accounts for 51.5 percent of the

variation in equation I. Rural fire protection districts revenues

are part of receipts from other governments and partially explain

the presence of this variable in all equations for fire protection. [29]

It would seem that this variable should be more important in ex-

plaining expenditures by smaller communities in rural areas. They

receive a large percent of their total receipts from other govern-

ments. [30] The percent of total receipts received by small com-

munities from rural fire protection districts is also likely to be

proportionately higher. This explanation does not account for the

importance of this variable in equation I which is dominated by

larger communities.

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[29] See Table 1.

[30] See Table 2.

Table 14. Regression analysis results for per capita fire expenditures.[1]

Equation number	Degrees freedom	b_o										R^2
I	10	16.56	b_9	b_7	b_{10}							
			-.22298	.00000078	-.00076							
			(-2.18)	(2.34)	(-1.74)							.69
II	45	.77	b_5	b_7	b_1	b_{13}	b_6	b_9	b_{11}	b_{10}	b_8	
			-.00001	-.00002	.00523	-.000007	.07074	.05674	.000003	.0006	.04889	
			(-.08)	(-3.63)	(2.77)	(-1.21)	(1.22)	(-.792)	(1.76)	(1.53)	(1.19)	.48
III	86	94	b_5	b_7	b_1	b_{11}	b_9	b_6	b_8			
			-.00002	-.00003	.00628	.0000045	-.03438	.09019	.03118			
			(-.23)	(-6.12)	(3.87)	(2.69)	(-1.08)	(1.98)	(1.04)			.49
IV	205	3.12	b_6	b_{11}	b_9	b_7	b_{12}					
			.30740	.0000045	-.02860	-.000005	.0000008					
			(5.57)	(2.22)	(-1.79)	(-1.68)	(1.55)					.237
V	51.	6.10	b_5	$b_5 2$	b_9							
			.00013	.00000000027	-.04645							
			(3.51)	(2.85)	(-1.16)							.34
VI	54	-16.6	$b_5$logs									
			2.55943									
			(7.014)									.48

X_1 Number of total population under 5 years of age.
X_5 1964 population.
X_6 Population change from 1950 to 1966 (%).
X_7 Assessed property value (in Hundreds).
X_8 Percent of total local government receipts from local tax sources.
X_9 Percent of total local government receipts received from other governments.
X_{10} Population density (population per square mile).
X_{11} Operation and maintenance of public facilities.
X_{12} Capital outlays by local governments for streets, utilities and other .
X_{13} Debt service expenditures by local governments.

[1]The computed t values are in parentheses below each coefficient.

The sign on the regression coefficient is negative in all equations indicating an inverse relationship between expenditure and receipts from other governments. Intuitively receipts from other governments and city expenditure categories would be positively related. The regression results are contrary to the idea that receipts from other governments are an important stimulus to spending and that expenditures are determined by the availability of funds.

The assessed value of property (X_7) appears in all four linear equations. The coefficients for assessed valuation in equations I and IV are positive and for equations II and III are negative. In equation I per capita fire expenditures increase with assessed property valuation. With the addition of cities in equations II and III the total effect is negative. Expenditures for fire protection and property value are inverse. As small cities are added in equation IV the relationship for all cities is again positive although here not statistically significant, indicating that fire expenditures increase with property value. The implications of this are uncertain. Per capita expenditures are higher for larger cities. The total assessed valuation of cities varies directly with city size. If total assessed property values as related to local tax revenues are important in explaining fire protection expenditures then per capita expenditures would vary directly with per capita property

value. Although wide variation exists the larger cities have higher

per capita assessed property value. This is consistent with the

larger cities in equation I.

With the addition of II and III, the relationship becomes

negative. Per capita expenditures may be less related to property

tax revenues within this range. It could be that more property

value is protected at a lower cost than is revealed in a negative

slope. The latter might indicate fire departments added in groups

II and III are more efficient. The positive relationship in I and

IV could indicate the fire protection is less efficiently provided by

large and small cities. It could also indicate that more services are

provided in I and also in IV with field and forest fire protection in

rural communities.

