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INTRAURBAN INTERACTIONS, SOCIAL STRUCTURE, AND URBAN GOVERNMENT EXPENDITURES: A STOCHASTIC MODEL

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A behavioral model is presented to identify the linkages between urban social structure and urban public expenditure data. The model is then tested on data from the 198 largest U.S. cities using first a principal components analysis to dimension the structural variables and second a regression model to measure the covariation between urban spending and selected measures of urban structure. The results suggest a relevant set of considerations for planning the urban fisc for purposes of State and Federal intergovernmental policy as well as for purposes of urban physical planning.

1. INTRODUCTION

THE INCREASINGLY critical fiscal position of metropolitan core cities may be partially traced to three basic factors, neither mutually exclusive nor collectively exhaustive, but all manifestations of the increasing complexities of the urban form. The first is the problem of externalities, encompassing such issues as the urban–suburban exploitation hypothesis, the fragmentation of local government, and the many corollaries of these two. The second is the rapid change in the demographic, economic, and ethnic composition of the core city population which has occurred over the past twenty years. The third dimension of the urban fiscal problem is the revealed inability of state governments to adapt policy to the changing needs of metropolitan America.

The concern in this paper is with only one side of the fiscal crisis of American cities—that of public expenditures. The objective here is to explain, first conceptually and then statistically, the relatively wide variance which exists among metropolitan core cities in per capita expenditures. Moreover, the intention here is to structure this explanation in terms of the first two general issues stated above: various *among cities* in the degree of interaction among residents *within an SMSA*: and variations *among cities* in the demographic, economic and sociological structure. The justification for examining this question in some detail is clear. Only when the determinants of city government spending levels are identified and their relative magnitudes weighed can either state and federal assistance programs or local revenue reforms effectively correct the public finance deficiencies of core cities.

Moreover, it is argued here that a rather detailed quantitative analysis is an imperative first step to understanding the complex urban structure and its relationship to urban finance. Accordingly, our quantitative approach involves first a dimensioning of the characteristics of core cities via a principal components analysis; second, an estimation of the covariation between these dimensions and urban spending via a single equation least squares model.

* I am indebted to Professors Jesse Burkhead, Alan Campbell, and Seymour Sacks for a number of helpful comments. The analysis and conclusions below are my own, and in no way do they necessarily reflect those held by the International Monetary Fund.

The objective in the sections below is to describe the model in conceptual terms and to present a general summary of the statistical results of the analysis on 1960 data for central cities of 198 metropolitan areas. More specifically, the concern is with developing an *a priori* basis for these arguments and identifying and measuring proxy variables, primarily by the nature of the interdependencies.

II. THE DETERMINANTS

Intraurban interactions

The urban government fiscal problem as a result of intrametropolitan spillovers is well covered in the literature. The catalyst of the metropolitan fiscal imbalances problem is seen to be the secular industrial and residential movement which has simultaneously depleted the central city tax base and forced on it the dual responsibilities of serving a high cost, low income population (much of which is elderly and Negro) and meeting the needs of a sizeable commuter population. It is hypothesized here that city expenditures will be greater to the extent intrametropolitan city to suburb movements are not taking place, and non-residents provide a drain on core city services.

The city-suburb migration factor may be tied to fiscal homogeneity in the SMSA. The implications of variations in *intrametropolitan* fiscal homogeneity for an explanation of *intermetropolitan* differences in per capita expenditures can best be explained in terms of the Tiebout thesis and the effects of expectations on the actions of public decision makers. According to the Tiebout argument, intrametropolitan differences in tax and service levels will lead consumer-residents to move toward the jurisdiction offering what they consider to be the best package of public goods [1]. If suburban communities generally offer the better package of public goods, and to the extent the Tiebout thesis is valid, the direction of the intra-SMSA migration will be toward the suburbs, the migrants being the middle and higher income families. Consequently, it would follow that more fiscally uniform SMSA's may realize less centrifugal population movement. Hence, public decision makers of central city governments in these SMSA's may be prone to plan for and carry out higher levels of public services than those of core city governments which do not have strong expectations for holding higher and middle income residents.

