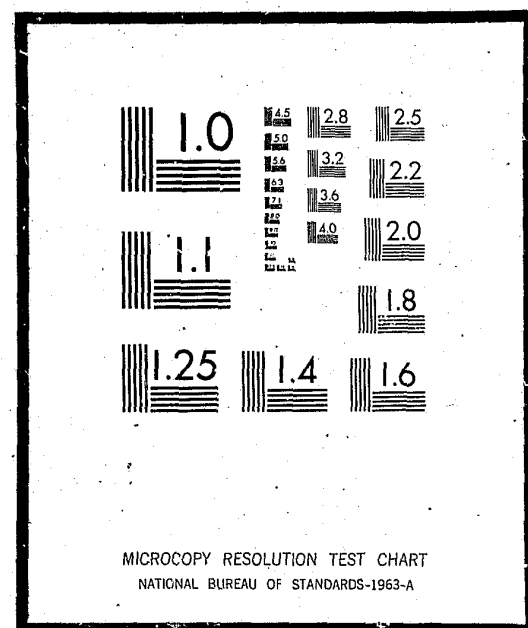


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## DEFINING AND MEASURING STRUCTURAL VARIATIONS IN INTERORGANIZATIONAL ARRANGEMENTS

by

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Introduction

Fragmentation of police services is extreme: there are 32,000 separate police departments. . . . Wasted energies and lost motion due to overlapping, duplication, and noncooperation are not the worst consequences of this fragmentation. Large areas of the United States--particularly rural communities and the small jurisdictions in or near metropolitan areas--lack anything resembling modern, professional police protection.<sup>1</sup>

Fragmentation, multiplicity, and duplication are terms which are frequently utilized in a perjorative sense to describe the relationships among local governmental units in metropolitan areas. Fragmentation, multiplicity, and duplication are repeatedly cited as causes for many of the ills facing police forces in such areas.<sup>2</sup> The presumptive knowledge accepted by many is that the presence of a large number of small police agencies within a metropolitan area results in inefficient performance and harmful consequences. Many recommendations have been made to decrease the number of police departments operating in a metropolitan area and to eliminate all small departments, where "small" can range from "less than 10" to "less than 50" sworn officers.<sup>3</sup>

However, for all the use of the terms "fragmentation," "multiplicity," and "duplication," they have rarely been defined with care. How many units need there be for "multiplicity" to exist? If multiplicity results in inefficiency (as is often charged) does this mean

that all federal systems must, by definition, be inefficient? What does it mean to say that units of government duplicate each other? Is such duplication harmful? If careful empirical research is to be conducted at a metropolitan level of analysis, utilizing the operating units of government providing services within metropolitan areas as the analytic units, then many of these terms will need to be defined and operationalized carefully.

Research at the metropolitan level which employs such defined and operationalized terms can also be important from a public policy perspective. Many reform proposals are initiated on the basis of an assumed positive relationship between the fragmentation of governmental units in a metropolitan area and increased costs or lowered output. However, little empirical research has been conducted which has specifically examined propositions associated with these reform proposals. In research efforts which have examined propositions derived from the traditional metropolitan reform literature much of the evidence produced has not supported propositions which are presumed to be true.<sup>4</sup>

In undertaking an NSF (RANN) sponsored study "Evaluating the Organization of Service Delivery: Police," we are attempting to examine the relevant effects of the structure of interorganizational arrangements among police agencies serving a common metropolitan area. In designing this research, we have found it necessary to define such terms as fragmentation, multiplicity, and duplication and to develop empirical operationalizations for them.

In this article we shall first describe our general approach to the problem of conceptualizing interorganizational arrangements among police agencies in a metropolitan area. This approach is based on the

concept of a public service industry.<sup>5</sup> Secondly, we shall describe the use of service structure matrices to delineate the service by service configurations of a police industry. Third, we shall illustrate the use of service structure matrices to describe the interorganizational arrangements among police agencies within a single metropolitan area. Fourth, we shall define six measures of metropolitan structure to be derived from service structure matrices. These measures are Fragmentation, Multiplicity, Duplication, Independence, Coordination, and Dominance. The use of such measures enables comparisons to be made across metropolitan areas. The fifth section of this paper will then utilize these measures to compare the structure of the police industries in three metropolitan areas with respect to four types of police services. The last section will focus on the use of structural measures in public policy analysis.

#### Police Agencies Viewed as Firms in Public Service Industries

Instead of thinking of each police agency in a metropolitan area as a department or bureau within a general governmental structure, we prefer to conceptualize the various police agencies as producers in a public service industry serving the metropolitan area. We start, that is, by considering each agency in terms of what it does rather than in terms of its relationship to some governmental unit. Our initial step is to identify those agencies which provide police services. The agencies may be public or private.

One of the problems in developing the conceptual underpinnings for research of this nature is how to limit the subject at hand. There is

no intrinsic feature of an agency that in and of itself places it definitely in one public industry rather than another. A police department, for example, may be considered in the health industry if it provides ambulance service, in the fire prevention industry if it inspects buildings and in the recreation industry if it sponsors a softball league. Like all taxonomies our limits and boundaries necessarily have elements of arbitrariness. If consistent limits are established, however, structural comparisons across metropolitan areas can be made and the effects of structural variations assessed.

