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SIZE AND ADMINISTRATIVE INTENSITY IN NATIONS*

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This paper reports the results of a cross-national study of the relationship between system size and administrative intensity in societies. Predictions that the relative size of government will increase with increases in system size derived from Mayhew and Levinger's (1976a) *density of interaction* model and consistent with an elaboration of Blau's (1970; 1972) *economy of scale* theory of administration are tested with data on 70 nations varying in size, population concentration, and general technological development. A nonmonotonic U-shaped relationship is found between population size and the relative size of government, and this relationship continues to be evidenced when general technological development is controlled. But despite the robustness of the nonmonotonic relationship of administrative intensity with system size, measures of urbanization and relative population concentration are shown to be highly and monotonically related to the relative size of the administrative component of nations. Differences between the two analyses and other problems are discussed, but, with minor qualification, results of these two analyses are interpreted as providing support for the Mayhew-Levinger (1976a) and elaborated Blau (1970; 1972) models and predictions.

The problem of determining the effects of increasing system size on the administrative structure of systems continues to be of interest to sociologists and students of organization. This is evidenced by the publication of two studies which arrive at contradictory conclusions concerning the effects of population size on administrative intensity in social systems (Kasarda [1974a] and Noell [1974a]) as well as by Kimberly's (1976) recent attempt to discern underlying continuities in a diverse and sometimes contradictory literature on formal organizations. Kasarda and Noell, in part, reflect an ongoing debate in the organizational literature (cf. Blau and Schoenherr, 1971:83–90; and Thompson 1967:74); however, their studies also indicate a line of development on this question. Both are concerned with the possible extension of size-administrative component generalizations from formal organizations to more diffusely organized systems: communities and societies. Unfortunately, the results of their studies are directly contradictory. Noell maintains that his data clearly demonstrate that such an extension is *warranted*; and Kasarda just as clearly states that such an extension is *unwarranted*. Before a third voice is added to this discussion, it is necessary to examine their respective studies in more detail.

Kasarda (1974a) argued, on the basis of the cross-sectional occupational distributions of 43 nonagricultural nations, that social systems experience an increasing administrative ratio with increasing system size. This clearly challenges the simple extension of economy of scale theories to social systems.[1] In fact, Kasarda's

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[1] In this context, an *economy of scale* is simply a savings in personnel that is engendered by growing organization size. Since there is some irreducible *minimum* of administrative personnel necessary for the functioning of an organization, it is often the case that an increase in organization size does not require a corresponding increase in administrative personnel, and, in fact, may provide for more efficient use of existing personnel. Therefore, a smaller proportion of the organization would be employed in administrative positions. The same reduction in the proportionate size of administration would result if

three-level analysis indicates that some of the reduction in administrative personnel found in formal organizations may be illusory, since declines in management are mitigated by offsetting increases in communications personnel required to coordinate activities in larger systems. This argument has gained considerable theoretical support from Mayhew and Levinger's (1976a) paper which posits that the expected level of interaction in a system is a multiplicative, rather than an additive, function of system size.[2] From this theoretical perspective, the increasing problems of coordination engendered by a multiplicatively increasing density of interaction might explain the disproportionate growth in administration found in some large formal organizations and social systems.

Noell's (1974a) study of the 50 state governments in the United States directly contradicts Kasarda's findings. Noell's data indicate that the proportion employed in state governments *declines* with increasing system size. He thus concludes that theories of an economy of scale *are* applicable across system levels. These two contradictory conclusions in themselves indicate that the issue warrants further study, but there are methodological limitations which also should be considered. Kasarda studied the problem cross-nationally but he employed an *indirect* indicator of the size of the administrative subsystem (i.e., the proportion of the labor force employed in administrative positions). Noell used a more direct indicator of the size of the administrative subsystem (i.e., the proportion employed in government) but he limited his study to one country, the United States, which cannot be considered typical or representative of national organizations, and, therefore, may not give an accurate depiction of the general relationship between the two variables.[3] This paper will combine what are felt to be the respective strengths of these two studies. It will use government employment as its indicator of the size of the administrative component of societies, and it will examine the relationship cross-nationally in 70 nations which vary in size, technological development, and population concentration.

