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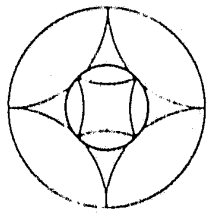
DETERMINANTS OF MUNICIPAL POLICE EXPENDITURES: A REVIEW ESSAY

by

Eric J. Scott



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Empirical analyses of the determinants of government expenditures have proliferated throughout the past 25 years. If one can judge the amount of scholarly output in a particular field by the number of reviews of the literature in that field, then the volume of determinants studies has reached epidemic proportions. There are several reasons for the continued appearance of these studies: the large and constantly-growing store of public finance data; the worsening financial status of municipalities; researchers' interests in assisting policy-makers in estimating future expenditure levels; and the amenability of existing data to relatively sophisticated analytic techniques.

This article does not attempt a thorough review of the determinants literature; interested readers are referred to the excellent summary article by Bahl (1969b), to the recent annotated bibliography by Fredland (1974), and to less comprehensive but nonetheless useful reviews by Wilensky (1970), Smith-Fibiger (1972), and Barlow (1966). Rather, it concentrates on the contributions and limitations of studies of municipal police expenditures. Average annual police expenditures have more than tripled since 1959; for large city departments, expenditures per capita have grown at better than an 8.5 percent annual rate, a rate at least 40 percent higher than that for per capita GNP (Odoni, 1975).

Studies of the determinants of police expenditures have seemingly

grown at a similar pace. This article identifies their major hypotheses, summarizes and assesses the support for each hypothesis, examines their strengths and limitations, and offers suggestions for improvements. Section 1 is a brief synthesis of the basic structure and findings of determinants literature in general. Section 2 reviews, in both tabular and descriptive form, the literature on determinants of police protection expenditures. Section 3 presents a detailed assessment and criticism of determinants literature, offering suggestions for improvements. Major criticisms are listed here, however, so that the reader may keep them in mind throughout the discussion. Among other problems, determinants studies often suffer from:

- a lack of theoretical guidance;
- logical inconsistencies and circular reasoning;
- confusion regarding the identification of supply and demand factors;
- a lack of adequate measures of output or service quality;
- misrepresentation of economies-of-scale;
- intercorrelation among independent variables;
- incorrect estimation of regression equations;
- drawing dynamic inferences from cross-sectional data;
- non-comparability of expenditure data across units of analysis;
- aggregation of data from individual functions to total government expenditures;
- ignorance of the effects of variation in city population size;
- improper handling of data on capital outlays and on pensions and fringe benefits; and
- overlooking the impact of agency organizational variables, including police unionization, on expenditure levels.

1. Determinants of General Public Expenditures

1.1 Statistical Techniques

Cross-sectional, single-equation multiple regression is the statistical technique normally used in studies of the determinants of public expenditures. The object is to explain the variations in some expenditure measure (usually total per capita expenditures or per capita expenditures for a particular service) at any given time by examining variations in socio-economic or demographic independent variables at any given time. Multiple regression analysis provides easily interpretable statistics, assuming certain conditions are met. A typical determinants study regression equation has the following form:

$$Y = a_c + a_1X_1 + a_2X_2 + a_3X_3 \ldots a_iX_i$$

where Y = expenditures per capita, a_c = constant term, a_i = regression coefficient for the ith variable, and X_i = ith independent variable (expenditure determinant).

While this form remains most prominent, numerous variations have been used. Some studies have introduced temporal considerations. Sacks-Harris (1964) compared beta weights for different periods to assess temporal changes in the relative importance of various determinants. Kee (1967), Bahl-Saunders (1965), and Greytak-Gustely-Dinkelmeyer (1974) examined expenditure change as a function of changes in socio-economic factors. Brown (1967) and Rakoff (1972) used longitudinal data to examine the effect of time on per capita expenditures. Most determinants studies, however, have been static analyses.

Some have broken away from the traditional multiple regression

models developed by Brazer (1959), Fisher (1964), and Sacks-Hellmuth (1961). Horowitz (1968) took a simultaneous equation approach to state-local expenditures, as did McPheters-Stronge (1974) to the effect of crime rates on police spending. Gabler (1971) constructed a series of regression equations by state to minimize the confounding effects of differing state laws and policies. Greenwood-Wadycki (1973) relied on a three-stage least squares simultaneous equation model to estimate per capita police spending. Smith-Fibiger (1972) and Beaton (1974) criticized ordinary least-squares regression techniques as inappropriate; the former adopted an Aitken two-stage approach, while the latter developed separate regression equations by city population size to avoid violating the assumption of homeoscedastic residuals. Adams (1967) relied on dummy variable regression, while Kurnow (1963) argued that linear additive models were inappropriate and developed an equation that considered joint effects.

Some authors have used techniques related to, but different from, multiple regression. Clark (1968) and Kasarda (1972) used path analysis in analyzing spending determinants. Wood (1961) and Masotti-Bowen (1965) relied on factor analysis, and Pidot (1969) and McPheters-Stronge (1974) on principal components analysis, to reorder a large number of determinants into a more manageable set of "underlying" factors.

While the choice of statistical technique should most properly be guided by theoretical considerations, it is in fact primarily determined by two related factors: the level of analysis and the nature of available data. Later sections of this paper will examine the appropriateness of the regression model; the next discusses the levels of analysis of determinants studies.

1.2 Levels of Analysis

1.2.1 State-Local Studies

Berolzheimer (1947) was among the first to statistically examine expenditure determinants, although credit is usually given to Fabricant (1952) for stimulating the large outpouring of follow-up studies. The unit of analysis in these early studies was per capita state and local government expenditures, while the independent variables were population density, urbanization, and per capita income. Of the three, income usually had the greatest effect, urbanization the smallest.

Fisher (1961, 1964), Kurnow (1963), Spangler (1963), Sacks-Harris (1964), Bahl-Saunders (1965), Osman (1966), Sharkansky (1967), and Horowitz (1968) extended the original analysis, each adding independent variables. Among variables with positive, significant impact on per capita state-local spending were federal and state aid, population growth, and per capita revenues. The general conclusion of these studies was that "interstate disparities in the level and distribution of income and in the level of per capita intergovernmental revenues account for most of the interstate variability in per capita state and local government expenditures" (Bahl, 1969b).

This analysis has been criticized for not disaggregating data into state and local components, since there may be different spending requirements and revenue sources at each level. Morss (1966) delivered the most stinging indictment, arguing that not only was the data aggregated at so high a level as to render analysis virtually worthless to policy-makers, but that the independent variables were highly inter-correlated and that there was no differentiation by government function.

1.2.2 Municipal Studies

Analyses of the determinants of municipal expenditures have been numerous and varied, but have taken three general forms. Many have focused on cities in general, usually attempting to identify variations in large city (minimum of 25,000 population) spending across states (Hawley, 1951; Brazer, 1959; Kee, 1965; Booms, 1966; Bahl, 1969a; Weicher, 1972; Rakoff, 1972; Gabler, 1971; Kasarda, 1972). These studies are often concerned only with central cities of Standard Metropolitan Statistical Areas (SMSAs).

A second group has limited analysis to cities within a single state. Authors taking this approach argue that it controls for the effects of differing state laws, policies, procedures, and geographical and historical peculiarities which have significant influence on functional responsibility and compilation of expenditure data (Scott-Feder, 1957; Brazer, 1959; Masotti-Bowen, 1965; Walzer, 1972a,b).

The third unit of analysis is the SMSA. Some studies minimize functional variation in fiscal responsibility by focusing on a single SMSA (Sacks-Hellmuth, 1961; Bollens, 1961; Hirsch, 1959; Burkhead, 1961; Schmandt-Stephens, 1960; Cook, 1973). Others concentrate on differences among SMSAs regardless of location (Davis-Haines, 1966; Campbell-Sacks, 1967; Sunley, 1971; Pidot, 1969; McPheters-Stronge, 1974; Greytak-Gustely-Dinkelmeyer, 1974; Greenwood-Wadycki, 1973; Hawkins-Dye, 1970; Sacks, 1962).

Recitation of the various independent variables analyzed by these studies, and their attendent results, would be far too voluminous for inclusion here. However, they can be roughly categorized to provide some idea of general findings. Weicher (1970) identified six

recurring categories of independent variables: measures of size, intergovernmental revenues, measures of metropolitan political fragmentation, fiscal capacity, community tastes, and service conditions; the relationship of each of these variables to per capita municipal expenditures is discussed below.

City population has received more attention than any other variable, mostly in relation to economies-of-scale. A negative relationship between city size and per capita expenditures has been incorrectly presumed to imply the existence of scale economies (see discussion in section 3). The bulk of the evidence, however, indicates that population size has a positive effect on, but is insignificant in explaining, per capita expenditure variations (Hirsch, 1959; Bahl, 1969a; Brazer, 1959; Hawley, 1951; Gabler, 1971; Weicher, 1970, Walzer, 1972a,b; Schmandt-Stephens, 1960, 1963).

Intergovernmental revenue, on the other hand, is often important. Morss (1966) strongly criticized its inclusion as a determinant, arguing that it was circular reasoning to regress expenditures against one of their components, but Osman (1966) and Weicher (1970) found that intergovernmental revenue earmarked for one function stimulated spending for others.

By metropolitan political fragmentation, Weicher (1970) meant the extent to which the central city provides services to non-residents. Operationalizations were the ratio of central city to SMSA population, the ratio of central city manufacturing employment to total SMSA manufacturing employment, employment per capita in manufacturing, trade, and services, and per capita retail sales. These variables proved very important in some studies in explaining per capita expenditure vari-

ation (Hawley, 1951; Brazer, 1959; Bahl, 1969a), but not in others (Sunley, 1971).

For some authors, fragmentation refers to an entirely different concept: the number of governmental units within an SMSA. This variable has generally had a negative association with higher expenditures per capita (Burkhead, 1959; Sacks, 1962; Adams, 1967; Brown, 1967; Ostrom-Parks, 1973), although Scott-Feder (1957) reached opposite conclusions. Burkhead (1959) found that fragmentation forced a greater reliance on the property tax and thus lowered per capita expenditures in central cities, while Brown (1967) suggested that annexation of neighboring areas by Houston, while lowering fragmentation, increased central city per capita spending. Sacks (1962) discovered that the more jurisdictions per person and per unit of area, the lower the per capita expenditures. Hawkins-Dye (1970) found that fragmentation had little effect on per capita expenditures, while Adams (1967) argued that it led to underallocation of resources and lower per capita expenditures.

Fiscal capacity, not surprisingly, is usually positively associated with spending (Bollens, 1961; Schmandt-Stephens, 1960; Scott-Feder, 1957; Sunley, 1971; Gabler, 1971; Greenwood-Wadycki, 1973; Lewin-Keith, 1976; Weicher, 1970). Several operationalizations of this variable exist, including the percentage of families with income under $3,000 per year or over $10,000 per year, median family income, per capita personal income, retail sales per capita, and per capita property valuation. Some authors consider these variables as indicators of community tastes, while others consider tastes fixed (McPheters-Stronge, 1974). Weicher's (1970) measures of taste (educational level and age

of population) have not generally been considered key explanatory factors.

Service condition variables such as population density and age of housing are usually strongly and positively related to per capita expenditures, although Gabler (1971) presents contrary evidence. Some scholars believe service conditions reflect public needs to which decision-makers respond by increasing expenditures.

Very few political variables have been considered determinants of public expenditures. Booms (1966), Lineberry-Fowler (1967), and Clark (1968) concluded that form of city government (manager or mayor) made a difference in levels of per capita spending, while Davis-Haines (1966) found that the number of registered voters in a city positively affected expenditure levels.

1.2.3 Other Sub-State Studies

Most non-municipal sub-state determinants studies have focused on county expenditures, although numerous articles have appeared dealing with special educational districts. Adams (1967) studied 478 counties with population density greater than 100 persons per square mile, treating government expenditures per capita by all local governments as the dependent variable. He found lower expenditures in counties with large numbers of in-migrants and concluded that migrants' tastes and preferences were under-valued by the public sector. Schmandt-Stephens (1963) examined per capita expenditures by local governments in over 3,000 counties. Using a simple correlation technique they determined that family income level and amount of state aid explained most of the expenditure variance. Mikesell (1972) studied West Virginia county

expenditures, concluding that counties with larger population losses have higher per capita expenditures because of a decision-making lag in response to those losses.