Since we are interested in answering questions about the effects of different ways of organizing police agencies in metropolitan areas, we consider a metropolitan police industry to consist of those agencies--public or private--which provide a specific set of services. These will include direct services to citizen-consumers in the metropolitan area and intermediate police services to agencies providing direct police services. There are a number of activities undertaken by police agencies which could be classified as direct police services. We will restrict our focus, however. We will include any direct service agency within the bounds of our analysis if that agency supplies one or more of the following services: patrol, criminal investigation or traffic control--and if its officers can exercise the power of arrest in rendering that service.<sup>6</sup> Similarly, there are a great many intermediate services required by police agencies which produce these three types of direct services. We will, however, limit the intermediate police services examined in this study to the following services: basic training, detention, dispatching and criminal laboratory facilities.<sup>7</sup> The

configuration of the police industry thus may differ from service to service. In one SMSA there may be many producers of patrol and only one producer of criminal investigation services. In another metropolitan area the situation could be reversed. This way of conceptualizing the industry allows us to examine these service by service patterns.<sup>8</sup>

The Use of Service Structure Matrices for Representing Interorganizational Arrangements in a Metropolitan Area

Having bounded the scope of what will be called a police industry within a metropolitan area by defining direct and indirect police services, we can then delineate the service by service configuration of a police industry by developing service structure matrices for each metropolitan area.<sup>9</sup> All police agencies which produce a given service in its metropolitan area will be arranged as rows in the structural matrix for that service. For the direct services, columns in the matrix will be the organized consumption units within the metropolitan area. For the indirect services, the matrix columns are those producers of direct services which are now consumers of the indirect service in question. These will include agencies which receive intermediate services from internal units (e.g., a municipal police department with its own dispatcher) as well as agencies receiving the intermediate service from another agency (e.g., a municipal department which relies upon the county sheriff for detention service). The general form of the service structure matrix is shown in Table I.

Some police services are provided regularly to consumers. By regular provision we mean that the producer makes the service available

to individuals within the consumption unit on a routine basis. Other services are provided irregularly. By irregular provision, we mean that the producer makes this service available only in unusual circumstances. A distinction between regular and irregular service provision would arise in cases where the detective squad of a municipal police department investigates all reported crimes in the city, while the state police provide criminal investigation in that same city only upon rare occasions. The former is the regular producer while the latter is the irregular producer. While we will determine the presence of irregular producers, most of our attention will be devoted to regular producers of each service.

Several producers may simultaneously provide the same service on a regular basis to any one consuming unit. There are three types of regular, simultaneous production: alternation, coordination, and duplication. Service flows between producers and consumers will be shown by entries in the service structure matrix. They will be categorized as Irregular, Regular, Coordinated, or Alternative. (See Table II)

Alternation results when each agency serves a restricted clientele or geographic area or provides services only during restricted periods of time. Detention facilities are frequently provided by two agencies alternatively: i.e., one agency provides detention for juveniles and another for adults. The attributes of the clientele determine which agency will provide the service. Alternative geographic provision of traffic control occurs where a city police department exclusively patrols all streets within its jurisdiction with the exception of interstate highways where traffic is regulated by the state highway patrol. An alternative provision of service by time exists when a small town police department does all

Table I

## Service Structure Matrix for

Service k ( $1 \leq K \leq L$ )

		Consuming Units <sup>a</sup> ( $1 \leq K \leq M_k$ )			
		1	j	M <sub>k</sub>	
Population <sup>b</sup>			P <sub>j</sub>		P
Area <sup>b</sup>			a <sub>j</sub>		A
Producing Units ( $1 \leq i \leq N_k$ )	1				
	i		S <sub>ijk</sub>		SP <sub>ik</sub>
	N <sub>k</sub>		NP <sub>jk</sub>		

<sup>a</sup>For direct services the Consuming Units will be Organized Consumption Units, while for intermediate services the Consuming Units will be direct Producing Units.

<sup>b</sup>Applicable for direct services only.

Table II

## Definitions of Matrix Terminology

- N<sub>k</sub> -- Number of producing units for service k.
- M<sub>k</sub> -- Number of consuming units for service k.
- P<sub>j</sub> -- Population of consuming unit j ( $1 \leq j \leq M_k$ ) stated in ten thousands (i.e., 1970 population  $\times 10^{-4}$ ).
- a<sub>j</sub> -- Area of consuming unit j in square miles.
- P --  $\sum_j P_j$  - SMSA population in ten thousands.
- A --  $\sum_j a_j$  - SMSA area in square miles.
- S<sub>ijk</sub> -- Service Flow Indicator with the following possible values (see definitions of terms in the text):
- R = Producing unit i regularly provides service k to consuming unit j **without coordination or alternation**.
- I = Producing unit i irregularly provides service k to consuming unit j.
- C = Producing unit i regularly provides service k to consuming unit j in coordination with some other producing unit for service k.
- A = Producing unit i regularly provides a portion of service k to consuming unit j, that is, unit i is an alternate provider (in terms of either time, space, or clientele) of service k to consuming unit j.
- O = A zero or a blank indicated that producing unit i is definitely not involved (even irregularly) in providing service k to consuming unit j.
- SP<sub>ik</sub> - Serviced population for producing unit i and service k. This is the sum of p<sub>j</sub> over row i for columns where s<sub>ijk</sub> is equal to R, C, or A.
- NP<sub>jk</sub> - Service density for consuming unit j for service k. This is simply a count of entries in column j, which are either R, C, or A, that is, the number of producers who regularly provide service k to unit j in some fashion.

dispatching for itself during the day while relying on the county sheriff for dispatching at night. Alternative producers will be indicated on the service structure matrix by entering A's in the consuming unit column at each alternative producer's row.

Coordinated production occurs when two or more regular producers interact in the planning of the day to day operation of service provision for the same consuming unit. Coordinated patrol, for example, exists when several police departments jointly provide organized surveillance within the boundaries of a single consumption unit through the use of a common communications network. Criminal laboratory facilities are used in a coordinated way when their activities are pooled in supporting a single criminal investigation. On the matrix, C's will be entered for each of the producers which coordinate service to a consuming unit.

Duplication occurs when two or more regular producers provide the same service at the same time, in the same places to the same people without joint consideration of the activities. Two producers of patrol services are duplicative when they serve the same consumption unit without consultation on patrol practices and day to day maintenance of radio contact. Two producers of adult detention are duplicative when they independently provide jail facilities to the same police department for the same clientele. Duplication will be shown on the matrix by the entry of two or more R's (for regular producer in a consuming unit column).