By reference to Table 13 it appears that per capita fire

protection expenditures vary directly with city size. The reasons

behind this are not clear cut. Fire protection is mainly a matter

of having an engine company within a suitable distance. Intuitively,

expenditures to provide a given level of service should not be ex-

pected to vary significantly from city to city. Providing for in-

creased protection for towns grown beyond the point where a volun-

teer fire department is adequate generally requires the duplication

of existing facilities in another location. This however, could be

reflected in constant per capita expenditures and increasing per

capita costs are not easy to explain. No economies of size appear

evident for this function, rather diseconomies might be indicated by

increasing costs.

Population change (X_6) is an unexpected first variable in

equation IV. It is unexpected because property valuation (some-

thing to protect) and indications of fiscal capacity seem more

closely related. However, over time population change may be an

indication of changing taxable property base. In this case the rela-

tionship between population change and expenditures would be direct.

The sign on the coefficient for this variable is compatible with this

statement.

The operation and maintenance of public facilities (X_{11}) is

the second variable entering equation IV. As was mentioned in the

police expenditure discussion the inclusion of this variable on the

right hand side of the equation is subject to question. Part of fire

protection expenditures are for maintenance of fire protection

facilities. The simple correlation between the operation and main-

tenance of public facilities and assessed valuation is .98. Thus

one of these could be eliminated from the analysis and the former

would be the best choice.

Population (X_5) shows up in equations II and III but the

relationship is confused by multicollinearity. In equation V popu-

lation and population squared are both significant. The addition of

a significant squared term in equation V indicates that a curvi-
linear relationship exists for per capita fire expenditures. Popula-
tion in logarithms in equation VI, allowing more curvature, by
itself accounts for 48.1 percent of the variation. The positive value
and large coefficient indicate a rising curve. Because this coeffi-
cient is in logarithmic form its value is also its elasticity coeffi-
cient.

The elasticities of other significant independent variables
are presented in Table 15. [31/]

These figures represent the expected change in per capita
fire expenditures from a one percent or specified change in the
respective independent variables. Greater than unitary changes
are indicated by the elasticities for the number of people under five
years of age (X_1) and population (X_5) in equation VI. The figure
for population (X_5) in equation VI indicates that if population (in
logarithms) changed 10 percent that per capita fire expenditure
would change approximately 26 percent. The elasticities for
assessed value (X_7) are close to unity in both groups II and III
indicating that a percent change in assessed value would result in
very nearly the same percent change in per capita fire expenditures.

The amount explained by the regression equation for per

31/ See page 35 for a brief note on elasticities.

Table 15. Fire expenditures: elasticities for significant independent variables from Table 14

Equation number	I	II		III			IV		V		VI
Variable	X_7	X_7	X_1	X_7	X_1	X_{11}	X_6	X_{11}	X_5	$X_5 2$	X_5 logs
Elasticity	.06	.93	1.21	1.02	1.23	.29	.26	.19	.35	.13	2.55

capita fire expenditures in group I was 69 percent. Previous

studies of this expenditure function on a national scale have been

made by Brazer (3, p. 25) and Pidot (32, p. 101). In their work

on large cities they reported R^2 of 51 and 75, respectively.

In Oregon, assessed property value (X_7), receipts from

other governments (X_9) and population (X_5) were the most important

explanatory variables for fire expenditures. These same variables

were found significant in Pidot's study. Receipts from other gov-

ernments (X_9) was found significant in Brazer's study.

SUMMARY AND IMPLICATIONS

Introduction

Local decision makers are not free to make the most effi-
cient local expenditure decisions, nor is traditional economic effi-
ciency analysis directly applicable to all aspects of public expendi-
tures. These two problems will be discussed under the titles of
institutional and economic framework. With these two brief
discussions in mind the summary and conclusions from Chapter III
will be presented. Following this will be implications for further
research.

Institutional Framework

There are many influences on public policy resulting in com-
peting demands for resource allocation within the public sector.
Complications are many: interaction between revenue and spending
decisions, effects of intergovernmental aid, and institutional con-
straints obscure any direct relationship between revenues collected
and services provided. Such factors as the candidate's regard for
his platform, popular pressure and the influence of party politics
all have important effects on flexibility and scope of possible

decisions. Constraints on choice by decision makers are many with respect to public services. Local governments have a defined area of jurisdiction that is relatively inflexible. Budget, capital and fiscal constraints exist that limit capacity variability. In addition, functional constraints are involved with interdependence of decision-making units. These factors help explain that even though a public agency is set up in the public interest and as such should consider total costs and benefits, this is not the case in practice.