The measurement of a second, more direct effect of intraurban interactions on the level of city expenditures involves examining the reasons for suburban resident trips to the central city, i.e., it involves exploring the nature of the urban-suburban exploitation hypothesis. The non-resident drain on core city services and public facilities tends to be greater to the extent the central city is a retail sales center (the trip to shop), an employment center (the trip to work), and contains the major libraries, auditoriums, museums, and theatres (the trip for entertainment). Taking a cue from these prime causes of interaction, empirical studies have indicated with some consistency that per capita spending in (or by) the core city is more closely related to the size of the "contact" population than to the number of people living within the city's jurisdictional limits [2]. Consequently, the measures used here to describe intercity variations in the per capita level of expenditures are the ratio of central city to urban fringe population (X_5), the employment-population ratio (X_7), and per capita retail sales (X_{12})*.

A popular argument is that the fragmentation of local government results in an inefficient allocation of already limited public resources. To the extent the amount of

* Retail sales is an appropriate measure of intercity difference in the degree to which the city attracts nonresident shoppers, given that income level may be held constant.

fragmentation varies across SMSA's, the degree of inefficiency should also vary, i.e., the number of government units providing the same services in a metropolitan area (X_{17}) and the level of spending for that service should be, *cet. par.*, positively related.

General population characteristics

Many have argued that urban governments experience internal economies of scale (size), hence core city population (X_1) is included here as an independent variable. These economies or diseconomies of relative size may be distinguished from economies of density for analytical purposes; *i.e.*, decreasing unit costs for public services are a function, not only of the increment in the number of units served in the city, but also of the size of the land area in which these units reside. To measure the effects of density, both population per square mile (X_4) and housing units per square mile (X_2) are initially included as independent variables.

The level of city spending would be expected also to vary directly with the wealth stock of the community as measured by property values and the nature of the industrial base; and with factors reflecting the flow of wealth, such as the level and distribution of personal income. Median family income (X_8) is included to reflect average income level, while per cent of families with incomes less than \$3,000 (X_9) and greater than \$10,000 (X_{10}) are used as measures of income distribution. Per cent of non-white population (X_{16}) is also used as an alternative description of the level of poverty in the city. The industrial composition of the city is an important factor in determining the differences in expenditure levels, since local industry not only draws heavily on city services but via the local tax base contributes substantially to the city government purse. The per cent of labor force employed in manufacturing industries (X_{11}) is used here to differentiate among cities in the nature of the economic base. Finally, median value of owner-occupied dwelling units (X_6) is taken to be a general measure of the level of wealth in the community.

Fiscal variables

If a substantial unexplained variance in core city government spending variations remains after the above factors are accounted for, it would seem desirable to introduce measures of differences in the financing arrangements for public services, *e.g.*, does a heavier reliance on a consumer sales tax have a positive or negative marginal effect on the level of per capita spending? In specific question here are the expenditure level effects of greater relative dependence on intergovernmental aids, and on the property tax. The ratio of intergovernmental to general revenue (X_{13}) is included as an independent variable to measure the effect of the relative importance of state aid in the local revenue structure, on the level of city government spending. Property tax revenues as a fraction of total general revenues (X_{15}) is included to measure relative dependence on the property tax or more specifically, to attempt detection of some marginal effect which would indicate the non-responsiveness of the property tax to differences in needs.

Interrelationships

The most desirable approach to explaining public expenditure levels would be to first use *a priori* reasoning and intercorrelations among the explanatory variables in order to classify each as either a demand or cost influence, and then proceed in the statistical analysis. However, it seems impossible to separate even on an *a priori* basis the demand from the supply side. For example, the level and distribution of incomes may be viewed as a demand