#### Service Structure Matrices for a Metropolitan Area

To illustrate the use of service structure matrices, we will

construct police service matrices for the Fayetteville, North Carolina Standard Metropolitan Statistical Area (SMSA). The Fayetteville SMSA encompasses 654 square miles and had a 1970 population of 212,000. The area has eight organized consumption units for direct police services. Cumberland County is the largest of these. In addition to the city of Fayetteville (population 54,000), there are three small towns within the SMSA (each with fewer than 4,000 inhabitants.) The U.S. Army's Fort Bragg and Pope Air Force Base are also organized consumption units. These two installations together have a population equal to that of Fayetteville. They have tended to dominate the entire metropolitan area although industrial expansion has recently been quite extensive in the southern end of Cumberland County. The remaining consumption unit is the Fayetteville State University campus in Fayetteville. For those services which it receives independently, it constitutes an enclave in the city. The resident population on campus is under 1000. Half of the total SMSA population lives outside the seven smaller consumption units in unincorporated areas of Cumberland County. The map in Figure I shows the geographic arrangement of the organized consumption units.

In this section, we will present the service structure matrices for four police services as they are organized in the Fayetteville SMSA. Table III depicts the arrangements for patrol. Each of the eight organized consumption units for police service has a distinct legal arrangement with a regular producer of patrol services. The entries in the main diagonal reflect these relationships. Military Police from Ft. Bragg also provide patrol services in areas of Fayetteville frequented by military personnel. Because they have a restricted clientele, they have been classified as alternative producers of patrol services in

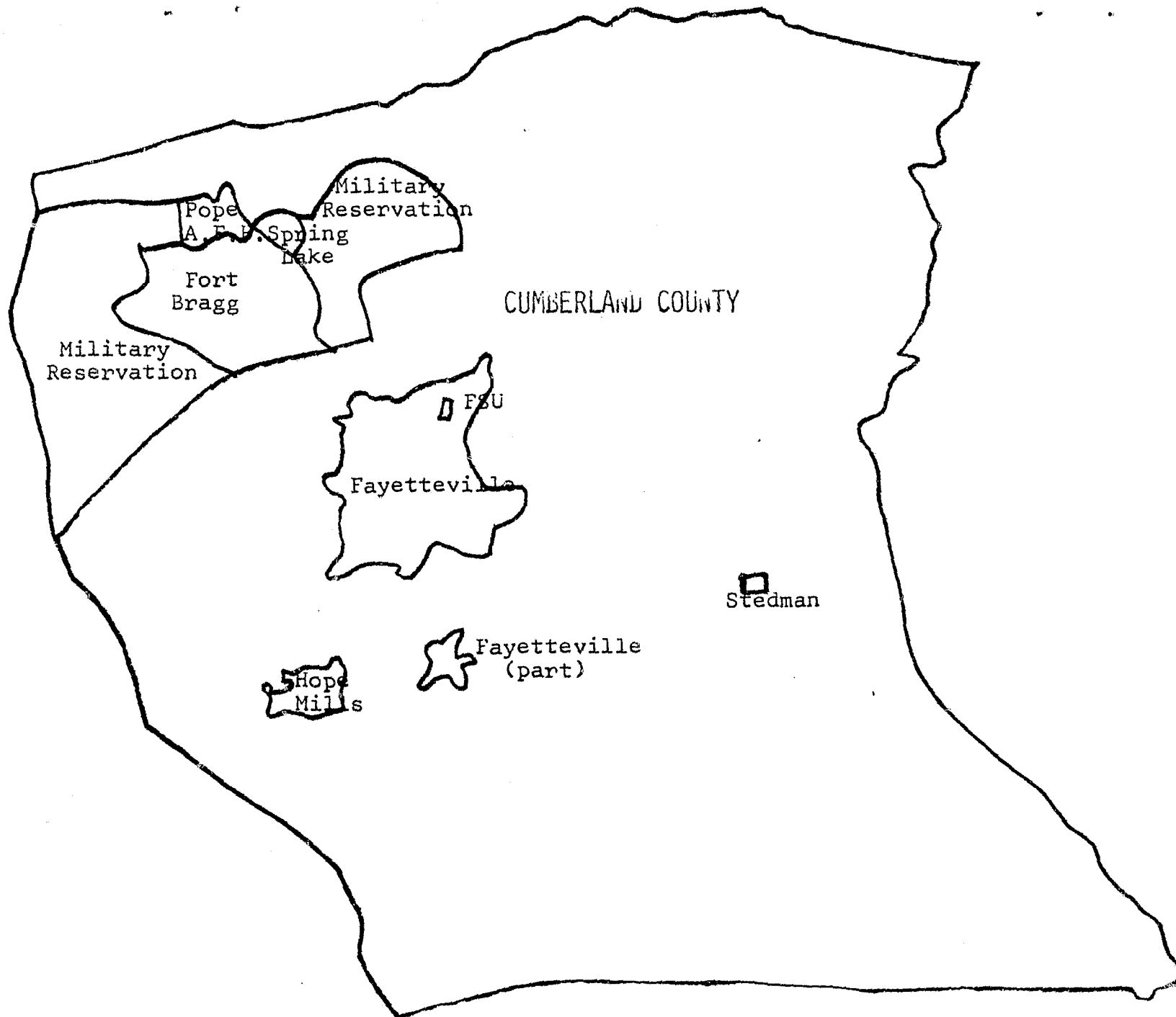


Table III

Patrol Services MatrixFayetteville, North Carolina, SMSAOrganized Consumption Units

<u>Producers</u>	Fort Bragg	Pope A.F.B.	Fayetteville State University Remainder of City of Fayetteville	Spring Lake	Hope Mills	Stedman	Remainder of Cumberland County
Fort Bragg Provost Marshal	R		A				
Pope A.F.B. Provost Marshal		R					
Fayetteville State Univ. Campus Police			R				
Fayetteville City Police			R	A			
Spring Lake Police				R			
Hope Mills Police					R		
Stedman Police						R	
Cumberland County Sheriff				I	I	R	R

Fayetteville. The Fayetteville Police are also classified as alternative producers of patrol services because they focus their attention on the civilian population of the city.