There is an extremely tortuous route from the development of welfare maximizing decisions on the one hand and the ultimate service expenditures on the other. The supply of public services by local governments contributes to a social welfare function. However, this function is yet to be defined and currently exists in societal attitudes and is occasionally expressed in public policy. Socially available resources vary from community to community and make comparisons difficult. The most readily available means of comparison, expenditures made for given services, may not be the most satisfactory. It is, however, a feasible method that can shed light on important issues.

General equilibrium theory is said to supply the conditions for optimal allocation by the market system. The breakdown of conditions for optimal private sector output supply the rationale for the existence of the public sector. This together with the complex

nature of society's production function make it difficult to apply traditional economic concepts. Income redistribution, the existence of externalities associated with city living and other factors may be more important than consideration of economic efficiency alone; however, greater economic efficiency in the public sector could lead to the provision of more public services or free resources for other important uses.

Economic Framework

The question arises as to what type of economic analysis is appropriate to study the local public sector. The answer is related to the particular service being analyzed. Those services that are more easily measured such as public works (water and sewer) can be studied with conventional equilibrium theory. Production functions could be constructed from engineering data and cost curves can be derived from market data for inputs. Differences in efficiency from one local government sector to the next can be determined. The assumption of constant quality of the services necessary to say anything about economies of scale would not be greatly violated. Moreover, an index could be made to put services on an equivalent level for comparison purposes. It should be noted, however, that expenditures for public works constitute only a small percentage of local government expenditures.

Problems become apparent when analysis is directed toward police protection, fire protection and general government expenditures. Problems with quantification of output or service levels preclude use of traditional analysis.

It is possible that fire protection could be quantified reasonably well through the use of fire insurance data. Difficulties not so readily alleviated remain for police protection and general control (government administration).

General equilibrium analysis could be used for police and general control if a very large assumption was made. This is that the quality aspect is constant among communities or for expenditure levels. It would seem on the surface that this is not the case and accepting this assumption would render analysis results virtually worthless. General equilibrium analysis would have to be approached from the supply side via expenditure levels. This would be a circuitous analysis, at best, with much needed information left out.

An approach might be to consider the contribution of police protection and general government to a general social welfare function. At least some researchers think preferences could be revealed in an interview that would make it possible to construct a social welfare function. Ackoff (1, p. 116) feels that building a measure of a community's evaluation of a service can be reasonably approximated from the evaluation of individuals responses and proposes a

series of basic questions to be answered in constructing a social

utility function. Tiebout (36) suggests interviewing residents

to establish pricing for police and fire protection.

Empirical estimation of the economic framework needed to

analyze efficiency is not now possible. Cost analysis requires we

know the specific inputs going into a production process, and that we

can measure a homogeneous output. In the case of city expenditure

analysis we do not have access to detail input expenditures for a

broad range of towns and cities. But more critically we have no

measurements of quantity or quality of the services which are the

outputs of these governmental expenditures. In short, the inability

to quantify output for most local public sector expenditures stymies

the use of traditional analysis. Theory to circumvent these prob-

lems has not yet been developed.

Previous empirical studies outlined in Chapter II represent

the philosophies of various researchers. What seems to be implied

in this existing work is that some theory will eventually be forth-

coming. It might, however, be useful to review the regression

analysis results presented in the last chapter from the standpoint

of traditional economic theory.