factor in that the quality of public services a family desires is thought to be directly related to their level of income. On the other hand, large proportions of low income residents may necessitate greater amounts of police protection. To further complicate matters, higher income levels generally mean higher revenue levels, giving the city government a greater capacity to supply public services. An alternative is to examine the effects of not specific variables but groups of variables, *i.e.*, a systematic examination of the intercorrelations may describe the multiplicity of socio-economic and demographic characteristics common to metropolitan areas. Two methods are offered here to unravel from this complicated web of interdependency an interpretation of the general factors underlying the 17 variables. First, a matrix of all possible zero order correlation coefficients is presented in Table 1. These data may be interpreted loosely to reveal certain general patterns which may enable differentiation among cities. For example, the more populous central cities show a tendency to be more densely populated, to have larger proportions of employment in manufacturing industries, higher unemployment rates, and to be located in more highly fragmented (politically) SMSA's. Then any importance of population as an explanatory variable may be largely due to these other factors. Consequently, though it may not be possible to partition clearly the separate effects of these variables, it is essential that the threads of interrelationship be woven together meaningfully.

The exclusive use of simple intercorrelations to reduce the dimension of a model is naive in the sense that no account is taken of higher order multivariable interrelationships, and in the sense that it does not provide a systematic determination of the actual dimensions of the problem. Perhaps a less naive quantitative approach to the problem of interdependency analysis is the method of principal components [3]. This approach to determining the dimensions of the problem involves deriving linear combinations of the type

$$\zeta_i = \sum a_{ij} x_j$$

where the x_j are the independent variables and the coefficients a are chosen such that the first principal component ζ_1 has as large a variance as possible, ζ_2 is chosen to be orthogonal to ζ_1 and to have as large a variance as possible, ζ_3 is chosen orthogonal to ζ_1 ζ_2, and has as large a variance as possible; and so on. The end result is a transformation of the original p independent variables into p uncorrelated components, ζ_i. If $m < p$ of these components explain a large proportion of the variance in the original independent variables, the dimensions of the problem are approximately identified and one might justify the use of m independent variables in a final regression model. However, the serious problems which remain are (a) exactly how much explained variation is to be considered a "large proportion"; and (b) which of the $(p\text{-}m)$ independent variables should be deleted.

A principal components analysis was carried out on the 17 independent variables for the 198 metropolitan core cities included in the sample*. The results, shown in Table 2, reveal that three independent variables may be removed at no cost at all, and that as few as nine of the ζ_i account for 90 per cent of the variance among the 17 explanatory variables. Hence, both the naive examination of the correlation coefficients and the principal components analysis indicate that the effective dimension number of the problem is considerably less than 17. The effects of collinearities and the identification of effective dimension are worthy and useful objectives, and are used extensively in the following analysis as a guide in interpreting the regression results; however, no attempt is made here to go so far as to orthogonalize the explanatory variables.

* Where an SMSA had more than one central city, only the largest was retained for this analysis.

TABLE 1. COEFFICIENTS OF SIMPLE CORRELATION* BETWEEN ALL POSSIBLE PAIRS OF 17 EXPLANATORY FACTORS: FOR 1960

Variable* 2†	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.53	−0.06	0.51	−0.02	0.24	0.16	0.12	−0.10	0.18	0.39	−0.13	−0.05	0.49	−0.04	0.09	0.64
2	...	−0.33	0.99	−0.27	0.18	0.30	0.08	−0.15	0.01	0.28	0.06	0.13	0.26	0.11	0.05	0.55
3	...	...	−0.33	0.31	0.10	−0.26	0.12	−0.06	0.18	−0.35	−0.13	−0.18	−0.11	−0.02	−0.03	−0.15
4	...	...	...	−0.25	0.15	0.25	0.05	−0.12	−0.01	0.30	0.03	0.14	0.27	0.12	0.07	0.53
5	...	...	...	...	−0.20	−0.25	−0.11	0.10	−0.07	−0.22	−0.41	−0.21	−0.11	0.31	−0.18	−0.19
6	...	...	...	...	...	0.37	0.60	−0.50	0.70	0.03	0.08	0.02	−0.16	0.08	−0.09	0.21
7	...	...	...	...	...	...	0.39	−0.39	0.38	0.19	0.34	0.12	−0.39	0.17	0.00	0.21
8	...	...	...	...	...	...	...	−0.89	0.83	0.20	0.10	0.06	−0.20	0.16	−0.46	0.25
9	...	...	...	...	...	...	...	...	−0.65	−0.38	0.06	−0.11	0.19	−0.22	0.60	−0.25
10	...	...	...	...	...	...	...	...	...	−0.08	0.59	−0.01	−0.26	0.09	−0.17	0.21
11	...	...	...	...	...	...	...	...	...	...	−0.22	0.38	0.11	0.17	−0.23	0.09
12	...	...	...	...	...	...	...	...	...	...	...	−0.40	0.02	−0.14	0.13	0.04
13	...	...	...	...	...	...	...	...	...	...	...	...	−0.05	−0.14	0.05	−0.01
14	...	...	...	...	...	...	...	...	...	...	...	...	...	−0.01	−0.03	0.12
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	−0.23	−0.01
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	−0.07
17																