Although conclusions are largely similar across units of analysis, there is considerable variation in expenditure determinants among functional spending categories. The following section presents a detailed discussion of the empirical findings regarding one of those functions -- police protection.

2. Explaining Variation in Police Expenditures

This section reviews the literature on the determinants of police protection expenditures. It sets out major hypotheses examined, noting the level of support for each. Figure 1 summarizes the units and scope of analysis, minimum city size requirement, and methodology of each study, indicating whether or not its findings support each hypothesis. It is impossible in a single table to reflect the differences in methodology and findings of so many diverse studies. Readers interested in a particular hypothesis are urged to return to the original study. Not all those listed are discussed in detail; the review covers only the general direction of the majority of findings, as well as interesting exceptions.

Nine broad hypotheses summarize the most important correlates of public spending for police services. They reflect the extent to which demographic and socio-economic factors are seen to influence municipal police expenditures:

H_1: Per capita public expenditures for police protection are positively related to city population size.

H_2: Per capita public expenditures for central city police protection are negatively related to the ratio of central city to SMSA population.

H_3: Per capita public expenditures for police protection are negatively related to the growth of city population.

H_4: Per capita public expenditures for police protection are positively related to city population density.

H_5: Per capita public expenditures for police protection in a metropolitan area are positively related to the number of jurisdictions providing police services in that area.

H_6: Per capita public expenditures for police protection are positively related to individual and jurisdictional wealth.

H_7: Per capita public expenditures for police protection are positively related to community service conditions.

H_8: Per capita public expenditures for police protection are positively related to the level of service provided and to the rate of crime.

H_9: Per capita public expenditures for police protection are positively related to prices of police inputs and to increases in price levels.

2.1 City Size and Police Expenditures

Of all the determinants of police expenditures, city size has received perhaps the greatest attention. Although empirical examinations of the population-expenditure relationship have produced quite consistent findings across studies, interpretations have been inconsistent and confusing. Despite the consistency of support for H_1 (Figure 1), that per capita police expenditures increase as city size increases, considerable debate continues about the actual effect of population on expenditure rates.

Early state-local studies showed a positive relationship between city size and per capita spending on police services (Walker, 1930;

Figure 1

	Brazer, 1959	Brazer, 1959	Brazer, 1959	Brazer, 1959	Brazer, 1959	Hirsch, 1959	Schmandt - Stephens, 1960	Bollens, 1961	Wood, 1961	Sacks - Hellmuth, 1961
Unit of Analysis	462 cities	32 cities	30 cities	35 cities	40 cities	64 cities	19 cities	63 cities	64 cities	58 cities
Scope of Analysis	nat	Calif	Mass	Ohio	nat	SMSA	SMSA	SMSA	NY-NJ	SMSA
Minimum City Size	25,000	25,000	25,000	25,000	250,000	none	none	none	10,000	none
Stat. Technique	MR	MR	MR	MR	MR	MR	SC-PC	MR	FA	SC-MR
H_1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
H_2	--	--	--	--	Y	--	--	--	--	--
H_3	N	Y	N	N	--	--	--	--	--	--
H_4	Y	N	Y	Y	Y	--	--	C	Y	--
H_5	--	--	--	--	--	--	--	--	--	--
H_6	Y	N	N	Y	N	--	--	Y	N	Y
H_7	--	--	--	--	--	--	--	Y	Y	--
H_8	--	--	--	--	--	Y	N	Y	--	--
H_9	--	--	--	--	--	--	--	--	--	--

Key to Abbreviations

nat - national

D - descriptive
FA - factor analysis
MR - multiple regression
PA - path analysis
PC - partial correlation
PR_CO - principal components
SC - simple correlation

Y - yes, hypothesis is supported

N - no, hypothesis is not supported

C - conflicting evidence about hypothesis

-- hypothesis not examined

Figure 1 (continued)

	Sacks, 1962	Schmandt - Stephens, 1963	Masotti - Bowen, 1965	Williams, 1965	Adams, 1967	Brown, 1967	Bahl, 1969a	Pidot, 1969	Bradford - Malt - Oates, 1969	Welcher, 1970	Hawkins - Dye, 1970	Bordua - Haurek, 1971	Gabler, 1971
Unit of Analysis	58 cities	3096 coun	18 cities	all cities	478 coun	1 city	198 - cities	80 cities	4 cities	206 cities	212 SMSAs	all cities	all cities
Scope of Analysis	SMSA	nat	Ohio	SMSA	nat	SMSA	nat	nat	nat	nat	nat	nat	8 states
Minimum City Size	none	--	50,000	none	--	--	50,000	50,000	50,000	50,000	none	none	25,000
Stat. Technique	D	SC	FA	PC	MR	MR	MR	PR CO	D	MR	SC	D	MR
H_1	--	Y	Y	--	--	--	Y	--	Y	Y	Y	--	Y
H_2	--	--	--	--	--	--	Y	--	--	Y	--	--	--
H_3	--	--	Y	--	--	--	N	--	--	Y	--	N	C
H_4	--	Y	--	Y	Y	--	Y	Y	--	Y	--	--	C
H_5	--	--	--	--	C	N	Y	--	--	--	C	--	--
H_6	Y	Y	Y	Y	Y	--	Y	--	--	Y	Y	--	Y
H_7	--	Y	--	Y	Y	--	Y	--	--	Y	Y	--	Y
H_8	--	--	--	--	--	--	--	--	--	--	--	--	--
H_9	--	--	--	--	--	--	--	--	Y	--	--	Y	--

Figure 1 (continued)

	Sunley, 1971	Walzer, 1971	Welcher, 1971	Allison, 1972	Chapman - Sonenblum, 1972	Fowler - Lineberry, 1972	Kasarda, 1972	Isiak, 1972	Mikesell, 1972	Smith - Pidigor, 1972	Walzer, 1972a	Walzer, 1972b	Welcher, 1972b
Unit of Analysis	all cities	23 cities	1 city	all cities	82 cities	sample cities	168 cities	4 cities	all coun	state-local	23 cities	31 cities	168 cities
Scope of Analysis	4 SMSAs	Ill	Chicago	Chicago vicinity	Calif	nat	nat	SMSA	W. Va.	nat	Ill	Ill	nat
Minimum City Size	10,000	25,000	--	25,000	none	50,000	50,000	none	--	--	25,000	22,000	50,000
Stat. Technique	MR	--	MR	MR	MR	MR	PA	D	MR	MR	MR	MR	MR
H_1	--	--	--	Y	--	Y	Y	N	--	--	C	C	--
H_2	--	--	Y	--	--	--	Y	--	--	--	--	--	N
H_3	N	--	--	--	--	--	C	--	Y	C	--	--	--
H_4	N	--	--	--	--	--	--	--	--	Y	Y	Y	--
H_5	N	--	--	--	--	--	--	--	--	--	--	--	--
H_6	Y	--	N	--	--	Y	Y	--	Y	Y	--	--	--
H_7	--	--	--	--	--	N	Y	--	Y	N	--	Y	--
H_8	--	--	--	N	Y	--	--	N	--	--	N	N	--
H_9	--	Y	--	--	--	--	--	--	--	--	Y	Y	--

Figure 1 (continued)

	Meicher, 1972c	Bergstrom - Goodman, 1973	Greenwood - Wadycki, 1973	Ostrom - Parks, 1973	Ostrom - Parks - Whitaker, 1973	Meicher - Eberline, 1973	Beaton, 1974	McPheters - Stronge, 1974	Clark, 1975	Greytak - Jump, 1975b	Odoni, 1975	Lewin - Keith, 1976	
Unit of Analysis	206 cities	826 cities	199 SMSAs	102 cities	4 cities	204 cities	562 cities	43 cities	51 cities	city-county	33 cities	all cities	
Scope of Analysis	nat	10 states	nat	nat	SMSA	nat	NJ	nat	nat	3 city, 3 county	nat	nat	
Minimum City Size	50,000	10,000	none	10,000	none	50,000	none	250,000	50,000	none	300,000	250,000	
Stat. Technique	MR	MR	MR	SC-PC	D	MR	MR	PR CO	MR	MR	D	MR	
H_1	Y	--	--	Y	Y	Y	Y	--	Y	--	Y	Y	
H_2	Y	--	--	--	--	Y	--	--	--	--	--	--	
H_3	Y	C	--	--	--	Y	C	--	--	--	--	--	
H_4	Y	C	N	--	--	Y	Y	--	--	--	--	Y	
H_5	--	--	--	C	--	--	--	--	--	--	--	--	
H_6	Y	--	Y	--	--	Y	Y	Y	Y	--	--	N	
H_7	Y	Y	N	--	--	Y	Y	--	Y	--	--	--	
H_8	--	--	Y	C	Y	--	Y	Y	--	--	--	--	
H_9	--	--	Y	--	--	--	--	--	--	Y	Y	Y	

Berolzheimer, 1947; Fabricant, 1952). Brazer (1959) was among the first to use multivariate analysis to test the effects of municipal population on per capita spending; he found a direct, though small, relationship. Follow-up studies have repeatedly discovered similar results (Wood, 1961; Schmandt-Stephens, 1963; Bahl, 1969a; Hawkins-Dye, 1970; Gabler, 1971; Fowler-Lineberry, 1972; Ostrom-Parks, 1973). Others have found no relationship (Hirsch, 1959; Weicher, 1970, 1973). No one has found any significant evidence of a negative relationship between city size and per capita police expenditures. Both Brazer (1959) and Bahl (1969a) reached similar conclusions as to possible interpretations of these results; they reflect the continuing debate surrounding a relationship whose direction is seemingly well-established:

- Scale economies exist, but are confounded by factors associated with larger populations, such as population density or growth, which may result in higher per unit cost for providing equal service quality;
- Municipal costs for police protection vary directly with population because of diseconomies-of-scale, especially in cities of more than 25,000 residents; or
- Larger cities provide a higher quality of public services -- or perhaps must provide more services free of charge to non-residents -- than do smaller cities (Bahl, 1969a:39).

The reason for, and resolution of, the argument over the true direction of the city size-expenditure association lies in a discussion of economies-of-scale. Several authors have argued that large police departments should have a decided cost advantage over smaller ones, that they should be able to capture scale economies in the production of services (Walzer, 1972a,b; Weicher, 1971). They have used the logic of determinants analysis to attempt to demonstrate their point; spending is considered a function of city population and several other dependent variables such that:

$$E = a + b_1 P + \sum_{i=2}^{n} b_i X_i + e_i$$

where E represents per capita police expenditures, P is city population, b_i are regression coefficients, X_i are other independent variables, and e_i is the error term. The inverse of H_1 then states that if a statistically negative coefficient b_1 is found, economies-of-scale in the production of police services can be assumed to exist.

But, as Bahl (1969a) and others have noted, there is considerable doubt that cross-sectional multiple regression analysis is an appropriate method of identifying economies-of-scale. In determinants studies using the regression model above, spending is considered a function of city population plus numerous other independent variables. In the analysis of the private firm, scale economies concern the production function that determines the relationship of unit costs to increases in output. For private firms, a U-shaped production function is normally assumed to indicate the presence of scale economies: unit costs fall as output expands, until such point as costs begin to rise with output. Thus, for determinants analysis to maintain the analogy to the firm, population must be viewed as the output of the public sector, as a surrogate for level or scale of activity. The relationship between population and scale of police operations, however, is undetermined.

One reason scholars have had such a difficult time using determinants analysis to assess the existence of scale economies in the production of police services is that, to measure these economies, levels of service quality must be controlled. Few studies, however, have attempted to determine quality. Thus, studies claiming the

existence of economies or diseconomies have often assumed constant service levels (Gabler, 1971). Also, most determinants studies ignore the nature of the police production function and fail to differentiate supply factors from demand factors in their expenditure equations.