The measure of output most readily available for public

services is expenditures. It is suggested in earlier work that

expenditures represent only an approximation to the supply side of

an equilibrium situation. Rather than following this line of thought

expenditure levels could represent equilibrium points where supply
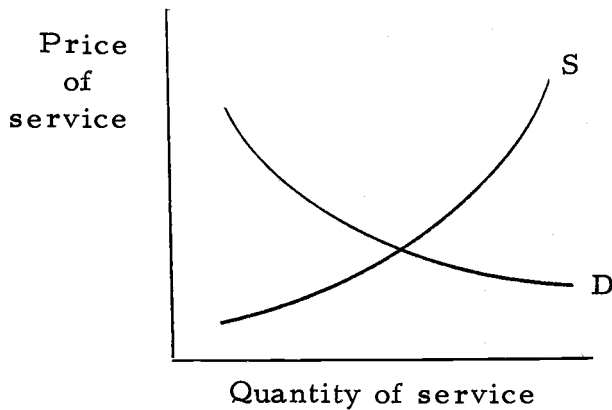
and demand are equal.

Price
of
service

Quantity of service

Figure 1.

Expenditure levels used as dependent variables in the regres-

sion analysis could approximate equilibrium points. Independent

variables could represent disturbances that influence the shape,

location or tendency of the supply or demand curves.

Summary and Conclusions

The title of this study, "The Efficiency of Social Capital

Expenditures in Oregon Towns and Cities", is somewhat pre-

sumptuous. It implies that the necessary ingredients for efficiency

analysis, i. e., inputs and outputs, are present. Far from being

the case, inputs are approximated via expenditures and outputs defy

easy description, much less measurement. Encompassed in the

title is a neglected area of study the dimensions of which are

growing steadily. Absolute and relative increases in local government expenditures over time emphasize the need for concerns of efficiency. Rather than an efficiency measure, the purpose of this study is to point out important economic and demographic factors that have an influence on local government expenditures and point to areas of further inquiry that might eventually lead to a measure of efficiency in the provision of local public services.

This study is a cross-sectional view of local government operating expenditures made by Oregon's towns and cities. The units of study are all the incorporated towns and cities in Oregon for the fiscal year 1963-64. The per capita expenditure categories analyzed are general government, public works, police protection and fire expenditures. A brief summary of the findings for each of these categories will be considered in turn.

General government expenditures support a variety of administrative functions that vary from city to city and make direct comparisons questionable. Less is explained by the regression results for per capita general government expenditures than the other three categories studied. R^2 range from .47 for the largest cities to less than .10 when the smallest incorporated cities are included. Previous work reviewed (3, 32) explained even less than is explained here for Oregon's 14 largest cities.

Variables offering the most explanation for general government expenditures were population density, receipts from other governments, and population change. Only one of these (receipts from other governments) was common to two major national studies reviewed. Generally, significant explanatory variables vary from study to study. Similar variables are important with various city size groups in Oregon but markedly less is explained as progressively smaller cities are added. Per capita general government expenditures appear relatively constant with respect to city size. This indicates that total expenditures for this function increase with size and no economies of scale are apparent.

What is included in public works expenditures varies widely from city to city. Expenditures for public works appear even less comparable than those for general government.

The amount explained by the regression results is unexpectedly high, especially for the group containing Oregon's largest cities. These 14 cities had an R^2 of .81. Previous national studies reduced public works expenditures into subgroups and yet explained less. The most important explanatory variables for public works expenditures were assessed property value and population change. None of these variables were found common to previous national studies reviewed.

Some earlier work has mentioned that public works

facilities avail themselves to large economies of scale. Conceivably because different things are included in public works expenditures from city to city these previous findings were not confirmed in this Oregon study.

Police and fire protection represent the largest and second largest expenditure categories, respectively, by Oregon cities. Together they comprise 45.6 percent of total operating expenditures. Expenditures for police and fire protection appear to be reasonably comparable from city to city. Difficulties in quantifying output are apparent however.

The amount explained by the regression equations for police and fire protection in Oregon's largest cities is quite similar to the findings of two previous studies of national scope. R^2 for both categories was .69. Regression results from this study indicate that many factors are important in determining per capita police and fire expenditures. This is indicated by both the large number of variables entering the equations and the lack of consistency in the appearance of variables as progressively smaller cities were brought into the regression analysis.

The regression results indicate that for police expenditures characteristics of population rather than population itself are important in explaining variations that exist. However, population itself appears as a significant variable in the regression results for fire

protection expenditures. Property valuation and receipts from other governments are two other important variables in explaining fire protection expenditures. One previous national study found these same three variables to be important; another reported only receipts from other governments in common with these findings for Oregon.