* A correlation coefficient greater than | 0.13 | is significant at the 0.05 level in a two-tail test.
† See Table 1a for variable code.

TABLE 1A. THE INDEPENDENT VARIABLES

X_1 = Central City Population
X_2 = Number of Dwelling Units Per Square Mile
X_3 = Percent Increase in City Population, 1950–1960
X_4 = Population Density
X_5 = Ratio of Central City to Urban Fringe Population
X_6 = Median Value of Owner-Occupied Dwelling Units
X_7 = Ratio of City Employment to City Population
X_8 = Median Family Income
X_9 = Percent of Families with Incomes Less Than $3,000
X_{10} = Percent of Families with Incomes Greater Than $10,000
X_{11} = Percent of City Employment in Manufacturing
X_{12} = Per Capita Retail Sales
X_{13} = Intergovernmental Revenue as a Percent of Total General Revenue
X_{14} = Percent of City Labor Force Unemployed
X_{15} = Property Tax Revenues as a Percent of Total General Revenue
X_{16} = Percent Nonwhite
X_{17} = Number of Governmental Units

Sources: U.S. Bureau of the Census, *County and City Data Book*, 1962 (1952) (A Statistical Abstract Supplement), U.S. Government Printing Office, Washington, D.C. 1963 (1953). U.S. Bureau of the Census, *Compendium of City Government* (1951), U.S. Government Printing Office, Washington, D.C., 1961 (1952).

TABLE 2. EIGEN VALUES AND EXPLAINED VARIANCES FROM A PRINCIPAL COMPONENTS ANALYSIS OF 17 VARIABLES* FOR 198 METROPOLITAN CORE CITIES IN 1960

Component	Eigen value	Cumulative variance explained	Contribution to Explained variance
1	4.1872	0.25	0.25
2	3.1095	0.43	0.18
3	1.9710	0.55	0.12
4	1.8071	0.65	0.10
5	1.2422	0.72	0.07
6	1.1566	0.79	0.07
7	0.7195	0.83	0.04
8	0.6265	0.87	0.04
9	0.5037	0.90	0.03
10	0.4870	0.93	0.03
11	0.4034	0.95	0.02
12	0.3239	0.97	0.02
13	0.2528	0.99	0.02
14	0.1145	0.99	0.00
15	0.0464	1.00	0.01
16	0.0439	1.00	0.00
17	0.0046	1.00	0.00

* See Table 1a

Dependent variables

Per capita City Government Expenditures are analyzed below as the dependent variable in an aggregate form and for individual functions. The per capita expression is not justified by any rigid theoretical formulation, but it is preferable to a per family, per household, or per square mile basis because it can be compared with previous research, and because there seems to be some merit in planning and evaluating service levels of certain public programs on a per capita basis. Total expenditures are treated in three different ways for purposes of analysis. The first is per capita total general expenditures

which includes both operating expenditures and capital outlays, but is net of education expenditures*. In the second form, capital outlays are eliminated and current expenditures (less education) are expressed on a per capita basis. Though measuring normal day-to-day expenditures, this dependent variable is subject to the limitation that the range of city services is greater in some cities than in others, e.g., the city of Odessa, Texas makes no current expenditures for hospitals, health, welfare, or housing and urban renewal while Worchester, Massachusetts includes all of these in its city budget.