Looking more closely at some determinants studies that have discussed economies-of-scale may help clarify the confusion. Hirsch (1959) presented one such study, using night-time population as his measure of scale, and developed a quasi-long-run expenditure function through multiple regression. He found that per capita police expenditures in the St. Louis area did not vary significantly with size of night-time population, even when quality of service was introduced as an independent variable, and concluded that no economies-of-scale were indicated. Long-run expenditures varied little with scale of operations until a very large scale was reached, at which point expenditures began to increase. Hirsch found that inclusion of his index of police quality, based largely on rankings of "experts," suggested that smaller communities had difficulty providing adequate police protection, but offered it at about the same per capita rate as did larger cities.

Schmandt-Stephens (1960) found that population was not significantly related to police expenditures per capita, but was related to a service index based on the number of subfunctions performed per department. They concluded that economies-of-scale were possible because of a negative relationship between per capita police expenditures and service levels, controlling for population. But their index of service level is a better measure of scale than quality of output, and their high correlation between population and output is not surprising.

Walzer (1972b) considered the number of cleared offenses, accidents

investigated, and vehicle miles travelled as output measures, claiming that reductions in unit cost accompanied increased output, and that scale economies were possible; however, city size remained unrelated to expenditure per capita. Walzer also hypothesized that if the number of officers per capita remained constant as city population increased, per capita expenditures would also remain constant, or perhaps increase slightly.

Ostrom-Parks (1973) held service levels (measured by citizen evaluation of police services) constant in a nationwide sample of cities, and found higher per capita expenditures in larger municipalities. In a sample from a single metropolitan area -- Grand Rapids -- service quality was higher and per capita expenditures lower in smaller cities than in corresponding neighborhoods within the center city (IsHak, 1972). In another metropolitan area -- Indianapolis -- smaller city departments provided higher service levels than did the center city department in corresponding neighborhoods, but for slightly higher expenditures per capita (Ostrom, et al., 1973; Ostrom-Parks-Whitaker, 1973). No claims were made in any of these studies concerning economies-of-scale.

One reason that economies-of-scale, even if present, might not be revealed by the population-expenditure relationship is the presence of other factors associated with larger populations that could result in the same service quality being provided at higher unit cost. Hirsch (1959:236) noted: "A few of the factors which might be assumed to affect per capita expenditure levels of local governments will tend to increase automatically with population growth . . . the net regression coefficient relating per capita expenditure and population assumes that

all other growth dimensions are held constant."

Several studies have sought to examine the population-expenditure relationship by undertaking separate regression analyses for cities within different population ranges. Gabler (1971) found that for cities of between 25,000 and 250,000 population, a positive and significant relationship obtained in only one of eight states; in general, city size was unrelated to expenditures within this population range. For cities of more than 25,000, inclusive of cities greater than 250,000, Gabler's samples in all eight states showed strongly positive associations between size and per capita expenditures, indicating that larger cities spent more per capita than smaller ones. Gabler concluded, again assuming constant service levels, that diseconomies-of-scale for police services were present in cities of more than 250,000.

In a more ambitious attempt to circumvent the problem of other determinants simultaneously interacting with population size, Beaton (1974) distributed his New Jersey municipalities over four size ranges and computed separate regression equations for each range. He concluded that the traditional assumption that the set of cities under analysis belonged to the same population was incorrect, and that each of the four population groupings revealed different determinants of police expenditures per capita. Beaton's results indicated no economies-of-scale in any of the four strata, and pointed out the continual need to test for potential covariation among independent variables. His analysis is one of only a few (others include studies of individual SMSAs--Bollens, 1961; Sacks-Hellmuth, 1961; Hirsch, 1959) to examine expenditure determinants in cities with fewer than 10,000 residents; comparative studies of smaller cities are almost non-existent (Ostrom-Parks, 1973

is an exception).

Figure 1 allows comparison of minimum city size standards imposed by various authors. By instituting relatively high population requirements for inclusion (usually 25,000 or more), many authors have biased their results. What form this potential bias may take is unclear. However, it apparently ensures positive relationships between population and per capita police expenditures. This is not to imply that such a relationship does not exist among municipalities in the lower size ranges, but Beaton's (1974) data, and especially that of Ostrom-Parks (1973), indicate that it is stronger in larger than smaller communities. The latter study found Pearson coefficients in the .5 range for central cities, in the .25 range for smaller suburban cities. Masten-Quindry (1970) present evidence that population is a stronger determinant of total expenditures in communities of less than 5,000 and greater than 20,000 population than it is in communities containing between 5,000 and 20,000 people. One argument in favor of ignoring the smaller communities is that their reported financial data may be susceptible to greater variation and error in compilation. Unless this allegation can be demonstrated, it seems that the potential bias introduced by concentrating only on central cities outweighs perceived data limitations.

2.2 Suburban Exploitation Hypothesis

Several studies have attempted to estimate the effects of suburban population on central city expenditures. Hypothesis H_2 states that central city police expenditures per capita are inversely related to the ratio of central city to SMSA population. Hawley (1951) showed

that the larger the proportion of SMSA population living outside the core city, the higher that city's per capita spending. He suggested that central city residents were being exploited in that they were forced to support costly services provided free of charge to non-resident commuters. Brazer (1959:52) clearly explained the reasoning behind the hypothesis:

> We should expect expenditures per capita, based on the population of the city itself, to vary inversely with this ratio, for as it declines the proportion of persons who do not live within the city limits but for whom public services must be provided rises. This hypothesis stems from two considerations. First, many persons living in the metropolitan area outside the central city spend much of their time . . . in activities within the central city . . . Second, central cities, to varying extents, provide services to outlying communities.

As Bish-Nourse (1975:165) further explain:

> The movement of high- and middle-income residents and the location of new businesses and industrial plants in the suburban areas has left the older central cities with increasing proportions of low-income families and relative and sometimes absolute declines in business activity. These shifts have aggravated the problems of the expenditure-revenue gap by requiring additional expenditures for low-income populations while the tax base was growing very slowly or perhaps even remaining stagnant. While economic activity in cities has been declining or growing slowly, many suburban areas with their above-average-income families and new business and industry are regarded as affluent. Many suburbanites, however, still commute to the central city for employment and shopping and use its streets, parks, and cultural facilities. These trends have led to the allegation that suburbanites do not pay their fair share of the central-city government costs although they benefit from central-city services. Thus, suburbanites are said to "exploit" the central city.

Only a handful of studies of determinants of police spending have examined the suburban exploitation issue empirically. Brazer tested this hypothesis for his sample of the 40 largest SMSAs, finding a significant negative regression coefficient for police services, and concluding that rapidly growing suburban communities placed increasing demands on central city public services. Even though suburbanites

were receiving free police services, Brazer argued, this was not enough evidence to "establish a case that the residents of the suburban area impose a net burden upon the central city" (Brazer, 1959:58), since the suburbanite was contributing enough to the central city's tax base to more than make up the expenses he imposed.

Bahl's (1969a) findings were insignificant, although they were in the direction indicated by H_2, as were Weicher's (1970, 1971, 1972c); neither author argued for the existence of exploitation, however. Through path analysis, Kasarda (1972) showed that suburban population in both 1960 and 1970 was a major contributor to increased per capita central city police expenditures ($r = .56$ and $.61$ respectively), much more so than was central city population ($r = .15$ and $.09$ respectively). Change in suburban population was even more strongly related to expenditure change. When controls were introduced for city age, per capita income, and percentage non-white, relationships between suburban population size and central city expenditures remained strong and in the hypothesized direction. Kasarda argued that since suburban commuters, by their daily use of central city facilities, greatly increased the cost of municipal police services, economies-of-scale might be realized through consolidation and metropolitan-wide government.

Weicher (1972b), in a direct test of the exploitation hypothesis, concluded that taxes paid to central cities by suburban residents outweighed central city spending increases; he argued that central cities exploit their suburbs. Expenditures for police protection were positively related to the ratio of suburban to central city population. Contrary to the prevailing hypothesis, cities appeared to spend more providing police services to manufacturing plants than

they received in return from tax revenue, but on the other hand received more in tax revenue from retail stores than they spent in providing police services to them. Weicher suggested that the loss of manufacturing to the suburbs, with its consequent decline in tax base, has not by itself produced the urban fiscal crisis. Unlike Kasarda, he believes that metropolitan government will not reduce the fiscal problems of center cities. His analysis suggests that researchers must know the economic composition of suburban cities -- with their differing retailing, manufacturing, and residential mixes -- before drawing conclusions about suburban exploitation; the exploitation hypothesis cannot be adequately treated in terms of a single expenditure function.

Thus, several studies have supported Hawley's original contention that central cities spend more than surrounding suburbs, but few authors interpret these findings as confirmation of the "suburban exploitation" hypothesis. Some (Brazer, 1959; Margolis, 1961; Kee, 1965, among others) have noted that suburbanites bear a portion of the central city tax burden; their purchases of goods from central city business establishments increase property values and contribute to tax revenues.

Two concise but comprehensive reviews of the exploitation issue appear in Bish-Nourse (1975:163-168) and Greene-Neenan-Scott (1974: 17-26). The latter are not convinced that existing studies adequately examine the issue. They perceive several major errors in studies which have found little evidence of exploitation and identify key questions which require resolution before the exploitation hypothesis can be properly assessed. Bish-Nourse (1975:167-168) recognize the difficul-

ties of measuring fiscal flows among citizens of different jurisdictions, but argue that:

> The net balance of public sector expenditure benefits and revenues among citizens of different jurisdictions is likely to vary from place to place depending on the ratios of manufacturing, retailing, and people of different income classes in the different jurisdictions . . . Even if net public sector benefits and expenditure flows result in net costs for central-city residents, income increase in the private sector will probably more than make up for the public sector costs. Our general conclusion is that central cities are probably not exploited by their commuters and that the cities would be worse off if commuters found jobs, in addition to residences, in the suburbs.

Another explanation of H_2 may be that no exploitation per se exists. As citizens move from central city to suburbs, central city police budgets may remain constant; per capita spending will increase simply because fewer people are receiving services for the same spending level. Further, citizens and police may be co-producers of police services -- citizens through calling the police, taking anti-crime precautions around the home, or forming neighborhood patrols, among many other activities. The citizens moving to the suburbs may have been better "factors" in co-production than those remaining. That is, individuals who remain may be less capable of coping with crime, and present greater problems for police, than did the residents who moved out. Therefore, police factor inputs must be increased to compensate for the loss. What may in fact be happening is exploitation in reverse; citizens bearing the brunt of co-production may have been exploited by non-contributors and forced to move to the suburbs. (For a discussion of citizens and police officers as co-producers, see Parks, 1976, forthcoming.) If suburbanites do indeed return to the center city to work, they may increase the demand for police traffic patrols more than for any other police service.

2.3 Population Growth Rate

A third demographic factor affecting police spending per capita is the municipal population growth rate, usually operationalized as the 10-year population increase. As city population grows, need for police services increases, but per capita expenditures may lag somewhat as existing manpower is spread more thinly throughout the city; "economies of size" may be forced upon rapidly growing cities, and therefore an inverse relationship between growth and per capita expenditures is expected (H_3).

Empirical studies contain mixed support for this hypothesis. Brazer (1959) found little support -- only in his California sample was the relationship in the hypothesized direction, and there only because that state's cities were growing rapidly. For Ohio, the relationship was positive and significant, but in each of the other samples, no association was discovered. Bahl's (1969a) results were also not supportive -- he found positive but insignificant association. Both Brazer and Bahl looked at the growth rate of the central city. Weicher (1970, 1972c), and Weicher-Emerine (1973) examined the effects of SMSA growth rates on central city spending and found relationships significant and in the hypothesized direction.

The time period of expenditure change and the year the dependent variable is measured are of paramount importance in assessing the effects of this variable. Smith-Fibiger (1972) reported a positive, insignificant association between state population change and per capita state-local police expenditures for 1957, a negative, insignificant association for 1962, and a positive, significant association for 1967.