The most important explanatory variables for per capita police expenditures were assessed property value, population change and receipts from other governments. Only the latter was found common to two previous studies and to appear consistently as progressively smaller cities were added.

The "best" regression results were obtained for Oregon's largest cities, only 14 in number. Previous studies with which these results compare favorably (in both the variables found important and R^2) were on much larger numbers of cities that were all standard metropolitan statistical areas. The Oregon results are based on a small sample and caution should be exercised when making comparisons. Definitions of expenditure categories and explanatory variables used differ from study to study. These as well as important geographical differences in the locations of cities make comparisons difficult. Brazer (3, p. 10) notes that location with respect to state is a significant source of variation in city government expenditures.

It appears that what is evident on the small scale of the Oregon study, variability increases with numbers of cities analyzed, becomes more apparent as attempts are made to cross state lines and study city expenditures on a national scale. Obstacles are many but the need is pressing to study efficiency in resource allocation by the local public sector. This and previous studies point out a few important variables associated with differences in city to city government operating expenditures. They do not get at the heart of the problem which is to measure efficiency in the provision of municipal services. Toward this more important objective suggestions are offered in the next section entitled implications for further research.

Implications for Further Research

The effective demand for all goods and services is increasing with growing incomes and productivity. The trend in the public sector is for the provision of more and better services. As more resources are allocated by the public sector considerations of efficiency become more important in a relative as well as an absolute sense.

There are at least two ways economics can be useful. The first is that economic logic be used to simply allocate after political mechanisms make the normative public sector decisions. The second is that economic analysis be used to evaluate various

alternatives as an aid to political decision making. Feasible alternatives could be analyzed by economic analysis and subsequently weighted via the political process. This allows more interaction between political, social and economic aspects of a welfare function.

Studies of efficiency can be the most helpful if directed in the manner suggested by the second approach. Efficiency factors may suggest one type of organizational structure over another. Economic evaluation can be a powerful tool in analyzing alternatives.

All services provided by the local public sector are interrelated. Allocation decisions must be made in the budgeting process for the provision of services not rendered on a user-fee basis. What is budgeted for one service obviously limits what is available to the other services. Even though this interrelationship exists it may be useful to study each public service individually.

Existing institutional arrangements may be inflexible but it may be instructive to step back and evaluate basic services being provided by the local public sector. The costs of social experimentation are high but on a theoretical basis it may be useful to consider a "with and without" model for some public services. If we assume that the main function of police protection is crime prevention then how much crime can we afford to prevent? That is, what is the opportunity cost associated with a certain level of crime?

This would necessitate an evaluation of losses to society resulting from criminal acts.

Expenditures to prevent crime by maintaining a large police force are essentially nonproductive. If some of these resources were diverted to crime prevention in the form of educational programs and campaigns directed toward the alleviation of poverty the long-run benefits are likely to be greater than maintaining a deterent force. If an evaluation of the opportunity cost of crime prevention was made then some basis might exist for reallocation of resources with emphasis on the causes of crime.

A with and without model might also be considered for fire protection. As with crime prevention it is difficult to assign value to a human life saved but a reasonable estimate of property losses from fire damage can be made. In material value at least, how much property can we afford to save and how much is actually saved by maintaining fire protection units? What is the opportunity cost of maintaining fire protection units in terms of material property saved?

Once such a determination is made then studies could be advanced to determine the most efficient means of providing a given level of protection. Studies by fire insurance underwriters could serve as an important base for an economic comparison. Fire insurance rates are based, other things equal, on the proximity to

a certain level of fire protection facilities and the probability as-
signed to losses occurring under various conditions. A comparison
of determinations made and practices carried out by profit-oriented
firms (fire insurance companies) and publicly supported fire protec-
tion facilities may prove interesting. It seems possible, although
this study does not investigate it, that fire protection could be
quantified reasonably well through the use of fire insurance data.
Vickery (52) suggests the use of fire insurance rates as a proxy
to the measurement of protection levels.