The third form of the dependent variable is per capita current expenditures on the common functions. The common functions—those supported more or less to the same extent by all cities included in the study—are police, fire, refuse collection, and other current expenses for sanitation, current expenses for roads and streets, parks and recreation, and general control. Finally, the common functions are expressed on individual per capita bases to analyze more clearly the effects of the explanatory variables.

A final limitation to be noted is that comparison of dollar figures may not represent the true among-city variation in per capita service levels because of wage rate variations and quality differentials. Though adjustment for quality differences would greatly enhance the meaning of these results, it represents a sizable task beyond the scope of this paper [4].

III. STATISTICAL RESULTS

When all 17 variables are introduced into a single equation least squares model, 41 per cent of the variation in per capita total expenditures is explained (see Table 3) with six independent variables statistically significant (Column 1). The significant positive association with population size suggests that larger cities offer a greater scope of public services and therefore per capita expenditures are higher. The fact that population is a significant determinant only for the total expenditure classes support this interpretation, and conversely would seem to leave little possibility for a case for diseconomies of size. The positive association between per capita expenditures and the ratio of intergovernmental to total revenues might also be explained in terms of intercity differences in the scope of services provided, i.e., cities that receive relatively high proportions of revenues in the form of aids may be responsible for a broader package of services. But this variable is also significant for non-aided functions such as per capita police expenditures, which implies another interpretation—that relatively greater dependence on non-local sources, *cet. par.*, results in an over-all greater level of expenditures.

The percentage employed and median home value both exhibit a positive partial influence on the level of per capita total spending, which illustrates the dual effects of income on the level of public services. That is, higher income families demand, expect, and are able to support a higher level of public services, while the prevalence of large numbers of lower income families in the central city results in higher costs for such municipal services as police, fire, and refuse collection. The positive association of expenditures with the ratio of city employment to city population is consistent with the hypothesis that a city's expenditures are higher if there is substantial commuting by non-residents to work in the central city. Finally, given the size of the labor force, greater proportions of employment in manufacturing tends to be associated with lower per capita expeditures. A tentative explanation is that since the wage structure in manufacturing industries tends toward

* Because education expenditures constitute the largest single portion of total municipal outlays, but are reported for only about one-third of the cities in this sample, they are excluded throughout this paper.

TABLE 3. RESULTS OF 17 VARIABLE ANALYSIS ON SELECTED PER CAPITA CITY GOVERNMENT EXPENDITURES* FOR 198 CORE CITIES IN 1960