Both Cumberland County and Fayetteville contain organized consumption units which are enclaves. Within Cumberland County, there are seven organized consuming units served by their own patrol service agencies. The county sheriff's department patrols in the remaining areas of the county. The far right-hand column on Figure III represents this "remainder." Fayetteville State University is a separately organized consuming enclave for patrol within Fayetteville. For each enclave, special legal arrangements for patrol have been established.

As shown by the double entries in several columns, some areas in Fayetteville have multiple agencies simultaneously providing regular patrol services. Both the Sheriff and the Fayetteville Police Department provide regular patrol services to some of the patrol enclaves. Stedman receives regular patrol support from the Sheriff's Department. Fayetteville State University is regularly patrolled by the Fayetteville City Police Department.

Criminal investigation activities in Fayetteville SMSA are organized somewhat differently from patrol as shown in Table IV. There are only six organized consumption units for criminal investigation because Stedman and Fayetteville State University have no unique legal arrangements with a producer of this service. However, there are nine different producers of criminal investigation serving this SMSA.<sup>10</sup> Only Fayetteville and the Cumberland County "remainder" unit rely regularly on their own investigative services. The military installations each call in specialized criminal investigation units from off-base. Spring



Table IV

Criminal Investigation Matrix  
Fayetteville, North Carolina, SMSA

Organized Consumption Units

<u>Producers</u>	Fort Bragg	Pope A.F.B.	Fayetteville	Spring Lake	Hope Mills	Remainder of Cumberland County
Ft. Bragg Provost Marshal	C					
U.S. Army Criminal Investigation	C					
Pope A.F.B. Provost Marshal		C				
U.S.A.F. Criminal Investigation		C				
Fayetteville Police Department			R			
Spring Lake Police Department				C		
Hope Mills Police Department					C	
Cumberland County Sheriff				C	C	R
N.C. State Bureau of Investigation			I	I	I	I

Lake and Hope Mills regularly coordinate with the Sheriff's Criminal Investigation Unit. The State Bureau of Investigation provides additional services to civilian agencies on request. It is not considered a regular producer of this service.

Turning to intermediate police services provides an opportunity to explore additional facets of the structure of service provision in the police industry of the Fayetteville SMSA. Our interest here is in seeing which agencies provide certain intermediate services to those agencies providing direct police services to citizens. The consuming units for intermediate services are police agencies which utilize those services in providing direct police services to citizens. Criminal laboratory services are used to assist criminal investigation. Thus, nine units are listed as consuming this intermediate police services, as nine units are listed in Table IV as producing criminal investigation. For adult detention the consuming units are eight police departments which provide patrol services and therefore require adult detention services. As a comparison of Tables IV and V indicates, the number of producers of police services can vary considerably from service to service. For adult detention there are only three producers. The County Sheriff provides adult detention facilities for all local police units. Each of the two military installations maintains its own detention facility. Military personnel taken into custody by civilian departments are usually remanded to their base for detention. Civilians arrested on one of the military bases would be sent to the County Jail for detention. Civilians arrested on one of the military bases would be sent to the County Jail for detention. Thus, the three producers can be viewed as providing alternative services restricted by clientele.

Table V

Adult Detention Matrix  
Fayetteville, North Carolina, SMSA

Organized Consumption Units

<u>Producers</u>	Ft. Bragg	Pope A.F.B.	Fayetteville S.U. Campus	Fayetteville	Spring Lake	Hope Mills	Stedman	Cumberland County Sheriff
Fort Bragg	A		A	A	A	A	A	A
Pope A.F.B.		A	A	A	A	A	A	
Cumberland Co. Sheriff	A	A	A	A	A	A	A	A

Table VI

Crime Lab Matrix  
Fayetteville, North Carolina, SMSA

Organized Consumption Units

<u>Producers</u>	Fort Bragg	Pope A.F.B.	Fayetteville	Spring Lake	Hope Mills	Cumberland Co.	N.C. State Bur. of Investigation	U.S. Army Crim. Investigation	U.S.A.F. Criminal Investigation
Fayetteville- Cumberland Co. Crime Lab			C	C	C	C			
N.C. Bureau of Investigation			C	C	C	C	R		
Army Criminal Investigation Division	R							R	
A.F. Criminal Investigation Division		R							R

There are four producers of crime laboratory services. The Fayetteville Police Department and the Cumberland County Sheriff have established a joint crime lab which serves all civilian criminal investigation agencies in the SMSA. The North Carolina State Bureau of Investigation maintains its own crime lab which is utilized by these same agencies for more sophisticated work. Given the coordination of work between the local and state agencies, the provision of services is coded as coordinated. Each of the military criminal investigation units has its own laboratory facilities which are used by its investigators.

Direct examination of the matrices themselves provides considerable insight into the difference in the structure of interorganizational arrangements across different services within the same SMSA. However, direct examination of the service structure matrices is not as helpful when one is comparing across metropolitan areas of varying sizes and complexity. One of the advantages of defining measures of metropolitan structure derived from service structure matrices is that such measures allow careful comparison across metropolitan areas.

Measures of Metropolitan Structure

We have defined a series of measures of metropolitan service structure which can be operationalized with the information contained in the service structure matrices. Wherever possible we have attempted to use definitions of terms which are consistent with previous usage, although this has been difficult in some cases. At present we have identified six conceptually distinct measures, each of which can be dealt with in either absolute or relative terms. These measures are: Fragmentation,

Multiplicity, Duplication, Independence, Coordination, and Dominance. Students of metropolitan reform will undoubtedly recognize such terms as ones which are frequently bandied about in the literature, but which are rarely defined. It is our intent to provide a series of operational definitions for these terms. We believe they will be useful in our own current research and also provide a consistent basis for discourse about metropolitan organization.