Both police and fire protection are highly labor intensive.
Of total expenditures for police and fire protection, seven-eighths
and four-fifths, respectively, are for wages and salaries (21). Since
neither of these services are seldom fully mobilized except during
emergencies, the feasibility of combining these services under one
administration could be studied. The possibility of reducing idle
capacity exists in at least some aspects of both services.

Public works expenditures are the most conducive to effi-
ciency analysis of the four expenditure categories studied in this
paper. Output is more readily subject to quantification and public
works are commonly rendered on a fee basis that closely approxi-
mates market conditions of the private sector. Public health stan-
dards exist that could be used as a gauge or minimum for acceptable
performance levels. An engineering approach is possible with data

available to construct production and cost functions. Even though public works expenditures are a small part of total local government expenditure, a significant contribution can be made to the efficient allocation of total public sector resources.

The management contribution encompassed in the general government expenditure category can only be measured by the total output of the local public sector influenced by the management factor. This is much less subject to quantification with its quality and quantity aspects, than individual components of local public sector output. An approach to efficiency analysis is therefore likely to be less direct for this expenditure category.

A study of various organizational arrangements for local governments could be made. For example, mayor-council and manager-council systems could be compared. In smaller local governments the replacement of part-time unpaid mayors with full-time professional management is likely to yield significant improvements in the quantity and quality of general government output.

The feasibility of accomplishing this through consolidating the management requirements of several small communities should be studied. The possibility of using management consulting services provided by the private sector should not be overlooked. Private sector management services might be of assistance with large

metropolitan governments also. It has been said by some that management may well be the limiting factor in the quest for overall efficiency in large metropolitan city governments. The division of large metropolitan areas into manageable units may be a general solution. Management aids such as program budgeting may be useful.

The efficient provision of public education while not covered in this paper is not difficult to justify. Both the magnitude of the expenditure category and the direct social impact of expenditures for education warrant concern. Educational expenditures are the largest by far of local government expenditures. The influence of the educational process on the lives and productive capability of the future labor force should not be overlooked.

A measure of output in the form of achievement test scores has been available for some time. Kiesling (17) in a recent comprehensive study pointed out that there is no close relationship between expenditures and output as measured by achievement test results. This is certainly suggestive of inefficiency and hopefully will stimulate investigation. To hazard a guess, it is possible that a greater service could be done here with efficiency analysis than with all the other local government expenditure categories combined.

The amount of variation explained by the regression

equations ranges from a low of nine percent to a high of 80 percent.

The remainder of the variation, of course, remains to be explained.

To suggest that the unexplained variance is a fruitful area for

further research may be true but not very helpful. Further, the

variance accounted for is explained only for circumstances peculiar

to the observations in question at one point in time. These results

may not apply equally well to another state or region of the country.

The way the model was set up it is difficult to separate the

influences of city size on the total regression results. The inclusion

of previous observations in subsequent equations certainly makes

the relationships between various size groups less clear. In all

categories studied except possibly general control it may have been

useful to stratify cities into appropriate population size groups. A

comparison of expenditures for various services by different popu-

lation size groups could yield useful information on scale economies.

Some adjustment would need to be made for differences in the level

of services provided by various size groups. It may be necessary

to obtain observations from other states so the larger city size

groups contain sufficient numbers to warrant conclusions. However,

caution should be exercised because previous research has indicated

that in some cases greater expenditure variations exist between

than within states (3, p. 10).

A major obstacle to efficiency analysis for most public

services is the inability to quantify output. Both quantity and
quality aspects need to be studied. Until some determinations are
made so that weights can be assigned to various service levels it
will not be possible to directly compare services provided by dif-
ferent communities.

Hirsch (15, p. 167) suggests that an approach to quality
determination can be made in three distinct steps. The first is that
service units need to be defined in real terms. Secondly, the im-
portant quality characteristics of each service unit need to be iden-
tified. Thirdly, he says an estimation of the money-value and
money-costs of these services should be determined. He says,

> "... the basic government service unit should be defined
> in such a way as to be a unit of contribution to the success-
> ful pursuit of the aims of government activity. ... the ideal
> basic service unit should be flexible and should accommodate
> the largest horizon of existing or potential quality dimen-
> sions. "

Some progress needs to be made along these basic lines of inquiry.