Dependent variable	Total	Total current	Common functions	Police	Fire	Sanitation	Highways	Parks
Explained variance in 17 variable model	0.4080	0.4562	0.4783	0.6429	0.5075	0.2916	0.2659	0.2374
Independent variables:								
Central city population	0.19015 (5)*	0.18443 (6)*	0.10581 (12)	0.8325 (13)	−0.05976 (15)	0.12495 (8)	0.17901 (6)	0.04938 (14)
Number of dwelling units per square mile	0.29681 (1)	0.31856 (1)	−0.03275 (17)	−0.41983 (2)	0.74859 (1)	−0.81397 (2)	−0.57610 (1)	0.69201 (2)
Percentage of increase in city population (1950–1960)	−0.06893 (12)	−0.05945 (13)	−0.05711 (13)	0.02712 (15)	−0.06347 (14)	0.06801 (15)	−0.21161 (4)*	0.00057 (17)
Population density	−0.02891 (15)	0.06353 (11)	0.17158 (9)	−0.77151 (1)	−0.50271 (2)	1.00062 (1)	0.28069 (2)	−0.86224 (1)
Ratio of central city to urban fringe population	−0.04040 (14)	−0.03552 (15)	−0.04338 (15)	−0.00745 (16)	−0.00263 (16)	−0.00618 (17)	0.09603 (12)	−0.06549 (12)
Median value of owner-occupied dwelling units	0.18729 (6)*	0.20829 (5)*	0.019907 (7)*	0.15195 (8)*	0.15256 (10)	0.09385 (10)	0.03763 (15)	0.10677 (11)
Ratio of city employment to city population	0.21814 (3)*	0.21657 (4)*	0.23928 (4)*	0.20450 (6)*	0.18609 (7)*	0.10419 (9)	0.14507 (8)	0.14063 (10)
Median family income	−0.00298 (17)	0.00176 (17)	0.37755 (1)*	0.33063 (3)*	0.38134 (3)*	0.25670 (4)	0.04685 (14)	0.35261 (4)
Percentage of families with incomes less than $3,000	−0.11705 (10)	−0.06076 (12)	0.03754 (16)	0.00129 (17)	0.10080 (17)	0.00846 (16)	−0.12499 (9)	−0.01523 (16)
Percentage of families with incomes greater than $10,000	−0.10443 (11)	−0.12868 (7)	−0.26435 (3)	−0.14574 (10)	−0.013849 (11)	−0.08796 (12)	−0.08311 (13)	−0.36251 (3)*
Percentage of city employment in manufacturing	−0.19319 (4)*	−0.12615 (8)	−0.18664 (8)*	−0.18014 (7)*	−0.08385 (13)	−0.08407 (13)	0.10053 (11)	−0.26730 (6)*
Per capita retail sales	0.04937 (13)	0.02860 (16)	0.20953 (6)*	0.14857 (9)*	0.16077 (9)*	0.15044 (5)	0.27384 (3)*	0.14620 (9)
Intergovernmental revenue as a percent of total general revenue	0.24489 (2)*	0.23449 (3)*	0.15017 (11)*	0.13146 (11)*	0.24786 (6)*	0.13481 (7)	0.21027 (5)*	0.06050 (13)
Percentage of labor force unemployed	0.15088 (8)*	0.15781 (9)*	0.32225 (12)	0.25926 (5)*	0.31457 (4)*	0.14903 (6)	0.15375 (7)	0.30692 (5)*
Property tax revenues as a percent of total general revenue	0.02401 (16)	0.05587 (14)	0.17115 (10)*	0.12555 (12)*	0.299911 (5)*	0.08243 (14)	0.11774 (10)	0.20559 (8)*
Percentage of nonwhite	0.15059 (9)	0.08086 (10)	0.22104 (5)*	0.32834 (4)*	0.11688 (12)	0.33395 (3)*	−0.02807 (16)	0.23640 (7)*
Number of governmental units	−0.15599 (7)	−0.23601 (2)*	−0.04905 (14)	0.07599 (14)	−0.017640 (8)*	−0.09178 (11)	−0.00585 (17)	0.02287 (15)

* Beta Coefficients are shown in each cell; number in parenthesis is ranking of the size of Beta coefficient (from highest to lowest); and the asterisk denotes two-tail significance at the 0.05 level.

a relatively great degree of equality, the over-all distribution of income tends to be more equal, therefore it follows from our "dual effect of income" hypothesis that per resident expenditures will be lower.

Though a greater amount of per capita current expenditures may be explained, the significant explanatory variables are approximately the same, still reflecting the scale of government services, the dual income effect, the size of the contact population, and the dependence on intergovernmental assistance. One exception is the negative significance of the number of governmental units within the SMSA with property taxing power, which may be interpreted as showing that if functional responsibility is more fractionated, the scope of public services provided by the core city government is smaller. Again, the reasons for the level of unexplained variance are to be found partially in intercity differences in the division of functional responsibility, *i.e.*, the higher levels of per capita total expenditures reflect not only higher levels of need, demand, or quality, but also the city government's responsibility for a greater number of public functions and/or sub-functions. This hypothesis may be tested by examining the common function form of the dependent variable.

Only slightly more of the variance in per capita common function expenditures (48 per cent) may be explained, the significant independent variables not differing substantially from those obtained for total and total current expenditures. But three additional findings are worth mention. First, per cent nonwhite enters at a positive and significant level reinforcing the thesis that large proportions of low income residents exert a strong upward pressure on core city spending levels. Second, cities with a greater relative dependence on property taxes spend greater per capita amounts. To interpret literally the significant property tax variable, a 1 per cent difference in the property tax as a proportion of all general revenues is accompanied by a $13 difference in per capita city expenditures. It is important here not to draw a temporal inference from this finding. Since these data show expenditures to be *higher* by city governments placing a greater reliance on the property tax, it does not necessarily follow that the property tax responds adequately to changes in income in urban areas.