We have operationalized fragmentation as the number of distinct organized consuming units for the service in question. For direct services these units will be for the most part governmental jurisdictions, although as noted above, we intend to include other organized units wherever appropriate. For the intermediate services consuming units are themselves producers of direct services. A simple count of the number of such units will then be our absolute measure of fragmentation. For the direct services a relative fragmentation measure will also be obtained by dividing the absolute measure by the population of the metropolitan area stated in ten thousands. That is, relative fragmentation for the direct services will be the number of organized consumption units per ten thousand metropolitan inhabitants. The absolute and relative measures of fragmentation may vary considerably for the same SMSA. As Thomas M. Scott has pointed out "the number of local governmental units per capita increases as the total population size of the SMSA decreases"--i.e., the largest SMSAs have less relative fragmentation per capita than do the smaller SMSAs.<sup>11</sup>

Multiplicity is operationalized as the number of service producing units in the metropolitan area. This absolute measure is the same as the lists or counts of police agencies often used by national commissions

and others when lamenting the lack of unified law enforcement systems.<sup>12</sup> However, a simple list does not control for the size of the metropolitan area, nor for the political arrangements in that area. Accordingly, we have defined two relative measures of multiplicity for the direct services and one for the intermediate ones. For both direct and indirect services relative multiplicity will be measured as the number of producing units for the service divided by the number of consuming units for that service, i.e., the average number of producers per consuming unit. For the direct services, relative multiplicity will also be defined as the number of producing units for the service per ten thousand residents of the metropolitan area. Our measures of absolute and relative multiplicity are similar to those utilized by Hawkins and Dye in a recent study.<sup>13</sup> Campbell and Sacks used a measure of multiplicity which was population per government and area per government which they called fragmentation.<sup>14</sup> Ostrom and Parks used both the absolute and population relative measure of multiplicity.<sup>15</sup> Critics of current police organization have usually argued that multiplicity results in inefficient provision of low quality service. However the evidence presented in the latter study runs counter to that argument when relative multiplicity is used as the measure. Campbell and Sacks did not find any significant relationship between their measure of population or area per government and expenditure patterns.<sup>16</sup>

Duplication will be operationalized in absolute terms as the number of consuming units in the metropolitan area which regularly receive the service in question from more than one producer. However, those cases in which one producer alternates with another in time, space, or clientele will not be counted as service duplication. Similarly, instances

where two or more producers coordinate in the provision of a service to a consuming unit will not be counted as duplication. By our definition, duplication in service provision exists only when two (or more) producing units are regularly providing service to a given consuming unit and the producing units do not either alternate or coordinate their activities. While such a definition will result in our finding much less service duplication than is commonly claimed, we believe that it sticks more closely to the common meaning of the term. The service duplication seen by most critics will be picked up by our other measures. Having defined absolute duplication, we can go on to state relative duplication for direct and indirect services as the ratio of the number of consuming units receiving duplicate service to the total number of consuming units for that service. Additionally, for the direct services, we define relative duplication as the sum of the population of the consuming units which receive duplicate service divided by the total population of the metropolitan area.

Independence is defined as the number of organized consumption units which receive the service in question regularly and solely from their "own" producing unit, that is, from a producing unit directly under their control (a municipal police department patrolling all of a municipality, for example). For this measure, irregular service provision by a different producing unit (as for example, when the State Police cruise through the municipality once or twice a month) will not be counted as reducing independence. In general, alternating or coordinated service provision will be counted as reducing independence. Relative independence for a metropolitan area on a particular service can then be stated as the ratio of the number of independent consuming

units to the total number of such units, and for direct services, as the population in independent units divided by the metropolitan population.

Dominance is defined by the extent to which the consuming units for a particular service are served by the dominant producer of that service. The dominant producer of a direct service is that producer having the largest serviced population; while for indirect services, the dominant producer is that producer providing the service to the largest number of consuming units. In both cases, instances of alternate or coordinate service provision will be included in the computations. Absolute dominance is measured as the count of consuming units receiving the service from the dominant producer. Relative dominance is then the ratio of this figure to the total number of consuming units. For direct services, relative dominance is also measured by the ratio of the serviced population of the dominant producer to the total population of the metropolitan area.

It should be noted that fragmentation, independence, and dominance taken together tell us additional information about the structure of a metropolitan area. A highly fragmented metropolitan area might show a low degree of independence and a high degree of dominance for a service--say patrol. This would then indicate that while the metropolitan area is divided into a large number of units providing their own patrol, many of those units also receive patrol service from one major producer, say the County Sheriff. High independence together with high dominance (in relative population terms) in a fragmented metropolitan area would indicate that there are many small independent consumption units, but that most of the metropolitan population was served by a single producer.

But the small independent units are served by their own police force; not the dominant producer.

Our final measure, Coordination, is defined as the number of consuming units receiving service from a coordinated arrangement between two or more producers. Such arrangements are often found where, for example, a county sheriff dispatches for both its own patrol car(s) and township police department car(s), both of which patrol a township simultaneously. In such cases the dispatcher will coordinate the movement of both producers' vehicles so as to avoid having them play "follow the leader" down Main Street. Arrangements of this nature may tend to result in higher quality service for the same number of units assigned than in the pure duplicative situation. This is a proposition which can be empirically examined. Relative coordination, as with the other measures, can be stated as the ratio of the number of units receiving coordinated service to the total number of consuming units, and, for the direct services, as the ratio of the population of units receiving coordinated service to the total population in the area.

#### Comparing Metropolitan Structures

Now that the measures of metropolitan structure have been defined, we can illustrate their use by comparing the police industries in three metropolitan areas: 1) The Fayetteville SMSA which was described in some detail above, 2) The Durham, North Carolina SMSA and 3) The Hamilton-Middletown, Ohio SMSA. All three had a 1970 population of approximately 200,000.