The hypothesis as originally formulated applied to total, not per

capita, municipal spending. Among the few studies to examine unstandardized expenditures was Bordua-Haurek (1971). The authors estimated 1960 expenditures from 1902 data on the basis of projections about the behavior of four specified independent variables. They calculated 1960 figures as if inflation, population growth, urbanization, and growth in motor vehicle usage had not occurred, deflating actual 1960 figures by simple control and standardization techniques. Their analysis suggested that 29 percent of the 58-year growth in total police spending nationwide was a result of population growth alone.

Several authors found conflicting evidence regarding H_3. Bergstrom-Goodman (1973) looked at the effects of city population change on a 10-state sample of 826 cities with 1960 populations of between 10,000 and 150,000. They summed their results by state, and found relationships in the hypothesized direction for cities in seven states; in only three, however -- California, New York, and Wisconsin -- were results significant.

Kasarda (1972) found a strongly positive relationship between changes in suburban population and changes in central city police expenditures from both 1950-1960 and 1960-1970. But the relationship between central city police expenditures and central city population change switched from moderately negative from 1950-1960 to moderately positive from 1960-1970.

Gabler (1971) reported that population change from 1950-1960 had a negative association with public expenditures for police services in New Jersey municipalities, but a positive one in Michigan cities. City size, time period of measurement, the nature of the independent and dependent variables, and scope of analysis all vary greatly among

studies concerned with H_3; these variations, always important in empirical analysis, are especially so for this hypothesis.

Beaton (1974) offered a cogent explanation for the varied results of population change. He found that growth rates interacted with city size in their explanation of variations in per capita spending. "Cities under 10,000 population experience high start-up costs with recent growth. To the contrary, larger cities are found to decrease their per capita police expenditures with increasing growth rates" (Beaton, 1974:342). Beaton discovered that smaller cities experience a longer expenditure lag than larger ones; in large cities, he found the hypothesized negative coefficients, indicating an ability to capitalize on a previously well-developed system of police services.

Beaton is among the few authors who have explicitly considered population decline and its effect on expenditures. As noted in the discussion of H_2, population reduction does not necessarily result in a reduction in police employees and consequently in police budgets. According to Beaton, large declining cities possess employee labor unions that will resist any attempt to reduce police spending. He found that determinants of spending in cities with declining populations were significantly different from those in growing cities.

2.4 Population Density

The fourth major hypothesis holds that the greater a city's population density, the higher its per capita police expenditures. This hypothesis originally stemmed from a belief that areas of high density contained large numbers of potential crime targets. Density was also presumed to engender problems of vehicular and pedestrian

control, as well as increased crime, all of which would require greater consumption of police services and increased expenditures.

H_4 is generally, although not always strongly, supported by the literature. Brazer (1959) found that density accounted for a larger proportion of the variation in per capita police expenditure in his 40-city sample than did any other variable; it was also highly significant in the 462-city sample. For his three intra-state samples, however, density was insignificant, although its effect was in the hypothesized direction in cities in Ohio and Massachusetts. Beaton (1974) explained Brazer's findings through the growth-decline model. Both Ohio and Massachusetts were dominated by declining cities; California, by growing cities. Beaton found that population density in New Jersey cities interacted with population size more strongly than did any other determinant, and that it had a positive effect on expenditures; however, this effect became stronger in cities declining in population, weaker in cities experiencing population growth.

Figure 1 reveals the level of support for H_4. While most authors found density to have a positive influence on spending, some found that influence insignificant (Bollens, 1961; Sunley, 1971; Bergstrom-Goodman, 1973; Greenwood-Wadycki, 1973). Only Gabler (1971) reported any negative association, that for cities in California and New Jersey; for Michigan and Ohio cities, the relationships were as hypothesized. Gabler argued that density could affect spending in either direction since crowding could make police provision both more difficult (and therefore more expensive) or easier, allowing fuller exploitation of existing manpower and equipment and therefore lowering per capita expenditures. He also noted that such cost reduction would be accom-

panied by lower service levels. Lewin-Keith (1976), arguing that higher population density led to increased criminal activity, suggested that density was positively associated with police salary levels. Wood (1961) found that housing density was strongly and positively associated with per capita spending.

The weight of the evidence thus suggests that it is more expensive to provide police protection in areas of high population density. The relationship, however, may be affected by density's strong intercorrelation with other factors also directly associated with higher spending, such as city population increase (Bahl, 1969b).

2.5 Metropolitan Political "Fragmentation"

The fifth hypothesis holds that as the number of police departments in a metropolitan area increases, the per capita expenditures of those departments also increase. This hypothesis is usually called the "metropolitan fragmentation" hypothesis, although the term fragmentation has meant different concepts to different authors.

One attempt at clarifying and defining the concept appears in Ostrom-Parks-Whitaker (1974), where fragmentation is operationalized as the number of distinct organized consuming units for a government service. While most determinants studies consider "fragmentation" a measure of the number of service producing units in a metropolitan area, Ostrom-Parks-Whitaker, and this review, refer to this concept as "multiplicity."

Some determinants studies discuss both absolute and relative measures of multiplicity; findings are often quite different, depending on the measure used. Ostrom-Parks-Whitaker (1974) define absolute

multiplicity as the number of service producing units in a metropolitan area, but this measure does not control for SMSA size nor for the political arrangements present. They define two relative measures of multiplicity: number of producing units for a service divided by the number of consuming units for that service (average number of producers per consuming unit), and number of producing units for a service per 10,000 residents. The latter relative measure is similar to that developed by Hawkins-Dye (1970).

Multiplicity has long been credited with inflating the cost of service provision, yet few scholars have actually tested its effects. The argument is that SMSAs in which many governments provide services are inherently inefficient because only the largest governments can support the specialized, professional police departments required for effective service; large agencies are more efficient because they can produce the same or higher levels of output at lower costs than smaller departments can. H_5 is at the very heart of the argument for metropolitan consolidation (see Ostrom-Parks-Whitaker, 1973).

Empirical tests of H_5 have produced mixed results and mixed interpretations. Adams (1967) found a generally positive relationship between number of counties and state-local expenditures per capita for police. In some areas with large numbers of jurisdictions, however, expenditures were lower. Adams speculated that "the fragmented local public sector does have difficulties in accurately measuring true preferences for police services and may be illustrative of the negative influence of 'spillovers' on public expenditures. On the other hand, the low police expenditures in county areas having only one local governmental jurisdiction may reflect economies-of-scale" (Adams, 1967: 21).

Brown (1967) presents evidence that, for the city of Houston from 1947 to 1962, there were steady increases in per capita police spending, but that there were relatively larger increases in the years directly following the annexations of suburban areas. Instead of citing these increases as evidence against H_5, Brown concluded that annexation helped ease the financial burden of the Houston metropolitan area because it ensured that the size of the group paying for services nearly equalled the size of the group receiving them.

Although they did not test its effect on police spending specifically, Campbell-Sacks (1967) found no association between expenditure and population per government. Bahl (1969a) included a measure of the number of governmental units per SMSA in his regression model. Although he found negative relationships between this measure and both per capita operating expenditures and per capita expenditures for common functions -- including police -- only the first was significant. When checking for the effect of number of governmental units on per capita police expenditures, Bahl found a positive but insignificant association. The variable contributed little toward explaining expenditure variance and was dropped from later analysis.

Hawkins-Dye (1970) measured "fragmentation" (number of governments in an SMSA) and its relationship with per capita spending. Associations were quite weak, but were strongest for police, where a correlation coefficient of .31 was found with total number of governments the independent variable, and of -.29 with total number of governments per 100,000 population the independent variable. Although the absolute measure produced relationships in the hypothesized direction, the relative measure was in the opposite

direction. When only municipal governments were considered, the absolute measure changed little (r = .35), but the relative measure dropped to r = -.01. Hawkins-Dye (1970:23) concluded that "fragmentation does not appear to increase or decrease government spending for municipal services," especially when environmental influences are controlled.

Sunley (1971) hypothesized, although attempting no empirical verification, that the high degree of political fragmentation in the Pittsburgh SMSA accounted for the low expenditure levels of the suburbs. He argued that because of the spillover of benefits from one municipality to another, each might be reluctant to spend more than is absolutely necessary to provide "basic" goods and services. He felt, however, that spillover benefits for police were probably less important than for other municipal services.

Results of these findings, as several authors readily admit, are difficult to interpret, largely because of the lack of a measure of service levels independent of expenditures themselves. This is the same problem encountered in the discussion of economies-of-scale. Ostrom-Parks (1973), using data from a nationwide NORC sample, controlled for service levels through citizen evaluations of police services. They found significant, positive relationships between number of police jurisdictions and per capita police expenditures, controlling for quality of service. The uncontrolled relationship was also positive, but considerably higher; however, the relationship was significantly weakened when evaluations of suburban residents were controlled. Just as with the Hawkins-Dye (1970) data, when number of jurisdictions per 100,000

population was correlated with police expenditures per capita, associations were strongly negative (all r's larger than .40). With suburban residents' evaluations of their police controlled, the relationship between relative number of jurisdictions and spending was even less supportive of H_5.

The hypothesis that multiplicity is positively associated with higher per capita expenditures for police is certainly not solidly confirmed by empirical analyses; considerable contrary evidence exists. Ostrom-Parks (1973) suggest that higher expenditures cannot be equated with higher service levels, and that a decrease in the relative number of police departments in a metropolitan area is associated with increased per capita costs. They argue that consolidation of suburban police departments might well reduce service levels and increase costs for suburban residents. They also suggest that "the most appropriately sized unit for providing one type of service may not be the most appropriate for other types of services" (Ostrom-Parks, 1973:397).

2.6 Income, Wealth, and Fiscal Capacity

The sixth hypothesis states that expenditures are directly related to individual and jurisdictional wealth. Many determinants studies have examined the effects of individual, family and jurisdictional income and wealth on both levels and distribution of per capita expenditures. Others have looked at measures of a city's ability to support given levels of per capita expenditures (fiscal capacity), measured by revenue indicators.

Countless variables have been used to operationalize these concepts. For example, levels of individual wealth have been measured by median

family income and per capita personal income, while wealth distribution has been operationalized by the percent of families with incomes below $3,000 or above $10,000 per year. Jurisdictional wealth or fiscal capacity has been measured by the ratio of central city employment to total SMSA employment, percentage of labor force employed in manufacturing, per capita retail sales, median value of owner-occupied housing units, per capita intergovernmental revenue, ratio of intergovernmental to total general revenue, property tax revenues as a percentage of total general revenues, per capita assessed valuation, and many more.

Because such a large number of variables have been examined, the level of support for H_6 as revealed in Figure 1 is necessarily a crude rendering of empirical findings. Where authors have examined the effects of more than one variable and found conflicting evidence, the symbol appearing in Figure 1 reflects the general trend of their findings.

Brazer (1959) found a positive relationship between per capita median family income and per capita police expenditures for his 462-city sample, but relationships in two of the three intra-state samples were insignificant. Positive associations, he concluded, reflected the fact that persons with high incomes can support higher spending levels for police services. In some cities, however, differences in levels of income are not nearly as influential a predictor of per capita spending as is population density. Also, narrower inter-city spreads in income levels reduced the size of the regression coefficients.

Other authors have discovered considerable support for H_6. Several have reported the positive effects of median family income or per capita property valuation without controlling for possible confounding effects of other variables (Sacks, 1962; Schmandt-Stephens, 1963;

Hawkins-Dye, 1970; Kasarda, 1972). Adams (1967), for example, found that while increases in the number of families earning more than $10,000 yearly was directly related to per capita spending increases, the expenditure variation which could be attributed to income distribution alone was considerably smaller. He still argued that individual income-related preferences for police services were affected by distribution as well as level of income (Adams, 1967:21-22).

Bahl (1969a) also analyzed interdependencies among income variables and found that median family income was strongly related to income distribution as measured by the percentages of families earning above $10,000 and below $3,000 per year. He argued that it was impossible to extract the effects of income levels from those of income distribution as explanatory factors (Bahl, 1969a:40-41). Bahl found that median family income was directly and significantly related to per capita police expenditures; the distribution of income variables were insignificant and were dropped from later analysis. Per capita retail sales, intergovernmental revenue as a percentage of total general revenue, and property tax revenue as a percentage of total general revenue were all positively and significantly associated with police spending per capita. Bahl's (1969a) model did not include median value of housing units as a reflection of general community wealth, even though simple correlation showed it strongly related to police spending, because it represented only values of owner-occupied dwelling units, and was highly intercorrelated with median family income and income distribution.