The third interesting pattern displayed by these data is the positive significance of *both* relative dependence on intergovernmental aids and relative dependence on property taxes. This suggests the surprising possibility that, *cet. par.*, core cities placing least reliance on nonproperty taxes demonstrate the ability to finance a higher level of services. However, the limitations imposed by the use of cross-section data and multi-collinearity constrain one from jumping quickly to a conclusion that local property taxes are somehow more adequate than sales or income levies.

The relatively high proportion of the intercity variance in police expenditures which may be explained (64 per cent) is due in part to the greater homogeneity of the data—police services are generally a local function everywhere and special district arrangements within core cities are not common. The level of per capita police expenditures seems most responsive to variations in a general density–poverty factor and to variations in the size of the contact population. The importance of population density, percentage of nonwhites, and percentage unemployed, in explaining variations in police expenditures results from the lower economic status of residents in the more crowded urban areas, or of the Negro population in general. Further, higher population densities may lead to greater vehicular and pedestrian traffic control problems, thereby creating a higher level of per person policing requirements. When 17 independent variables are examined, both the ratio of city employment to city population (which measures the extent to which workers commute

to jobs within the central city) and per capita retail sales (which, given the level of income, measures the extent to which shoppers make use of city retail establishments) are significantly and positively related to the level of police expenditures. This is again consistent with the contact population hypothesis, that the greater the extent to which nonresidents of the city come within the jurisdiction of the local police force, the greater will be the cost of providing police services.

The 17 independent variables jointly account for approximately 51 per cent of the variation in per capita fire expenditures. An examination of the pattern of intercorrelation, and a ranking of the Beta coefficients shows the density factor to exert a strong positive influence on the level of spending for fire protection. Increased fire hazards are likely to result in more densely populated areas because of more inaccessible buildings, fewer fire breaks, and greater congestion. The importance of the unemployment rate as a determinant may be traced along similar lines, since higher unemployment levels generally are associated with lower grade housing and more densely populated areas. Conversely, median family income exerts a positive influence on the level of city spending for fire protection, possibly reflecting the demands of higher income core city residents or similarly, the higher value of real property in the core city area. The significance of per capita retail sales (given the level of income) and the city employment–population ratio may reflect the increased fire protection burden thrust on the central city by nonresident immigration. Finally, it may be noted that in SMSA's with greater levels of political fragmentation (to the extent that fragmentation be measured by the number of governmental units), the core city government makes lower per capita expenditures for fire protection. If this local government proliferation is a proxy for core city decline in industrial and commercial activity, the negative relationship may reflect a reduction in nonresidential demands for central city fire services.

Roughly 30 per cent of the variation in per capita sanitation expenditures may be explained. Widely varying methods of financing and administering the sanitation function results in a discrepancy between sanitation expenditures *in the central city* and sanitation expenditures *by the city government*; this partially explains the low explained variance. However, the general poverty–density factor is observed to be significant at a positive level. The importance of population density reflects the more intensive collection and disposal services required by heavy pedestrian and automobile traffic and by large commercial, wholesale, and market areas. Furthermore, refuse collection is more regular and more extensive in the densely populated, predominantly nonwhite areas, reflecting the higher cost of serving run-down neighborhoods.

Because of similar data comparability problems, the variance explained in per capita current road-street expenditures is relatively low (about 27 per cent), though three variables exert an expected effect. First, intergovernmental revenue as a fraction of total general revenue is significant at a positive level because higher proportions of aid in the revenue structure may indicate that a given city has a greater direct fiscal responsibility for the highway function. Second, population density is expectedly significant at a positive level, because greater densities mean that the physical mileage per person which must be maintained will fall. Third, the partial effect of core city population growth rate is negative, indicating that street maintenance is a function of streets and not of people; therefore the growth of population in the already-built-up areas (the core city) merely enables the cost to be "spread" over a greater number of residents.