The test of value weights applicable to the market system
is what users or consumers are willing to pay. The problem of
getting consumers to reveal their preferences exists but it may
be possible to construct a community measure of service outputs
from a tabulation of individual evaluations. For example, an opinion
survey in two comparable communities could be used to index ser-
vice quality for say police protection.

Our knowledge of efficiency in the provision of local public services is in a primitive state. At this stage the returns from a case study investigation of cities and towns with extremes in per capita public service expenditures are likely to be high. A detailed analysis of the socio-economic characteristics of the area along with a dissection of each service into components is needed.

An analysis of a community's voting record might reveal useful insight into social preferences for a given service level. A case study of a particular community using time series data could be used. It may be possible to construct a demand function for a particular service or group of services with this approach.

my vote for
against may k
heavily sway
by current da
obligations
ones recently
committed

Information on total receipts and expenditures is available for local government units. The "best" means of allocating these receipts among expenditure categories has not been developed. A criterion such as a social welfare function needs to be maximized subject to the constraint established by the total budget. In this way, the decision-making process of local governments could theoretically be isolated.

An interesting question is what are the social costs of corruption in the local public sector. Obviously measurement problems exist but perhaps it could be approached through institutional changes that reduce the chances for its occurrence. A system of checks and balances like those incorporated in a program budgeting

may offer
greatest
savings or
efficiency

system or the replacement of the spoils system with appointment based on merit and qualifications may be useful. It is probable that studies toward improving service quality and/or reducing expenditures could result.

Data Shortcomings

The analysis of variations in per capita expenditures for municipal services is made difficult by data shortcomings. Different accounting systems are used by various cities. Uniform reporting practices do not prevail, especially for small communities. What is needed is a uniform collection of data on selected variables that would make communities more comparable. An accounting of what is actually included in various expenditure categories needs to be made.

Previous studies indicate the importance of certain variables in explaining public expenditure variations. These studies have been on standard metropolitan statistical areas on which a wealth of publicly collected information is available. For smaller communities gaps in the availability of data increase rapidly. In this study poverty indices were limited to 14 cities. Population density figures were calculated from area figures available for only 55 cities. Figures on the age distribution of population were available for only 94 cities.

Data on other important variables was not available. For

example, employment statistics are collected on a county basis

only and not directly traceable to individual cities. These gaps in

the availability of data must be alleviated before much progress in

efficiency analysis can be expected. [32/]

[32/] Much of the data used in this study can be credited to a com-
pilation done by the Legislative Fiscal Committee of the 54th Oregon
Legislature (25, 26). They compiled a catalogue of Oregon state,
county and local government fiscal data not previously or since
reported in one volume.

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APPENDIX

Simple Correlation Coefficients Between Variables Used In The Regression Analysis

X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{20}	X_{21}	X_{22}	X_{23}
1.0	.870	.998	.994	.997	-.069	.997	.249	-.239	.360	.987	.661	.989	-.003	.661	.331	.454
	1.0	.879	.883	.896	-.062	.864	.192	-.215	.421	.858	.539	.881	-.069	.553	.244	.426
		1.0	.998	.997	-.082	.998	.245	-.236	.353	.991	.634	.986	.553	.661	.340	.444
			1.0	.993	-.100	.997	.230	-.222	.344	.992	.611	.901	.002	.654	.342	.426
				1.0	-.056	.994	.240	.240	.388	.984	.674	.992	-.022	.653	.320	.456
					1.0	-.069	-.131	-.067	.322	-.091	.030	-.036	-.205	.167	-.322	.107
						1.0	.245	-.233	.347	.991	.630	.985	.0005	.662	.339	.428
							1.0	-.579	-.131	.210	.092	.225	.180	.261	.154	.258
								1.0	-.004	-.211	-.164	-.243	-.189	-.257	-.257	-.283
									1.0	.326	.325	.387	-.283	.197	.006	.355
										1.0	.613	.971	.016	.649	.345	.436
											1.0	.670	-.031	.368	.184	.430
												1.0	.032	.653	.314	.435
													1.0	.151	.356	.097
														1.0	.205	.374
															1.0	.440
																1.0