As suggested by Mayhew and Levinger (1976a), the expectation is that increasing interaction will increase problems of coordination and control and since governments are the *subsystems specifically charged with monitoring and responding to system-spanning problems,* they can be expected to expand in size to meet these growing contingencies at the national and regional level. Since the rate of interaction and its attendant problems are predicted to be increasing at a faster rate than the population is growing, government is expected to grow at a faster rate than population. Therefore, as the size of the system increases government employment should begin to constitute a greater proportion of the population or work force. Growth in government, however, is not the only way that a government can increase its capacity to coordinate. We are not maintaining, therefore, that growth in employment is the only way that governments can be expected to respond to increasing problems of administration, but rather that it is a reasonable place to look for a society's response to an increase in problems of administration.

At first glance such a prediction appears to contradict the extension economy of scale theories to social systems, but further examination of one economy of scale theory suggests this need not be the case. Blau's (1970; 1972) discussion of the indirect effects of size on administration contends that economies of scale are, in some measure, offset by the increasing complexity that size introduces into the system via differentiation (this is also at the heart of Kasarda's [1974a] argument regarding increased communication needs in complex systems). Blau maintains,

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administrative personnel grew at a slower rate than overall organization population. In such cases, the administrative component would increase in *absolute* numbers while declining as a proportion of the total population of the organization.

[2] Kasarda's (1974a) hypotheses originally were derived from theories of nonproportional growth put forth by Thompson (1917) and by Boulding (1953).

[3] Noell (1974a:555) is aware of some of the limitations on the generalizability of his findings to other independent and federal systems.

therefore, that while initial increases in size and differentiation produce substantial decreases in administrative ratios, further increases in size are accompanied by ever smaller declines in administration, presumably because increasing complexity introduces increasing problems of coordination and communication. In Blau's data on formal organizations, these indirect effects never fully counteract the direct effects which reduce administration, although they do, he argues, begin to attenuate the slope of the curve. It is important to keep in mind that the upper size limit of the organizations that Blau examined was well below that of even the smallest nation. It is thus conceivable and consistent with Blau's theory to posit that *in larger systems the indirect effect of size might begin to outweigh the direct effect, and a reversal of the trend of declining administration would evidence itself.* Blau (1974:16, emphasis added), in fact, alludes to this possibility:

> Within organizations, structural differentiation, by enhancing problems of coordination and communication, enlarges the administrative component. The same may well be true for entire societies. Specifically, the increasing differentiation of societies may *expand the proportion of civil servants* and of their labor force in other administrative positions.

Thus Blau's theory, rather than being discredited by such a finding at the societal level would, in fact, be elaborated empirically by demonstrating the effects of size over a greater range of the variables.[4] Also, considering the problem in this light makes it clear that even the demonstration of a decline in the *rate* at which administrative ratio decreases with increases in the size of social systems provides plausible, if not compelling, evidence for our proposition. Stronger evidence, of course, would be provided if it could be demonstrated that administrative ratio increases in larger systems, for this would indicate that the decline in administration had not only been attenuated, but in fact had been arrested and reversed.

Given the considerable evidence in support of economy of scale theories found in organization research, it makes sense to test this density of interaction hypothesis against them. Orienting ourselves to economy of scale theories establishes an explicity *gradient* of support for the hypothesis, and this allows consistent inferences to be drawn from the data.[5]

DATA AND METHODS

For purposes of the present analysis, system size is operationalized by population, since this is the most basic indicator of the system's conduciveness as well as its limitations on interaction density according to the Mayhew-Levinger model

[4] Given the strong empirical and theoretical connection between size and the division of labor (e.g., Mayhew et al., 1972; Durkheim, 1964; Blau and Schoenherr, 1971), there is no incompatibility between the density of interaction hypothesis discussed here, and theories that see the division of labor as generating problems which require a greater development of mechanisms of coordination and integration to maintain system integrity. In fact, moving to this level of analysis (which is more sociological), one could generate an expectation for the density of interaction between *structural units* rather than individuals. The density of interaction hypothesis should apply at this level (i.e., interaction between units should increase at a multiplicative rate), and it is conceivable that the hypothesis would have more explanatory power at this level. To do so, however, would require a measure of the *division of labor* in the form of structural differentiation, *not* the distribution of individuals in general occupational categories. Of concern would be the number of occupational categories or organizations, not the distribution of individuals in them.

In any event, when the effects of size on the administrative component are examined, one can assume that this increase in size produces an increasing division of labor. The division of labor, therefore, can be seen as an unmeasured intervening variable.