Bahl (1969a) and others used per capita intergovernmental revenue as a measure of government's capacity to finance services, despite

strong objections from Morss (1966) that it, and other variables such as per capita assessed valuation, merely reflect revenue levels from which fiscal support is drawn for all governmental services. While there is an element of circularity in the use of these variables, which are consistently positively associated with per capita police expenditures, revenues are legitimate components of demand functions for public services and as such may be spending determinants. Fredland's (1974) review describes many studies that have examined the impact of intergovernmental revenues.

Not all authors, however, have found support for H_6. Wood (1961) reported a negative relationship between per capita police spending and residential affluence. Pidot (1969) found that while state and federal aid per capita were positively and significantly associated with police spending, community welath was not. Lewin-Keith (1976) reported significant negative relationships between median family income and size of patrolmen's starting salaries. They postulate two interpretations of their findings. First, while family income was presumed to represent "ability" to pay, it may in fact measure "willingness" to pay. According to this interpretation, cities with high levels of median family income are less willing to support high police salaries than are cities with relatively low median family incomes. The second interpretation involves family income as a strong determinant of, and negatively associated with, criminal activity. Thus, the higher the median family income in a city, the lower the incentive of residents of that city to commit crime, the lower the crime rate, the lower the demand for police services, and the lower the police salaries (Lewin-Keith, 1976:10). But Greenwood-Wadycki (1973:149) suggested

that a one percent increase in median family income resulted in a .85 percent increase in per capita police expenditures. They argued that higher-income residents supported higher spending levels to avoid what they perceived as potentially great losses due to crime.

Weicher (1971) attempted to directly examine the extent of police protection afforded Chicago citizens, comparing the number of policemen assigned to rich and poor police districts. He found that poorer districts (those with relatively low median family income) were assigned more officers than richer ones, and reported a negative association between district median family income and number of assigned policemen. Weicher suggested two hypotheses. First, policemen were assigned to protect citizens of districts with high crime rates; this implies that more is spent in providing protection to poorer citizens. Second, more protection is really being provided to rich residents by concentrating manpower in poor districts, and the negative income-manpower relationship has no implications whatsoever about expenditure distribution by income class. Weicher opts for the first hypothesis, arguing that middle income citizens subsidize police protection of the poor. There are considerable methodological problems with Weicher's study, however (no direct expenditure measure, no clear manpower breakdown by function or district).

While the bulk of empirical evidence indicates that levels and distribution of community wealth, income, and fiscal capacity are positively related to levels of municipal expenditures per capita, the amount of existing contradictory evidence is not surprising. These factors influence supply and demand of police services in complex ways; any single interpretation is very likely to be inaccurate or incomplete.

Most studies do not point out that, as the municipality under study becomes smaller, land uses become more specialized and divergence between jurisdictional wealth (total taxable property) and median family income increases (Bish, 1976, forthcoming).

2.7 Service Conditions

The seventh hypothesis, that police expenditures per capita are directly related to certain service conditions, applies to a number of different community characteristics. Certainly city population, population density, and fiscal capacity also represent service conditions, but H_7 accounts for such variables as percentage non-white, age distribution of residents, city age, land area, and even political variables such as governmental structure and political patronage.

For example, Schmandt-Stephens (1963) found that county land area was positively ($r = .17$) related to per capita police expenditures. Their evidence indicates that area is not highly correlated with either population or density, but they do not explore its effect on spending with other variables controlled. Walzer (1972b) reported a negative association between land area and expenditures for 1958 data, but a positive one for 1960 data, although neither was significant. In an earlier article, Schmandt-Stephens (1960) found that total municipal land area showed no correlation with per capita spending on all municipal functions, although city age did have a positive effect on total sponding; older, more established cities spent more per capita than more recently incorporated ones. Kasarda (1972) found no city age-expenditure relationship. Masten-Quindry (1970), in a study of 567 Wisconsin cities and villages, found that land area contributed

more to the coefficient of determination for total city expenditures than did city population, per capita income, or population density.

Percentage non-white is perhaps the most frequently examined service condition variable, often showing strongly positive association with per capita police spending. Weicher has found percent non-white consistently one of the most positive and significant determinants (Weicher, 1970, 1972c; Weicher-Emerine, 1973). Gabler (1971) reported that percent non-white was positively related to police spending in three of his eight states -- Michigan, New York, and New Jersey. Kasarda (1972) computed a path coefficient of .16 between police spending and percent non-white. Bergstrom-Goodman (1973) found positive associations for cities in nine of 10 states; only Wisconsin municipalities reflected a negative relationship, but results were significant only in Illinois and New Jersey cities.

Some studies have found percent non-white to have only slight association with police per capita spending. Bollens (1961) reported it significant in one model, insignificant in another. Hawkins-Dye (1970) reported a correlation coefficient of only .01 for 212 SMSAs. Greenwood-Wadycki (1973) examined the proportion of black residents in an SMSA, expecting it to be positively related to police spending; it was not. Adams (1967) was unable to separate the effects of non-white population from region of the country, although he did suggest that higher percentages of non-white residents created "social tensions which may instigate criminal behavior" (Adams, 1967:17).

Bahl (1969a) found a strong percent non-white-police spending relationship. Since it was highly correlated with median family income (negatively) and percentage of families with income less than

$3,000 per year (positively), however, percent non-white was dropped from the analysis. Because of this intercorrelation problem, percent non-white has appeared in fewer regression models than would normally be expected from the size and significance of the majority of the findings.

Age of residents is strongly associated with per capita police spending in some studies. Wood (1961) suggested that high percentages of citizens under the age of 14 reduced spending levels for police, but high percentages of residents over 65 increased spending slightly, largely because of the correlation between age and poor housing or public facilities. Data from Gabler (1971), Weicher (1970), Weicher-Emerine (1973), and Mikesell (1972) support this hypothesis and show a strong negative relationship between the percentage of young persons and spending for police protection. Bergstrom-Goodman (1973) report that high concentrations of residents over 65 increase city police spending in seven of 12 states, although age is not generally significant. Beaton (1974) took a different approach, suggesting that persons 22-39 years of age would have a relatively high budget constraint that would tend to retard per capita police expenditures, whereas the presence of older persons in the peak of their earning period should tend to expand expenditures.

Another service condition variable is the municipal political system. Clark (1968) and Lineberry-Fowler (1967) both looked at the association between governmental reform structures and general budget expenditures, finding moderate relationships with government, election, and constituency-types as independent variables. The relationship between political variables and police spending, however, has received

little attention. Fowler-Lineberry (1972) did examine the association between police per capita expenditures and voter turnout in municipal election, finding it negative but insignificant. On the state-local level, Smith-Fibiger (1972) discovered generally negative, insignificant associations between state-local police and fire protection expenditures and the minimum number of years between elections.

A more sophisticated analysis of the effects of political variables on police spending has recently been conducted by Clark (1975). Based on data gathered in 51 cities for several time periods, he reported that cities with higher percentages of Irish residents spent considerably more per capita on police protection than did other cities. Clark reviewed other data sets showing the percentages of Irish, Catholics, and foreign-born residents to be among the most important factors associated with high municipal expenditures. He concluded that the resources of the Irish were converted to political influence through a system of patronage politics. Many Irish joined the police department, and as the patronage system responded to the demands for increased numbers of jobs and higher salaries, police budgets rose accordingly. While Clark did not include many other demographic or economic independent variables in his regression model (population size and taxable property value were the only two), he argued that as long as other variables were not seriously co-linear with the percentage of Irish residents, his results would not be affected by ignoring them (Clark, 1975).

H_7 does not describe the influence of any one variable on per capita police spending. Rather, its inclusion in Figure 1 is designed to allow interested readers to further investigate some of the issues

raised. The results listed for H_7 are not reliable in the sense that, more than for any other hypothesis, they are subject to the vagaries of statistical techniques, period of data collection, and operationalizations of independent variables.

2.8 Service Levels, Outputs, and Crime Rates

This section examines in greater detail an aspect of the literature discussed earlier -- the effect of police service levels on per capita expenditures. The eighth hypothesis states that police expenditures rise directly with the increased agency output. This section first examines various measures of police output that have been related to expenditures, then looks at the effect of crime rates on per capita expenditures -- and vice versa.

Hirsch (1959) developed an index of policy agency scope and quantity based on subjective rankings of five St. Louis area police experts who considered such factors as qualifications and leadership ability of police chief's; qualifications, strength, and training of police force; supporting equipment; morale; and "basic conditions bearing on the magnitude of the policing problem" (Hirsch, 1959:237). Hirsch concluded that "relatively poor police services were offered at about equal per capita expenditures regardless of the size of the community, partialling out the effect of other factors" (Hirsch, 1959:238). As reported in Bollens (1961), Hirsch found that increases in per capita expenditures for police protection were positively associated with his service level index.

Schmandt-Stephens (1960) criticized Hirsch's index of service level as consisting primarily of inputs such as personnel, salaries,

and equipment, and argued that inputs reflect per capita spending rather than output and that the index was thus guilty of circular reasoning (Schmandt-Stephens, 1960:370). They constructed an output index based on the number of subfunctions or activities performed by each police department in Milwaukee County, and related it to both population and expenditures. Correlations between service levels and population were strong and positive, reflecting the manner in which the index was constructed -- larger departments are more specialized than smaller ones; the index is undoubtedly influenced by departmental organizational structure. Correlation between service levels and per capita police expenditures was positive but small (r = .10). When population was controlled, though, a negative coefficient was observed (r = -.28). The authors suggested that this relationship indicated the presence of economies-of-scale (Schmandt-Stephens, 1960:374). Although the number of subfunctions performed by police agencies may provide some indication of the scale of activities, it no more reflects the quality of those activities than do per capita expenditures.

Walzer (1972a,b) developed an index of service based on a composite of the number of offenses cleared, accidents investigated, and miles travelled by police vehicles for a sample of 31 Illinois cities. Each item was weighted by the amount of time devoted to handling and disposing of an average offense. The activities index was treated as a measure of scale. Police expenditures were divided by the service index to calculate average cost, which was then regressed against several expenditure determinants. Walzer's data did not account for the cost of solving particular types of crimes. He argued that a negative relationship between average cost and the output index indica-

ted economies-of-scale. As a quality measure, he relied on the number of offenses cleared by arrest as a percentage of total reported offenses; average entry-level salary was a second quality measure, although it is more properly an input factor. His regression analysis supported the economies-of-scale hypothesis, he argued, since he found a significant negative association between scale and cost. But when population was treated as the scale measure and expenditures as the cost measure, results were insignificant, although negative. Walzer concluded that there were serious measurement problems in both his scale measure (which included both input and output variables) and in population as a scale measure; depending on which was used, arguments could be made both for and against the presence of economies-of-scale in police protection.

Ostrom-Parks (1973) did not measure the direct effects of service levels on per capita expenditures in their national sample, but did show that there was no change in the size-expenditure relationship when service levels were held constant. They relied on citizen evaluations of, and confidence in, their local police as their measure of service quality. Findings from studies of two metropolitan areas were inconclusive; in Indianapolis, suburban departments were providing higher service levels than was the central city in similar neighborhoods, but were spending more per capita (Ostrom-Parks-Whitaker, 1973), while in Grand Rapids, estimated costs of service provision in central city neighborhoods were higher, and service levels lower, than those in the incorporated suburbs (IsHak, 1972).

Skogan (1976) measured output by total arrests within each of several crime categories; his index was positively correlated with per

capita police expenditures. Chapman-Sonenblum (1972) constructed an output measure that included the effects of both crime prevention and apprehension of criminals. Although they did not relate it directly to expenditures, they did suggest that police expenditures increased as a result of increases in crime.