IV. CONCLUSIONS AND POLICY IMPLICATIONS

From this statistical analysis, several general conclusions may be drawn and certain policy implications offered [5]. Two basic determinants of city government spending levels are uncovered; (a) the size of the metropolitan area population relative to that in the central city, and (b) a dual effect of income. Per capita core city government expenditures are found to be lower in SMSA's where the central city comprises a greater fraction of the area population. That is, where nonresident "contact" population is relatively great, a greater upward pressure is exerted on expenditures by suburban trips to the city for the purposes of work, shopping, or amusements. Then spatial equity within SMSA's would require that these nonresidents compensate the city government adequately for services provided. It follows that cities relying almost exclusively on property taxes have little chance to capture the costs imposed by nonresident users. State assistance is more likely to aggravate this fiscal deficiency than improve it, in light of the past record of most state governments which shows a higher level of aid to suburbs than to core cities.

The second major factor explaining variations in the level of per resident city government spending is the nature of the local income distribution. The findings presented in the previous section may be interpreted as showing that large proportions of the population at either extreme in the city income distribution exert a significant upward pressure on the level of spending. Families in the higher income brackets tend to levy a positive effect via the demand for a higher quality of services and through their effect on the local tax base. Alternatively, high proportions of families with incomes below the poverty level occasion greater per resident costs in the provision of certain services—partially because of the higher costs of servicing their run-down neighborhoods. Then one might offer the very general observation that, *cet. par.*, the more equal the distribution of income, the lower the level of per capita core city expenditures.

The significance of intergovernmental aids as an explanatory factor must be attributed in large part to intercity variations in the division of direct state-local responsibility. But the consistency of this finding across aided and nonaided functions—that cities depending more heavily on intergovernmental assistance spend more per capita—tempts one to take the "high-powered-state-money" position, that the "pass-down" of funds ultimately results in a greater level of expenditures via some stimulative effect on local revenues. Definitive support for this argument, however, must await extensive empirical analysis of city government revenues, and probably an approach more suitable than a single equation regression analysis.

Fourth, the direct and interactive effects of the significant variables indicate that a certain type of city is more likely to require and/or desire a higher level of spending. In general, this city is large, densely populated, and has a relatively high proportion of families at each extreme of the income distribution (or a relatively unequal distribution of income in any case), and has a "contact population" which relative to its own is quite large. Conversely, one would expect lower expenditures by city governments to the extent the population is both smaller and less congested, the income distribution is more equal, and a larger proportion of the SMSA population lives within the corporate boundaries of the central city.

Finally, the regression results show that certain public functions are specifically affected by particular needs factors. Studies of city government spending (including this one) have shown with some consistency that current highway expenditures are inversely

related to population density (reflecting a lower physical mileage per person to be maintained) and police and fire spending are higher where ghetto conditions are most severe.

These five general and overlapping conclusions may be drawn about the nature of the determinants of core city spending. It might be worth turning also to the question of what these statistical results *do not* show *i.e.*, which hypothesis about the structure of metropolitan city expenditures are not supported here.

First, these data give no evidence of the existence of economies of size (scale) since the partial effect of population is not negatively related to any per capita expenditure category considered, and in the only cases where size does exert a significant effect on spending, the direct association is positive. Second, the number of metropolitan local governments with property taxing power is not found to be significantly and positively related to per capita city expenditures in all cases. However, this finding could be construed to mean that (a) fragmented local government is not inefficient (from a point-of-view of municipal costs), (b) fragmented local government is inefficient, but the measured effects of this variable are obscured by collinearities in the data, and/or (c) this variable is not an appropriate measure of governmental fragmentation. At any rate, time series data and some measure of output would be needed to empirically substantiate the fragmentation–inefficiency argument. Finally, to return to the opening section and basic premise of this paper, this analysis does not give strong empirical support to the argument that greater intergovernment fiscal homogeneity within the SMSA will result in high levels of spending by core city governments. But again, the failure to support the argument here may be in part due to an inappropriate measurement of fiscal uniformity within the metropolitan area.

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