[5] For instance,

strong support:	proportion in administration is *positively* and highly correlated with size;
moderate support:	proportion in administration is *positively*, but not highly, correlated with size;
qualified support:	proportion in administration is *not negatively* correlated with size.

Of course provisions could be made for changes in the direction or sign of the relationship over the range of size—certainly a shift from negative to positive as size increases is in line with the theory, whereas a shift from zero or positive to negative would not be. (Zero values would be interpreted in the context in which they might appear in the analysis—as in the cases of specification.)

(1976a). And, although there has been some disagreement as to whether government employment or the percent of the labor force employed in administrative positions provides the more accurate assessment of administration at the societal level (Noell, 1974b; Kasarda 1974b), it is arguable that the level of government employment is at least one reasonable place to look for a society's response to problems of regulation and coordination posed by increasing levels of interaction and system activity.

In gathering government employment data as an index of the size administrative component of the nation, the intent was to get the most accurate measure of total civilian government employment (salary and wage workers) including local, regional, and central government where reported separately.[6] Rupprecht (1974) provides the most comprehensive argument as to why total government employment is the best cross-national indicator of the size of government. He argues that it is superior to revenue and taxation measures in indicating size, and that it is clearly the most comparable measure available cross culturally. This is not to say, however that the measure is without limitations and problems. Kasarda (1974b) has raised objections and has indicated the heterogeneity of government employment in somewhat the same manner that Rushing (1966) pointed out the heterogeneity in the administrative component of formal organizations. There are undoubtedly other sources of error and slippage in this indicator due to its generation from secondary sources (Webb et al., 1966), but multiple sources were sought, and discrepancies between sources were investigated in order to get the most accurate assessment. The date for the government figure was used then to determine the relevant date of the independent variables. In some cases it was necessary to adjust figures by determining the number of noncivilian personnel and subtracting them from government in order to make measures more comparable cross nationally.

In contrast to Kasarda (1974b), Noell (1974b) argues for the use of government employment as the best indicator of administration at the societal level, and although the relative utilities of these measures cannot be resolved here (each would seem to have its advantages and disadvantages), use of government as an indicator of the size of administration in a cross-national context will allow us to determine if the discrepancy between Noell (1974a) and Kasarda (1974a) is due merely to their respective choice of indicators. In all, cross-sectional data on government employment were obtained from secondary sources for 70 nations.[7] Of particular use

[6] In order to avoid confusion, it should be clearly understood that when we are dealing with the size of government, we are dealing with what might be termed the implementation structure, we are making no statements about decision making in these systems. The number of persons that are involved in making decisions or in setting policy is clearly independent of the number of persons needed to administer or implement those decisions and policies.

A growing government sector may become increasingly unwieldy, but no one would argue that a system is more democratic simply because more people are required to run it. This also posits that no contradiction exists between the predictions made here of an increasing proportion employed in government and Mayhew (1973) and Mayhew and Levinger's (1973; 1976b) theoretical argument for a declining proportion in the "ruling elite." The two are analytically separable questions. What is argued here is that increased coordination problems will put pressure on the system to expand its administrative capacity by increasing employment—it does not imply that more persons will thereby be involved in *making* decisions and setting policy. It is conceivable that a growing government sector could be implementing policies that are set by a proportionately declining "elite." Failure to separate these two questions can only result in unproductive debate and confusion.

[7] Although this analysis relies on cross-sectional data, examination of over-time data has shown that in the United States government employment has increased at a faster rate than population at both the federal and the local level (Lenski and Lenski, 1974: 359–60; Fabricant, 1949; 1952). Labor force statistics for Canada and Great Britain indicate that this same disproportionate growth in government has taken place in these countries as well.

In Canada the percent of total population employed by government has increased from .27 in 1912 (earliest total figure) to 1.0 in 1959. In Great Britain employment in "Public Administration" expressed as a percent of the population of England and Wales has increased from .27 in 1840 to 1.2 in 1921 (when the classification system was changed).