In addition to developing indices of service levels from experts, from citizen evaluations, or from police activities, several studies have examined the effects of crime rates on the cost of police services. While these studies do not necessarily assume that crime rates are an inverse measure of police output, that argument has often been made.

Beaton (1974) found that an elevated crime rate increased per capita police expenditures, but that as the crime rate increased, its impact declined. Greenwood-Wadycki (1973) attempted to determine factors associated with rising crime rates, but also examined the impact of those rates on police spending. They hypothesized that crimes against both persons and property would be positively related to expenditures "since increased crime rates are likely to result in a decision by society to increase the resources it devotes to police protection" (Greenwood-Wadycki, 1973:144). Their hypothesis was confirmed as both crime rate variables had positive and significant impact on spending; crimes against property induced a larger spending increase than did crimes against persons.

Allison (1972) looked at the effect of police expenditures per capita on the crime rate, treating expenditures as the level of service, and found no correlation. He explained this finding through Baumol's model of unbalanced growth, in which expenditures and crime rates rise congruently and the marginal efficiency of police protection

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declines as a result of rising population (see Baumol, 1967).

McPheters-Stronge (1974) complained that most studies of police spending failed to consider the effects of crime rates on expenditures; they briefly reviewed several that had found positive relationships. While noting that theoretical analysis suggested police spending should have a deterrent (negative) effect on crime, their data also indicated a positive association. They argued that their findings, contrary to previous interpretations, showed that historically, law enforcement expenditures tended to respond to crime; positive associations thus reflected the "cleanup" effects of spending which followed in the wake of crime, rather than spending designed to prevent crime.

2.9 The Composition of Police Costs: Inputs and Price Levels

Odoni (1975), in his survey of expenditure and employment trends in large city police departments, reviewed the literature on police expenditures, turning up "surprisingly little material . . . none of (which) examines in any detail the composition of police costs" (Odoni, 1975:5-6). Hirsch noted that the long-run average unit cost of a given urban public service was affected by service quality, technology, and prices of factor inputs. The empirical analyses reviewed thus far have concentrated on quantity and occasionally on quality, while technology has been assumed constant. Very few studies of the determinants of municipal police expenditures have considered the effects of prices of factor inputs, or the potential effects of inflation. Hypothesis H_9 states that per capita expenditures for police services are positively associated with increases in input price levels.

Bradford-Malt-Oates (1969) observed that from 1902 to 1966, per

capita police protection expenditures rose at an average annual rate of 4.7 percent, while the wholesale price index rose an average of 1.9 percent annually. They questioned whether the spending increases resulted from rising unit costs or indicated a growing per capita service output. They concluded that "rising costs have probably been quantitatively the more important of the two sources of increasing spending" (Bradford-Malt-Oates, 1969:197). Recognizing the labor-intensive nature of police inputs, they examined aggregate employment data and found that the number of police personnel per capita had increased only slightly in recent years relative to the rise in prices. The authors doubted whether technological advances in the provision of police services had occurred at a rate equal to that of the spending increase, so that better service quality was not necessarily the result of higher unit costs. However, they included no analysis of the effects of federal funding, the major source of support for advances in police technology, nor did they attempt to control for levels of output. They found that the pressures of rising costs had a larger impact on large cities than on small ones; in general, technological advances had not allowed municipal governments to offset input price rises through utilization of fewer units. Bradford-Malt-Oates generally support Baumol's unbalanced growth model, in which less progressive public services -- such as police -- undergo inevitable price rises without corresponding technological advances.

Walzer (1971) asked the same question as Bradford-Malt-Oates: what proportion of increases in police spending has occurred because of expanded service levels and what proportion because of input price increases? Walzer attempted to develop a price index for police

inputs, a measure of the change in the price level resulting from price, not quality, changes. He weighted each police expenditure category by its percentage of the total police budget, then multiplied by price increases as measured by one of three indices: Consumer Price Index, Wholesale Price Index, or Implicit Gross National Product Deflator for State and Local Government purchases. The products were summed on an annual basis and divided by the value of the first year to obtain a cumulative percentage increase. His analysis showed that, of the three price indices, the GNP Deflator was most appropriate for estimating increases in police input prices. Walzer concluded that the price index for police inputs increased nearly eight times faster than the WPI and three times faster than the CPI. Wage and salary increases constributed the most; salaries increased greatly during the period studied, and nearly 90 percent of police expenditures were devoted to salaries and wages. Walzer demonstrated that policemen's wages increased about twice as much as those of production workers. His price index, however, did not account for possible increases in police efficiency.

Walzer (1972a,b) also examined police wages in multiple regression analyses and found small but significant positive association between average wage for recruits and police expenditures per capita. Greytak-Gustely-Dinkelmeyer (1974), while not dealing specifically with police expenditures, found that inflation accounted for 43 percent of the growth of total New York City government expenditures from 1956-1972, while 42 percent was attributable to increases in quantities of goods and services, and the remainder to cost growth. Bordua-Haurek (1971) estimated that 46 percent of the 1902-1960 increase in police expendi-

tures was attributable to inflation.

Greytak-Jump (1975) argued that standard price indexes are inadequate for estimating the impact of inflation on expenditures. Both CPI and WPI are heavily weighted by goods and services not purchased in large amounts by most local governments, and the GNP Deflator is highly aggregative; it includes not only prices of goods and services irrelevant to local government, but does not reflect inter-jurisdictional differences in purchases and treats all salary and wage increases exactly like other price increases. The authors created their own price index for each of six jurisdictions -- three cities and three counties.

Greytak-Jump (1975a) disaggregated expenditures into components attributable to inflation, increases in input quantity, and increases in real salaries and wages. They estimated the percent increase in expenditures attributable to each of these factors. Additionally, they argued that inflation has different effects according to functional expenditure categories, partly as a result of variation in demand, of variation in input composition, and of increases in unit prices of basic inputs. They reported the percentage of expenditures attributable to each of these factors for each of several functional categories in six jurisdictions.

The authors also developed a regression model to predict future spending, based on an input cost approach. Expenditure growth was analyzed in terms of changes in input prices and quantities. Inputs examined included wage and salary expenditures; employer contribution to retirement, social security, and fringe benefits; non-labor expenditures; transfer payments; capital expenditures; debt service;

and other expenditures. Components of each of these costs were disaggregated into shares attributable to changes in inflation, real salary and wage rates, and input quantity.

Another study that considers input factors associated with police agency organization is the Lewin-Keith (1976) model of police salary determination, which showed that city size was positively associated with both maximum and minimum salary levels. Lewin-Keith found presence of police unions and bargaining associations, contrary to expectations, inversely related to police salaries in three of four regressions, suggesting among other things that police employed in low-wage cities organize mainly to raise salary levels. Future determinants studies may find that police unionization at time t - n has the greatest impact of any factor on police spending at time t.

Chapman-Sonenblum (1972) also considered police agency inputs in their production function, including such variables as number of motorcycle, field, and non-field officers, and number of civilian employees, but they did not relate them directly to expenditures. Rather, inputs were related to a measure of police output based on crime prevention and arrest statistics. Odoni (1975) concluded that the three primary contributors to growth in police expenditures between 1959 and 1973 were increased police employment, price inflation, and real gains in salaries and wages -- all three input factors (although Odoni did not test the effects of demographic and socio-economic variables). On a percentage basis, real wage gains for police officers were twice those of non-government workers.

2.10 Summary of Empirical Literature

In general, the most significant determinants of police expenditures are generally considered to be economic and demographic factors reflecting levels of demand for services -- population, population density, population growth rate, personal and community income, and percentage non-white -- and factors reflecting the costs of police inputs -- inflation, price levels, and salary increases. Variations in economic, demographic, and sociological factors are generally considered more important than variations in political factors such as governmental form or the extent of metropolitan area fragmentation. Crime rates, quality of services, and police agency organization also appear to be positively related to police spending per capita, although research on these determinants has not been as prolific. Of course, all results are largely determined by scope and unit of analysis, statistical techniques, and time of measurement.

Limiting analysis to intrastate or intrametropolitan areas tends to increase the amount of explained variation, pointing out the importance of regional, historical, and legal influences on municipal spending. Unfortunately, effects of data limitations and methodological bias are difficult to separate from those of the independent variables themselves. It is also important to consider that factors most strongly influencing police spending, such as labor costs or city population, may not be important determinants of expenditures for other governmental services.

3. Conceptual and Methodological Limitations

This section summarizes some of the problems with analyses of police expenditure determinants. These problems lie in three general categories: lack of theory, logical inconsistencies, and methodological errors.

3.1 Lack of Theory

It has become de rigeur to accuse most empirical studies of public service provision of being theoretically deficient, but determinants studies are surely among the most deserving of this charge. Hirsch (1968:500) observed that most expenditure studies have serious shortcomings, "the single most important one being the absence of a rigorous, logical, underlying theory." Meltsner-Wildavsky (1970) charged that these studies lack theoretical statement and that "There are few attempts to explain the general significance of the statistical manipulations . . . this work exhibits a mindless empiricism with relations established not on grounds of explanatory relevance but simply by the availability of census data." Determinants studies are more concerned with attaining methodological sophistication than with conceptual development, so much so that most do not even append a theoretical framework, let alone rely on it for guidance.

Determinants studies face no shortage of testable hypotheses; what is lacking is the development of an a priori basis through which to link them and to identify and operationalize variables useful in empirical analysis. One seemingly obvious approach would be to identify variables as either cost or demand factors. But as Bahl (1969a)

and Burkhead-Miner (1971) have noted, it is seemingly impossible to clearly separate demand from supply factors in an examination of public expenditures.

One reason is that no conclusive findings are available regarding the true nature of cost functions of urban public services. Dajani (1973) attributed the lack of a general conceptual framework for examining public expenditures to several factors, including:

- development of statistical correlations based on the use of the aggregate cost of a variety of services having different cost functions as the dependent variable;
- inability to account for service quality, economic mix, or local traditions;
- emphasis on the development of models for estimating actual service production costs to the neglect of both private and social costs;
- lack of distinction between operating and capital costs; and
- emphasis on estimating total costs in terms of either population size or density (Dajani, 1973:480-481).

With determinants studies suffering from an inability to separate demand from supply, and from a lack of an underlying theoretical structure, they are open to the criticism that their attempts to account for intercity spending variation are simply aimless efforts to randomly interrelate large numbers of variables; those explaining the highest proportion of variation become "determinants." The search for explanatory variables is often casual, the direction of influence between independent and dependent variables uncertain. A prime example emerged in the discussion of H_8, where expenditure levels both determined, and were determined by, crime rates, sometimes within the same study. In the absence of theory, scholars have developed "models" of urban police expenditures that are presented as if based on the

analytic techniques of traditional economic theory, but that actually model little more than is allowed by available, easily quantifiable, data.

Both Bahl (1969b) and Wilensky (1970) have suggested that "determinants analysis reflects in part an attempt to construct a positive theory of public expenditures, i.e., to explain the allocation of resources between the public and the private sector and the allocation of resources among public functions" (Bahl, 1969:201). A positive theory of public expenditures is one that "explains why expenditures are as they are rather than what they should be" (Wilensky, 1970:215). It tries to explain actual spending levels through identification of major spending determinants and their direction and size of effect. But to do this, it must first be able to distinguish among independent and dependent variables. The indiscriminate use of multiple regression analysis has not helped this effort. Minus theoretical guidance, and minus the immediate likelihood of receiving it, scholars interested in explaining public expenditure levels must remember that determinants studies are simply studies of factors associated with public spending, rather than analyses of demand for, or supply of, public goods and services.

3.2 Logical Inconsistencies

3.2.1 Circular Reasoning

Determinants studies have been accused of circular reasoning. Two examples have been discussed -- the reciprocal association between crime rates and police spending, and the use of revenue variables,

such as amount of federal aid, to explain expenditures. Bahl, who identified several other examples, also argued that "The conclusion that revenues are a significant determinant of expenditures is of little use in constructing a theory of public spending" (Bahl, 1969b: 188). Technically, his argument is incorrect. Observed expenditure levels are always the result of both supply and demand factors, and revenues and income are legitimate components of demand functions. There is nothing inherently wrong with mixing proxy measures for supply and demand factors in a single equation examining expenditure determinants; problems arise because of the difficulty in specifying which factors represent demand and which represent supply. (For a careful example including both supply and demand variables in a single equation, see Ahlbrandt, 1972; for a careful analysis of the demand for public goods and services, see Borcherding-Deacon, 1972). Economic theory, contrary to Bahl, does imply that revenue and income variables may be a part of demand.