Let us first examine the measures for patrol and criminal investigation services. As shown on Table VII, these metropolitan areas differ

Table VII

#### Structural Measures - Direct - Services

	Fayetteville			Durham			Hamilton-Middletown		
	Abso- lute	Relative		Abso- lute	Relative		Abso- lute	Relative	
		C.U.	Pop		C.U.	Pop		C.U.	Pop
<u>Fragmentation</u>									
Patrol	8	-	.38	10	-	.53	20	-	.83
Criminal Investigation	6	-	.28	10	-	.53	20	-	.83
<u>Multiplicity</u>									
Patrol	8	1.00	.38	11	1.10	.58	20	1.00	.83
Criminal Investigation	9	1.50	.42	11	1.10	.58	20	1.00	.83
<u>Duplication</u>									
Patrol	2	.25	.01	0	-	-	0	-	-
Criminal Investigation	0	-	-	0	-	-	0	-	-
<u>Independence</u>									
Patrol	5	.63	.75	10	1.00	1.00	7	.35	.82
Criminal Investigation	2	.33	.75	5	.50	.93	6	.30	.80
<u>Dominance</u>									
Patrol	2	.25	.50	1	.10	.48	14	.70	.34
Criminal Investigation	3	.50	.53	3	.30	.50	14	.70	.34
<u>Coordination</u>									
Patrol	0	-	-	0	-	-	13	.65	.18
Criminal Investigation	4	.67	.25	5	.50	.07	14	.70	.20

significantly from one another both in absolute fragmentation and in relative fragmentation. The Hamilton SMSA has 20 consuming units for patrol services, while Fayetteville has only eight. Because they have approximately the same populations, an increase from eight to twenty consuming units raises the population relative fragmentation score from .38 to .83. In both the Hamilton and Durham SMSAs there are as many organized consumption units for criminal investigation as for patrol. Therefore, each has the same fragmentation score for both services. The difference in the fragmentation scores in the Fayetteville SMSA reflects the fact that neither Stedman nor Fayetteville State University have unique legal arrangements with a producer of criminal investigation service.

The difference between fragmentation of consumption units and multiplicity of producing units is also illustrated in the Table. Fragmentation refers to consuming units, while multiplicity refers to producing units. The multiplicity score in Fayetteville for criminal investigation is higher than the fragmentation score in the same area for the same service: while there are only six consuming units for criminal investigation in that SMSA, there are nine units producing for this service (see Table IV). Where the number of producing units equals the number of consuming units for a particular service, the multiplicity score relative to consuming units will equal 1.0 as it does in Hamilton for both patrol and criminal investigation and in Fayetteville for patrol. Where there are more producing units than consuming units this score will exceed 1.0. The measure will be lower than 1.0 where there are fewer producing units than consuming units.

For patrol or criminal investigation little duplication exists in

any of the three metropolitan areas. Only in the Fayetteville SMSA is there any duplication for either of these services. As shown in Table III, two of the columns of the Fayetteville patrol matrix contain multiple "R" entries indicating regular, non-alternating, non-coordinating producers.

The independence of production units varies considerably in these three metropolitan areas. While in Durham, all ten organized consuming units receive patrol regularly and solely from their "own" producing units (a score of 1.00 for both relative measures of independence) only five of the eight consuming units (63%) in Fayetteville receive patrol regularly and solely from their own patrol units. However, these four consuming units comprise about 75 per cent of the population in the SMSA. While only seven out of twenty consuming units have patrol independence in the Hamilton-Middletown SMSA, these seven constitute about 82 per cent of the population.

In regard to dominance, only one of the ten consuming units in the Durham area receives patrol services from the dominant producer, the Durham City Police. That agency patrols for almost half of the population living in the SMSA. In the Hamilton-Middletown SMSA, fourteen out of twenty consuming units receive services from the dominant producer. These consuming units represent only 34 per cent of the population, however. The Butler County Sheriff's Department is the dominant patrol agency in the Hamilton-Middletown SMSA, serving fourteen organized consuming units. No other producer in the SMSA patrols for a larger population. Thus, the Butler County Sheriff's Department is more dominant than the Durham Police Department in terms of consuming units served, while it is less dominant in terms of total population served.

We have noted that duplication of patrol for the Hamilton-Middletown SMSA is zero and that the dominant producer serves fourteen of the twenty consuming units. Is this an inconsistency? We have also noted that only seven of the consuming units in Hamilton have independent patrol service. How are the other thirteen to be categorized? As the coordination measure indicate on Table VII, each of these units is patrolled by multiple agencies which coordinate service provision so as to avoid duplication of effort. Neither of our other example SMSAs have coordinated patrol provision. All three SMSAs do have some coordinated criminal investigation. However, in the Fayetteville SMSA, all consuming units receive coordinated criminal investigation. Seventy per cent of consuming units in the Hamilton Middletown SMSA have coordinated criminal investigation although these are small and include only 20 per cent of the area's population. Fifty per cent of the consuming units in the Durham SMSA have coordinated criminal investigation, but only seven per cent of the population is included in those units.