Thus, on the basis of readily available over-time data, one would conclude that government has grown at a faster rate than population in the United

in generating these data were the *Worldmark Encyclopedia of Nations, The Statesman's Yearbook*, the *Europa Yearbook,* and Rupprecht (1974). In addition to these compilations, the statistical yearbooks of the various nations that were held by the Temple University Library, University of Pennsylvania Library, the Library of Congress, and the Department of Labor were directly consulted (where language and assistance permitted) in the collection of government data. The 70 nations for which data were available comprise roughly half of the independent and quasi-independent nations in the world (136) as determined by the U.S. Department of State in 1969.[8] The only known bias in the data set is the exclusion of most communist or socialist nations. This is a result of the fact that most socialist nations do not report a government employment figure that is sufficiently distinct from industrial employment. Lack of probability sampling and the exclusion of socialist nations does not necessarily affect the validity of this study but it does limit the generalizability of the findings.

Since it is the relative rather than the absolute size of government that is of interest, this figure is expressed as a percent or proportion of the total population. This measure is analogous to the administrative ratio that has been used as an index of administrative intensity in formal organization research. And despite their long history in the study of organizations and macrostructures, ratio variables and the administrative ratio in particular have become the subject of some controversy in methodological and statistical circles (Freeman and Kronenfeld, 1973; Fuguitt and Lieberson, 1974; and Schuessler, 1974). This controversy, therefore, needs to be considered before proceeding to the analyses of our data. It is interesting that the issue is considered to be a statistical one, given that both Fuguitt and Lieberson (1974:132–3) and Schuessler (1974: 394–5) point out that the determination of whether to use ratio variables or the administrative ratio in a given research context is determined by *theoretical* and *conceptual* concerns, rather than statistical or technical concerns. This is clearly evident in Fuguitt and Lieberson's (1974) discussion of the issue of "spurious correlation," as originally raised by Pearson (1897), where they state:

> A number have pointed out that there is nothing intrinsically spurious about the correlation, though interpretations may indeed be spurious, *as in inferring from a ratio correlation the size or direction of a component correlation or vice versa. A basic distinction here is whether one's major interest really focuses on the component measures.* (Fuguitt and Lieberson, 1974:132, emphasis added)

They argue that if in fact one's concern is with the ratio itself and not its components, then the presence of a common term is not problematic. It is the *theoretical concern* and the *substantive* focus that determines if ratio variables are appropriate, not technical statistical concerns (Schuessler, 1974:395). In reiterating this contention in their conclusion, Fuguitt and Lieberson (1974:141, emphasis added) add on a "belief" and a suggestion:

> First, an argument can be made that spurious correlation is not an issue in correlating ratio or difference terms, provided that one's interest is exclusively in the composite variables rather than in the components. We *believe*, however, that it is usually difficult to maintain that position; problems *can* be reformulated in terms of component variables,

States, Canada, and Great Britain. The fact that such diachronic data are limited to western, industrialized nations of considerable size, makes it important to examine the question cross-nationally, in different types of nations, even if that examination is synchronic. This is necessary to avoid inferring a "universal" process from a limited and perhaps culturally biased sample of nations. Sources: Mitchell, 1965; Urquhart, 1962.

[8] The data set consists of: Argentina, Australia, Bahrain, Barbados, Belgium, Bolivia, Botswana, Burma, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chile, Columbia, Cyprus, Dahomey, Ecuador, Ethiopia, Finland, France, Gambia, West Germany, Ghana, India, Iraq, Ireland, Israel, Italy, Ivory Coast, Japan, Kenya, South Korea, Kuwait, Madagascar, Malaysian Federation, Malawi, Malta, Mauritania, Mexico, Morocco, Netherlands, New Zealand, Norway, Paraguay, Peru, Puerto Rico, Southern Rhodesia, Romania, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, Republic of South Africa, Swaziland, Sweden, Syria, Tanzania, Togo, Trinidad and Tobago, Uganda, Upper Volta, United Kingdom, United States, Venezuela, Western Samoa, Southern Yemen, Yugoslavia, Zambia.

Further information on the data set is available in Nolan (1978) and from the author on request.

> or in any event the relation between the components and the composite variables *may be profitably explored.*

Fuguitt and Lieberson's "belief" would appear to be the belief that sociologists cannot be genuinely interested in the study of social structures and the use of structural variables, and does not detract from the fact that they have themselves argued that the problem is a theoretical and conceptual issue rather than a simple technical or statistical one. The determination of the use of a ratio must stand or fall on the basis of its theoretical justification.