Ohls-Wales (1972) attempt to distinguish between demand and supply variables for determinants studies. They consider the effects of economic-demographic variables on the market, and contend that few significantly affect demand for public services; variables such as population density affect spending through the cost side of the market. That density is positively related to police spending does not imply that residents desire lower crime rates, but rather, that density increases the cost of given levels of police protection (Ohls-Wales, 1972:424-425).

Bahl also criticized the logic underlying inclusion of input costs as explanatory variables. Inputs have rarely been considered (Greytak-

Jump, 1975a,b, and Odoni, 1975 are notable exceptions); examples are the number of officers, average entry-level salary, total miles driven by patrol cars, and employers' contribution to pensions and fringe benefits. Their inclusion as expenditure determinants represents a conceptual error only if they are used to explain unstandardized spending levels. There is no guarantee that entry-level salary is strongly correlated with either per capita expenditures or output levels. Cost factors have been ignored too long. If the goal of analysis is to be able to predict spending levels from given levels of independent variables, i.e., to assist policy-makers, then agency organizational variables (input factors) are of paramount importance.

3.2.2 Measurement of Service Levels: Equation of Cost with Quality

Many determinants studies accept expenditures as measures of both service quality and service cost. Do higher police expenditures per capita reflect greater public preferences for law and order, a higher level of police protection, the magnitude of the crime rate, or corruption, graft, or inefficiency? Confining analysis to the determinants of public expenditures for police services reveals nothing about the quality of services provided; until adequate quality measures can be devised and related to expenditures, supply and demand factors are likely to remain inseparable.

Some studies have attempted to relate expenditures to quality of police service, and were discussed in the section on H_8. Most, however, assume that expenditure levels are surrogates for quality, that there are no quality differences among municipalities, or that the independent variables account for both cost and quality differentials, and only

attempt to explain per capita expenditure variation. The problem with these approaches is a lack of recognition that the variance in per capita expenditures is due both to determinants of cost and determinants of quality. Determinants studies are demand-oriented, but expenditures are determined jointly by demand and supply (cost). Few studies have considered the effects of cost factors, such as price levels and wage rates, on per capita police spending (see Hirsch, 1968, for a discussion of the difficulties in specifying these factors).

Most determinants studies dealing in any way with levels of output have adopted the second approach, looking at the effects of police service quantity on per capita expenditures. Schmandt-Stephens (1960) is a good example. Their service index, the number of activities performed by each department, had a slight positive association with per capita spending, but it reflected departmental size and nominal scope of services, not service quality. It was beset by intercorrelations with other independent variables. A more useful approach to considering service quality appeared in Ostrom-Parks (1973), where quality (as measured by citizen evaluation) was held constant as the relationship between city size and per capita expenditures was examined.

3.2.3 Economies-of-Scale

Problems concerning economies-of-scale were discussed in detail in the section on H_1. Basically, the issue involves the failure to specify the underlying police production function, which encompasses the concept of unit costs. Economies-of-scale occur when increased production of a good or service results in reduced per-unit cost of output. Determinants studies have assumed that if a significant

negative relationship is found between police per capita expenditures and city population size, economies-of-scale may be present. The logic of this argument is that "as population increases, output must be increasing and if this increase is associated with a reduction in 'cost' (i.e., per capita expenditures), there is evidence of economies-of-scale" (Wilensky, 1970:211).

There are at least three major fallacies in this argument. First, as we have just seen, expenditure variation reflects variation in both cost and quality; per capita expenditures are not a good proxy for unit costs. Second, city population is equated with output, since service quality measures are rarely introduced, and population is clearly not an adequate output proxy; it may be positively associated with both demand and cost of services. The result is that neither proxy produces any useful information about economies-of-scale, or about the police production function. Third, according to Bahl (1969: 190), it does not necessarily follow that as population increases for any given municipality, it will be accompanied by a per capita cost decline. If demand for police services is elastic, decreased cost per unit of output might result in increased per capita expenditures; even if scale economies were present, expenditures might not decline (Wilensky, 1970:212). To make any claims concerning economies-of-scale for police protection, it is necessary to know both input and output costs. First, however, appropriate output measures for police must be developed (see Ostrom, 1973, for a discussion of this problem).

3.3 Methodological Weaknesses

3.3.1 Intercorrelation Among Independent Variables

Multiple regression analysis requires that the independent variables be truly independent, that is, uncorrelated with each other. Unfortunately, many police expenditure determinants have severe multicolinearity problems that greatly decrease their explanatory value. Large intercorrelations increase the standard errors of the estimated coefficients and may lead to inferences that only variables with significant coefficients are important. Yet a coefficient may be insignificant not only because it contributes little to explained variation, but because it is strongly associated with another independent variable. Thus, two highly intercorrelated determinants could explain equal amounts of variation, but only one would appear significant.

To avoid multicolinearity, some authors have relied on a single variable as a proxy for one or two closely related measures. Others have relied on principal components or factor analysis to create broad variables which are combinations of several factors. Neither strategy is very useful if the goal is to assess the effects of a specific variable. It is imperative that a correlation matrix be generated prior to formulating regression equations to identify potential multicolinearity; tests for homeoscedasticity should also be applied.

3.3.2 Estimation of a Single Equation

Beaton (1974) has argued that a major limitation of determinants studies is their estimation of only a single regression equation. He believes that single equation least squares techniques are likely to

produce incorrect results, and that different equations are necessary for analyzing expenditures of cities within different size ranges to accurately control for the systematic interaction of size with spending per capita. Beaton's argument is that a single equation incorrectly assumes that the set of cities under consideration belongs to a single population. Formulating separate equations by city size, he finds considerable inter-city variation in expenditure determinants. Data obtained from cities within a wide population range produce heteroscedastic residuals, i.e., the distribution of the residuals does not have a constant variance, and produces biased coefficients. Beaton's technique is promising, although it is not clear how much of the differences in his findings are the result of his methodology and how much the result of his inclusion of a large number of small municipalities.

3.3.3 Lack of Time Series Data

Lack of time series analysis is a frequent criticism of public policy analysis. For those interested in the aggregate pattern of police expenditures at a single point, cross-sectional data are certainly appropriate. For those interested in examining variations in expenditures over time, cross-sectional data are inappropriate. Determinants studies often assume too much in claiming that differences in expenditures among municipalities at one point in time can be explained by changes in population from one time to another. They may also incorrectly assume that what is true for different communities at a particular point is also true for a single community over time.

Some determinants studies have used time series data. Smith-

Fibiger (1972) argued that the Aitken estimator for a system of unrelated regressions could integrate both time series and cross-sectional information, thereby capturing the dynamic aspects of expenditure decisions. Their technique produced mixed results; it reduced the amount of intercorrelation among the residuals (which they claimed was a common fault of static analyses) but also introduced new problems of interpretation. Brown (1967) investigated the effect of annexation on Houston expenditures from 1947-1962 and found a .91 correlation between time and per capita expenditures (.74 with prices deflated). Rakoff (1972) found similar results for a sample of 279 cities from 1946-1969. Using factor analysis, he discovered that the effects of economic, demographic, and political factors on public spending were overstated, that spending decisions were simple linear functions of time, i.e., previous spending levels.

These results are not particularly illuminating, and certainly not surprising. It is important to remember that cross-sectional analysis is not designed to answer the same questions as is time series analysis. The former assesses the degree to which differences in expenditures per capita among municipalities are associated with differences in various independent variables at any one point in time. The latter measures the trends in spending for an individual community or communities and describes the fluctuations about that trend. Time series reveals little about structure at any given time, while cross-sectional analysis reveals little about temporal covariability between per capita expenditures and socio-economic factors (Bahl, 1969b:185). The time series analyses that have been conducted have not contributed much information about the determinants of expenditures. Additionally,

there are statistical problems which make inferences from time series data less reliable than those from cross-sectional data (Hirsch, 1959:236). Over time, explanatory variables are highly intercorrelated. Also, inflationary price changes must be controlled. Expenditure analysts must keep these problems in mind, and must carefully consider the nature of their data before rejecting cross-sectional analysis.

3.3.4 Non-Comparability of Data

Determinants studies often suffer from serious problems of non-comparability of data across municipalities; there is often no common base for expenditures. Explanation of spending differences among cities is possible only if the data accurately reflect actual spending differentials. Data may be inaccurate because of variation in functional responsibilities, differences in accounting procedures, and vagaries of reporting methods across municipalities. National studies using Census Bureau financial data are especially susceptible to these problems, which may be less serious in analyses of police expenditures than in those of other government services; the number of functional expenditure categories for police is often relatively small compared to those for sanitation or public health, for example. Additionally, functional responsibilities among police departments of equal size are often similar. State laws, metropolitan-wide convention, and municipal policies all affect the functional arraying of expenditure data. Interstate comparisons of expenditure data may also be perilous because of differences in relative price levels.

The problem of geographic heterogeneity of public expenditure functions is carefully analyzed by Scanlon-Strauss (1972). They

conclude that pooled data from a wide geographic area "is untenable, for regression across state boundaries implicitly assumes either identical state tax institutions or relatively homogeneous institutions and homogeneous needs and preferences of each resident population" (Scanlon-Strauss, 1972:191). They argue that prediction of future expenditure levels would be substantially improved by accounting for geographic heterogeneity, and that omission of geographic considerations will lead to major specification error.

Aggregation across government functions, like geographic data aggregation, is also a problem in many determinants analyses. Numerous studies have shown that explained variation increases when per capita expenditures for individual functions, rather than for total general government, are examined (see Brazer, 1959, and Bahl, 1969a, among many others). A brief but useful review of various strategies for dealing with problems of functional aggregation appears in Liebert (1974). He notes several approaches which have considered combinations of functional expenditures as the dependent variable; each one sought to control for the aggregation problem, but failed to consider effects of variation in functional scope on total expenditures. Liebert suggests that even though police protection among cities is more similar in scope than is any other service, it still cannot sustain the test of universality because of the existence of state and regional crime laboratories, investigative units, and training academies.

Meltsner-Wildavsky (1970:313) support Liebert's contention, arguing that:

> The explanatory power of the independent variables changes with the unit of analysis and with the particular category of expenditures. The same set of independent variables is sometimes statistically useful and sometimes not when the

> analysis is conducted individually for states, cities, metropolitan areas, and towns or for fire, police, education, sanitation, and street expenditures . . . Once the analysis focuses on smaller units of government and on particular functions, a variety of variables can be introduced which improve the 'fit' between expenditures and their particular determinants but which lose generality.

3.3.5 Limitations on City Size

Of the 42 studies listed in Figure 1 that examined expenditures across municipalities, 69 percent established a minimum city population size for inclusion in the analysis. Most research on the determinants of police expenditures has thus been conducted on the largest cities; in fact, most of it has been conducted on central cities of metropolitan areas. One reason for this large-city bias is likely that more complete and easily-obtainable data exist for cities above 50,000 population.

The effect of this bias on findings of determinants studies is unknown. Masten-Quindry (1970:79) argued that expenditure determinants "can be most meaningfully assessed only for areas of relative homogeneous population sizes," attributing the wide deviation in findings across studies to a lack of data dealing with smaller cities and villages. Beaton's (1974) analysis of the effects of population size suggests that determinants of smaller city expenditures are quite different from those of larger ones. He discovered that the larger the city, the less the political participation by the most politically active sub-group, and the less responsive the budgetary process to the activities of this sub-group (composed mostly of persons from upper income and educational strata). Thus, political participation and the interaction of social class determinants "suggest that city size

can be viewed as placing distinctive structural conditions upon the set of expenditure determinants which cause a variation in the magnitude of their respective impacts upon per capita expenditures" (Beaton, 1974:337).