Turning to intermediate services in Table VIII we no longer have two relative measures for each type. Since the consuming units are in this case the producing units of direct services, all relative measures are in terms of the number of consuming units served. For fragmentation, only an absolute measure can be computed for indirect services. On multiplicity, the number of units producing adult detention and crime laboratory services is much lower than that of patrol and criminal investigation. While there are multiple producers

Table VIII

Structural Measures - Intermediate Services

<u>SMSA</u>	Fayetteville		Durham		Hamilton-Middletown	
	Abso-lute	Relative	Abso-lute	Relative	Abso-lute	Relative
<u>Fragmentation</u>						
Adult Detention	8	-	11	-	20	-
Crime Lab	9	-	11	-	20	-
<u>Multiplicity</u>						
Adult Detention	3	0.38	2	0.18	3	0.15
Crime Lab	4	0.44	2	0.18	5	0.25
<u>Duplication</u>						
Adult Detention	0	-	0	-	2	0.10
Crime Lab	0	-	0	-	0	-
<u>Independence</u>						
Adult Detention	0	-	2	0.18	1	0.05
Crime Lab	3	0.33	1	0.09	0	-
<u>Coordination</u>						
Adult Detention	8	1.00	5	0.45	20	1.00
Crime Lab	5	0.56	11	1.00	20	1.00
<u>Dominance</u>						
Adult Detention	0	-	0	-	0	-
Crime Lab	4	0.44	3	0.27	20	1.00

of these services, only in the Hamilton SMSA is there any duplication. Hamilton City Jail and Middletown City Jail are duplicative in the sense that the police departments which utilize them also utilize the Butler County jail.

There is considerably less independence for the intermediate services than for direct services. Few jurisdictions are solely served by their own crime lab or jail facility for adult detention. On the other hand, the dominance measures are much higher for intermediate services than for direct services. In both Fayetteville and Hamilton-Middletown the largest producer of jail services provides for the entire county while in Durham the largest jail services provides for the entire county while in Durham the largest jail serves about half of the consuming units. The largest crime lab in Durham and Hamilton-Middletown also serves the entire SMSA. There is no coordination in the provision of adult detention in any of the three SMSAs while coordination of crime lab services ranges from low in Durham to high in Hamilton-Middletown.

Use of these structural measures enables an analyst to be quite specific about the ways in which one metropolitan area is similar to or differs from other metropolitan areas. When many metropolitan areas are simultaneously being considered, the structural measures can be used as variables in statistical analysis to ascertain what other factors are associated with a particular type of structural arrangement among units in a metropolitan area.

### The Use of Structural Measures in Public Policy Analysis

Many assertions exist about the effects of fragmentation and other terms used to describe the structure of interorganizational arrangements in metropolitan areas. The use of service structure matrices and the structural measures derived from these matrices will enable scholars to examine these assertions empirically. Consideration of future reforms will then have a firmer grounding.

The first step in utilizing these measures is the derivation of causal statements from literature on metropolitan government. Fragmentation, for example, is thought to be the prime cause of many of the problems facing urban areas. The following statements about fragmentation have been made in the metropolitan literature:

1. Fragmentation leads to the inability of central cities to finance their service provision adequately.
2. Fragmentation produces inequality in tax base.
3. Fragmentation decreases the political capacity of local governments to acquire resources.
4. Fragmentation produces inequities in the administration and distribution of services.
5. Fragmentation produces variations in service levels in metropolitan areas.
6. Fragmentation results in higher per capita costs for providing governmental services.
7. Fragmentation produces variations in the efficiency of



different units.

8. Fragmentation leads to inefficient production processes.
9. Fragmentation results in higher taxes.
10. Fragmentation leads to generally low levels of some services throughout an area.
11. Fragmentation encourages an irresponsible attitude toward center city problems by citizens of high-income suburbs.
12. Fragmentation reduces a citizen's capacity to fix responsibility and hold government officials responsible.<sup>17</sup>

A similar set of statements exist concerning the effects of multiplicity, overlap, duplication, coordination, and independence.

The second step in utilizing these measures is the operationalization of the other terms used in the above statements. Terms such as "inequality in tax base," "variations in service levels," and "inefficient production processes," etc., will need careful definition and specific procedures for their measurement. The third step in utilizing these measures is to convert causal statements into a more testable form. Advocates of reform for example, have freely used causal language but most testable propositions will need to be stated in a language of association. Thus, statement 2 above could be restated in a testable form to read: "Fragmentation is positively associated with inequitable tax bases." Statement 6 could be restated as: "Fragmentation is positively associated with higher per capita costs for providing government services." The latter proposition would probably be best stated as it related to specific types of services rather than to a general spectrum of services.

As restated and with operationalized measures for both the independent variables (the structural measures) and the various dependent

variables mentioned above, these propositions can then be subjected to empirical examination by a number of different scholars in different research settings. Our own research project will specifically examine propositions relating structural measures to expenditure levels and patterns of manpower utilization in 200 SMSAs. For example, we will be able to examine propositions of the following types:

1. Fragmentation of consuming units in metropolitan areas is positively associated with expenditures per capita.
2. Multiplicity of producing units in metropolitan areas is positively associated with expenditures per capita.
3. Duplication of producing units in metropolitan areas is positively associated with expenditures per capita.
4. Coordination of producing units in metropolitan areas is negatively associated with expenditures per capita.

These propositions will be subjected to empirical testing in regard to each of the direct and indirect services of the police industry with a large enough data base to enable one to have confidence in the findings.

The use of these structural variables in research related to other service areas should contribute to the cumulative knowledge of the effects of different patterns of intergovernmental and interorganizational relationships upon performance in federal systems of government. The defining characteristics of federal systems of government necessarily include fragmentation, multiplicity and duplication. Coordination, independence and dominance are additional measures for specifying interorganizational structures. The performance of federal systems as systems of government can be assessed only if we can deal explicitly with different patterns of interorganizational arrangements with such consistent, operational measures.

<sup>1</sup>Committee for Economic Development, Reducing Crime and Assuring Justice (New York: Committee for Economic Development, 1972), pp. 30-31.

<sup>2</sup>President's Commission on Law Enforcement and Administration of Justice, The Challenge of Crime in a Free Society (Washington, D.C.: Superintendent of Documents, 1967); J. L. McCausland, "Crime in the Suburbs," in Charles Haar (ed.), The End of Innocence: A Suburban Reader (Glenview, Ill.: Scott, Foresman, 1972), pp. 61-64; Daniel L. Skoler and June M. Hetler, "Governmental Restructuring and Criminal Administration: The Challenge of Consolidation," in Crisis in Urban Government: A Symposium: Restructuring Metropolitan Area Government (Silver Spring, MD: Thomas Jefferson Publishing Company, 1970), pp. 53-75.