The widely-accepted notion of a dichotomy between the central cities and suburbs may bias the findings of determinants studies, since there may be more variation among suburbs of greatly differing sizes than between the central city and any particular suburb. To reach accurate conclusions about metropolitan area police expenditure patterns, inclusion of small municipalities that provide police services is essential.

3.3.6 Exclusion of Capital Outlays from Operating Expenditures

There has been widespread debate in the literature concerning the applicability of capital outlays to determinants analysis. Normal procedure has been either to eliminate capital costs completely and examine determinants of operating expenditures only, or to compute separate regressions for each. The problem with including capital expenditures is that they are not spread smoothly from year to year. Investments may remain in service for years after initial payment, creating occasional "lumps" in yearly spending figures. Most authors suggest that smaller municipalities are characterized by non-recurring capital expenditures to a much greater degree than are larger ones (Hansen, 1965; Wilensky, 1970).

There have been several approaches to handling capital costs. Hansen (1965) argued that although many early studies (Hirsch, 1959; Scott-Feder, 1957; Shapiro, 1963) combined current operating expendi-

tures and capital outlays, making no attempt to amortize costs over the "useful life" of the investment, the forces influencing the two were quite different. Hansen also claimed that it was impossible to study capital costs in smaller communities because they did not have enough available revenue to permit a continuous capital outflow.

Scott-Feder (1957) and Groves-Riew (1964) both included capital costs in their expenditure totals. The former concluded, however, that such costs were not smoothed out even when three-year spending averages were employed; they suggested that other studies exclude capital costs if possible. Groves-Riew used a five-year average of capital outlays to control for irregularities.

Some authors have included capital costs. Bollens (1961) argued for their inclusion since a substantial portion of police capital investments (mostly vehicles) was replaced on an annual or biennial basis. Schmandt-Stephens (1963) found that a large number of cases minimized the yearly variance. For county expenditures, capital costs exhibited the same general tendencies as operating expenditures. In a recent study, Clark et al. (1976) found that capital outlays played a crucial role in the New York fiscal crisis. Not only did they operate in isolation, but they were strongly predictive of fiscal strain.

Other authors suggest that while capital outlays should be excluded from analysis of expenditures of some government services, they should be included in studies of police because they represent such a small portion of total budgets (Bradford-Malt-Oates, 1969; Gabler, 1971; Odoni, 1975). Despite the increasing use of sophisticated capital equipment in the provision of police services, the major

portion of spending is for manpower. A recent study revealed that labor expenses represent, on the average, at least 90 percent of major city police department budgets; that percentage has remained stable over time, even in the face of expensive new capital equipment (Odoni, 1975).

Wilensky (1970:206-207) notes two assumptions necessary to justify exclusion of capital outlays. First, the ratio of capital to operating expenditures must be the same regardless of the scale of output. Second, for any given amount of output, capital and operating expenditures must be non-substitutable. There is little evidence regarding the first assumption, but those who favor installation of computer data banks and area-wide communications systems would probably argue that the second is unreasonable for certain police tasks. If substitution is possible -- and it appears that it is for some functions -- then exclusion of capital outlays will distort the relative importance of spending determinants.

3.3.7 Pensions, Fringe Benefits, and Unionization

Few determinants studies consider the effects of fringe benefits and pension plans on police agency expenditures. Overtime pay, workmen's compensation, health insurance, and retirement packages are difficult to catalogue in any systematic manner, and vary greatly among cities. Odoni (1975) and Greytak-Jump (1975b) present good overviews of the problems engendered by attempts to include these figures within total expenditures. Odoni (1975:33) notes the "meagerness and lack of organization" of data on fringe benefits, attributing it to the large number of items which must be considered for each city, and

the variation in detail.

Greytak-Jump (1975b:II-24) contend that fringe benefits compromise a large proportion of police expenditures, and "may be largely uncontrollable once the benefit has been adopted as an element of employee compensation, at least in the sense that benefit costs cannot be held in check independent of sharp reductions in the number of employees on the payroll." The principal components of fringe benefits are usually retirement, social security, and health insurance payments; they typically comprise from 10 to 40 percent of an employee's salary (Greytak-Jump, 1975). Since pensions and social security costs are directly related to annual salaries -- through employers' contributions which are computed as a specified percentage of salaries -- annual salary increases bear directly on future benefit expenditures. Benefit costs are also sensitive to changes in employment and inflation, as well as to increases in salaries.

Greytak-Jump (1975b:II-25-26) explain one of the most vexing problems in computation of pension costs:

> The computation of true pension costs is a complex and sometimes controversial procedure. The essence of the difficulty is that though employees earn retirement benefits gradually throughout their working careers, the benefits are not paid until employees retire or otherwise become eligible to being receiving payment. Thus, it is possible for an employer to avoid any significant expenditure for retirement benefits during the years immediately following introduction of a retirement plan and during which time few employees are eligible to retire. Obviously, however, retirement obligations build from the moment a plan is initiated, whether or not an employer reflects them in the budget and sets aside funds systematically throughout the period when an employee is on the payroll . . . the central problem in pension funding is the true costs of an employee's retirement benefits cannot be known with certainty until all costs have been paid (i.e., the employee ceases to collect benefit payments . . .). So, the annual contribution that an employer should make each year to the accumulating fund must be estimated actuarially on the basis of assumptions about future rates of salary increases, age at retirement, number of employees who resign before

> becoming eligible to collect benefits, the interest rate to be earned by investing the accumulated funds, and the like . . . But, two of the key assumptions required for estimating retirement costs, the future rate of salary increase and the rate of interest to be earned, are open to debate since what has happened in the past is not necessarily a good indicator of what will happen in the future . . . The computation of appropriate retirement contributions is a process requiring considerable judgement. Some of the necessary assumptions, though decidedly arbitrary, can have major implications for the annual expenditure of a municipality.

Yet fringe benefit expenditures are of such importance that attempts at estimation are essential, even if estimation techniques are based on debatable assumptions. "The cost to cities of fringe benefit packages and other personnel-related outlays seems to have grown, between 1959 and 1973, by percentages which are, at the least, comparable with (and, most likely, higher than) the corresponding percentages for the growth in the total cost of basic salaries and wages" (Odoni, 1975:55). Thirty-eight percent was Odoni's best estimate of the growth of the cost of non-salary personnel expenditures. Beaton (1974) included per capita municipal share of payments for pensions, fringe benefits, and social security as independent variables in his regression analysis; they were positively associated with per capita expenditures in all cases, although their impact declined as city size increased.

Another variable omitted from most determinants studies is police unionization. Lewin-Keith (1976) was the only study examined which related the presence of collective bargaining associations to police spending, reporting a negative relationship (with maximum and minimum salary levels the dependent variables). The authors posited several possible interpretations of their findings:

- unions may be more concerned with non-pecuniary benefits than with salaries;
- wage settlements may be retroactive to the start of the contract;

- the data do not reflect presence of written (as opposed to informal) labor contracts;
- unionization may lead to an increase in labor supply and a decrease in salaries; or
- police employed in low-wage cities may organize for purposing of raising salaries, but have not yet been successful in negotiating new contracts (Lewin-Keith, 1976:9-10).

Whatever the reason for the negative findings, there is little doubt that unionization will have an increasing impact on municipal spending for police protection; incidence of employee organization among police departments is widespread and increasing (Lewin-Keith, 1976). Longitudinal analysis of recent spending trends may be required to reveal this impact.

4. Suggested Improvements

Studies of police expenditures determinants are obviously beset with problems in conception, execution, interpretation, and applicability to policy analysis. Some state the obvious and proceed to demonstrate that it is true; others formulate hypotheses, reject them empirically, then conclude that data were insufficient or methodology inappropriate. Some claim to assist policy-makers, then assume so much about data and methodology that their equations are virtually useless in predicting future expenditures. Many consider spending as the end product of public policy, yet few assess its impact. The list of problems with these studies is as long as the list of determinants themselves.

Yet determinants analysis is not totally without merit. It has identified factors associated with intergovernmental differences in levels of municipal police spending. It has developed equations pre-

dicting levels of future expenditures, given specific values of economic and demographic variables, which are useful for speculation if not accurate for prediction. It has improved understanding of the effects of certain factors on intergovernmental spending. To yield more meaningful results, however, refinements are required. They are not easily accomplished in the face of the litany of limitations recited in the previous section.

First, and perhaps most obvious, is the need to develop measures of police output and quality. Considerable effort has already been made in this regard (see Ostrom, 1973 for references), but more is needed if separation of supply and demand factors is to occur. Second, developing a "positive theory" of public expenditures requires estimating structural relationships through the derivation of police production and cost functions. Attempts have been made (Hirsch, 1959, 1968; Chapman-Sonenblum, 1972; Sonenblum-Hirsch-Marcus, 1971) but have suffered from a lack of reliable measures of service quality and quantity. Supply prices, effects of price changes, and capital outlays should be included in analyses of expenditures, even if cost and production functions are unattainable.

A third improvement would be the abandonment of the macro approach to statistical analysis and the adoption of an intensive case study approach. This entails focusing not on national samples but on samples of specific states or metropolitan areas. By so doing, the problem of differing state and municipal laws regarding functional responsibility and accounting procedures is minimized (Brazer, 1959; Walzer, 1972b; Beaton, 1974). And it implies inclusion of all municipal police agencies, regardless of size. Bahl (1969b:202) lists four advantages

to this approach: service quality variation within metropolitan areas is smaller and perhaps more measurable, problems of externalities may be more closely examined, more accurate and detailed data can be collected for longer periods of time from local sources, and data problems created by varying intergovernmental fiscal arrangements can be reduced. Even if the first two points are questionable, operationally the last two are more important. In-depth analysis requires access to data not normally collected on a large scale; cost of collection may be prohibitive for multi-state studies. While the case study approach reduces the generalizability of the findings, it increases their accuracy; inclusion of smaller municipalities also helps overcome problems of sample size.

If concentrating on a single state or metropolitan area can decrease statistical noise and increase explained spending variation, concentration on a single public service can remove even more extraneous factors. More detailed data can be collected on elements often ignored in expenditure analyses, such as fringe benefits and pensions. Data from a single service should be more amenable to time series analysis; any "lumps" can be more easily accounted for. In fact, if data are available, further disaggregating services into subfunctions is even more desirable, assuming comparability of functions across agencies. For example, expenditures for police patrolling may be affected by factors significantly different from those influencing expenditures for criminal investigation.

Fifth, given the methodological problems specified in the previous section, it is essential that the statistical techniques chosen fit not only the data at hand but the purpose of the analysis. Multiple

regression can be a very useful technique if properly applied. A check for multicolinearity of independent variables is imperitive; intercorrelations among residuals should also be examined. With a wide city population range, single equation models may be inappropriate; the possibility that several equations will improve the explained variance is worth examining.

Sixth, and finally, expenditure studies must improve their utility for policy-makers. The analysis of aggregate data which has characterized the macro approach to determinants analysis may lead to conclusions that are so general as to be virtually useless to municipal policy-makers. It is unlikely that many predictions of future police spending levels have been developed from knowledge of the relationship between per capita police expenditures and the percent of occupied housing units with food freezers (Masotti-Bowen, 1965), or from knowing the relationship between expenditures and almost any aggregated variable.

The greatest oversight of the determinant studies has been their lack of interest in the effect of agency structure on per capita spending. Policy-makers faced with estimating future budgets are much more likely to want to know such factors as number of currently employed police officers, whether they are unionized, their salary scale and method of overtime compensation, and departmental policies on the use of one or two-person patrol vehicles, than they are the ratio of the population of the central city of their SMSA to that of the total SMSA. Economic and demographic variables are certainly important, but only when considered along with the basic budgetary constraints imposed by agency organization and structure.

Agency organization's effect on expenditure levels involves more

than simply defining input factors and prices; it establishes the boundaries within which spending levels are formulated. Most studies of public expenditures have not had access to such information, relying instead on census data. The ideal situation is thus one in which both economic-demographic factors and agency organizational variables can be applied to an analysis of the determinants of police expenditures across cities of varying size within a single state.

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