<sup>3</sup>See, for example, Bernard L. Garmire, "The Police Role in an Urban Society," in Robert F. Steadman (ed.), The Police and the Community (New York: Committee for Economic Development), p. 9.

<sup>4</sup>See Elinor Ostrom and Roger B. Parks, "Suburban Police Departments: Too Many and Too Small?" in Louis H. Masotti and Jeffrey K. Hadden (eds.), The Urbanization of the Suburbs, Vol. 7, Urban Affairs Annual Reviews (Beverly Hills: Sage Publishers, 1973), pp. 367-402.

<sup>5</sup>See Vincent Ostrom and Elinor Ostrom, "A Behavioral Approach to the Study of Intergovernmental Relations," The Annals of the American Academy of Political and Social Science 359 (May, 1965), pp. 137-146. See also Vincent Ostrom, Institutional Arrangements for Water Resource Development--With Special Reference to the California Water Industry (Springfield, Va.: National Technical Information Service, 1972), and Robert L. Bish and Vincent Ostrom, Understanding Urban Government. Metropolitan Reform Reconsidered (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1973).

<sup>6</sup>Patrol is defined as organized surveillance of public places within a defined territory and response to reports of suspected criminal acts for the purpose of preventing crime, apprehending offenders and maintaining public order. Criminal investigation is defined as activities undertaken to identify the perpetrators of alleged criminal acts, to gather evidence for criminal proceedings and to recover stolen goods. Traffic control is defined as the monitoring of vehicular traffic, the investigation of traffic accidents and on-site traffic direction.

<sup>7</sup>Basic training is defined as the provision of department required entry level training for a direct police producing unit. (By department required, we do not mean to exclude state requirements. However, many departments have higher requirements than the state in which they are located.) Detention is defined as the holding of an individual up to the time of an arraignment, formal court order, or other dismissal. Dispatching is defined as the receipt and processing of calls for police service. Criminal laboratory facilities is defined as the maintenance and operation of a technical support facility for the processing of evidence.

<sup>8</sup>We will not in this paper attempt to provide a method for measuring

the structure of an entire police industry within a metropolitan area.

<sup>9</sup>While our use of matrices for representing the structure of inter-organizational arrangements with metropolitan areas is relatively novel, it draws its intellectual base from two traditions. First, this form of representation draws on the work of Wassily M. Leontief in input-output analysis. (See Wassily M. Leontief, The Structure of American Economy, 1919-1939, Second Edition. Fair Lawn, N.J.: Oxford University Press, 1951.) Input-output analysis arrays producers and consumers of a service as we propose to do but fills in the cells with the amount of goods flowing from one to the other. Our entries will represent presence or absences of certain types of service relationships rather than flows of goods. The second related tradition is the work of sociologists interested in the relationships among individuals in small groups represented by matrices or directed graphs. (See, for example, Frank Harary, Robert Z. Norman and Dorwin Cartwright, Structural Models: An Introduction to the Theory of Directed Graphs.) In a recent article, Paul Craven and Barry Wellman of the University of Toronto discuss the potential use of matrices (or networks) for describing the relationships among communities within a region. "Such matrices can be constructed for any type of relationship between communities. We should then be able to analyze, for example, information exchange among communities, comparing the process to commercial transactions, or to intercommunity friendship links." (See Paul Craven and Barry Wellman, "The Network City," Sociological Inquiry 43, 1973, pp. 57-88.

<sup>10</sup>If one were to include the federal criminal investigation units that serve the area, the number of producers would of course be considerably greater. However, since the operation of the F.B.I., and U.S. Postal Service, and the Internal Revenue Service, and other federal investigative units are relatively invariant across SMSAs, they are not being included within the frame of this analysis.

<sup>11</sup>Thomas M. Scott, "Suburban Governmental Structures," in Louis H. Masotti and Jeffrey K. Hadden, eds., The Urbanization of the Suburbs, Vol. 7, Urban Affairs Annual Reviews (California: Sage Publishers, 1973), p. 215.

<sup>12</sup>See President's Commission on Law Enforcement and Administration of Justice, op. cit., McCausland, op. cit., and Skoler and Hetler, op. cit.

<sup>13</sup>Brett W. Hawkins and Thomas R. Dye, "Metropolitan 'Fragmentation': A Research Note," Midwest Review of Public Administration 4 (February 1970), p. 23.

<sup>14</sup>Alan K. Campbell and Seymour Sacks, Metropolitan America. Fiscal Patterns and Governmental Systems (New York: The Free Press, 1967), p. 179.

<sup>15</sup>Ostrom and Parks, op. cit.

<sup>16</sup>Campbell and Sacks, op. cit.

<sup>17</sup>See Robert L. Lineberry, "Reforming Metropolitan Governance: Requiem or Reality," The Georgetown Law Journal 58 (March-May 1970), pp. 676-678; Timothy Schlitz and William Moffitt, "Inner-City Outer-City Relationships in Metropolitan Areas. A Bibliographic Essay," Urban Affairs Quarterly 7 (September 1971), pp. 75-108; Amos H. Hawley and Basil G. Zimmer, The Metropolitan Community (Beverly Hills, Sage Publishers, 1970); Scott Greer, "Dilemmas of Action Research on the Metropolitan Problem," in Morris Janowitz, ed., Community Political Systems (Glencoe, Illinois: The Free Press, 1961); Charles M. Haar, "A Service Community: The Immediate Environment," in The End of Innocence. A Suburban Reader edited by Charles M. Haar (Glenview, Illinois: Scott, Foresman & Co., 1972), pp. 49-53; Advisory Commission on Intergovernmental Relations, Urban America and the Federal System (Washington, D.C.: Government Printing Office, 1969).

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