Clearly the interest in administrative ratio expressed here is the use of it as an indicator of the relative size of the administrative component of the nation. It is to be used to determine the effects of system size (scale) on the administrative component, not the effects of increasing population on administrative employment. Although the distinction may be subtle, this is not merely hair-splitting. The focus is on administrative ratio as a *structural variable,* and it differs from the managerial concern with the effects of increasing production employment on overhead or nonproductive personnel. It is not used to enable the prediction of the number of government employees from the size of the population, but rather to see the effects of increasing population on the relative size of the administrative component of the nation. Since interest is in the composite rather than the components, use of administrative ratio would appear to meet Schuessler's as well as Fuguitt and Lieberson's criteria of acceptability. The fact that the hypothesis *can* be stated in other terms is another matter.

Other critics, notably Freeman and Kronenfeld (1973), have added to this controversy by claiming that correlations between size and administrative ratio are an "artifact" and can be produced by "random noise." This issue of "definitional dependency" or "built in" *negative* association between these variables has been seen to result from the assumptions these critics make rather than the intrinsic properties of the variables (Mayhew and Levinger, 1976b:1018; MacMillan, 1975; Kasarda and Nolan, 1978), but since knowledge of this is not widespread, it is fortunate that these critics have proposed alternative methods which they claim are free of this problem. One of these methods which was proposed also by Akers and Campbell (1970) has been used to determine the relative growth rates of a variety of phenomena including: the organs of cats, size and functional differentiation in preindustrial and industrial societies, and even the relative growth rates of populations, legislatures, and governments (Svalastoga, 1974). Since this method is presumably free of the "problems" Freeman and Kronenfeld (1973) have discussed, and there is neither the time nor the space here to consider the issue more fully, this alternative method will be used to check the results of the analyses that employ administrative ratio (see fn. 13).

Two indicators of technological development also were gathered for use in the analysis: (1) the percent of the total population engaged in agriculture (United Nations, 1971: Table 5) and (2) the energy consumed per capita in kilograms coal equivalent (United Nations, 1973: Table 137). Employing these measures as controls will allow us to determine if size has an effect on administrative ratio that is independent of general technological development. Measures based on the areal expanse of the system also will be introduced as controls in this analysis. In addition, because we are sensitive to the fact that the relative concentration of a population is as important as the size of the population, we will examine the relationship between administrative intensity and two direct measures of population size and concentration (cf. Taylor and Hudson, 1972: Tables 4.1 and 4.2, respectively):

(1) URBAN, the percent of the population residing in cities of 100,000 or more;

(2) CONCENT, an index of the relative concentration of population over the area of the country varying from .000 to 1.0.

The use of these variables as indicators of structural properties provides the same

Table 1. Correlations of the Percent Employed in Government and Population Size All Nations (N = 70)

	CORRELATION	SIGNIFICANCE
PERCENT IN GOVERNMENT BY POPULATION	.09	.22
LOG PERCENT IN GOVERNMENT BY POPULATION	.13	.14
PERCENT IN GOVERNMENT BY LOG POPULATION	−.01	.47
LOG PERCENT IN GOVERNMENT BY LOG POPULATION	.03	.40

defense for these ratio variables that was given for the use of the administrative ratio itself.

ANALYSIS AND DISCUSSION

The zero-order product-moment correlations shown in Table 1 between population and the proportionate size of government offer little evidence of relationship. Certainly no strong *linear* relationship is present. The simple correlation between size and the percent employed in government is .09, and when the variables are logarithmically transformed to detect simple curvilinearity, the coefficients remain small, and in one case change signs. The lack of probability sampling prevents one from relying too heavily on significance figures in drawing conclusions.[9] But since Pearson-correlation is only capable of measuring the degree of *linear* association, and logarithmic transformations will only detect certain forms of curvilinearity, examination of the scatterplot is always indicated before concluding that no relationship exists (Blalock, 1960:312). Examination of the scatterplots suggested that the relationship was not only curvilinear, but was also *nonmonotonic*. It appeared to be a rather flattened U-shaped curve with an inflection approximately at the medium of population size. In order to test this impression, the data were broken into four size categories and the mean percent in government was computed for each category.[10] This distribution of the means, shown in Table 2, confirms the impression gleaned from the scatterplots.

The lowest size category has the highest mean government employment. The second size category has the lowest mean government employment with the third and fourth category means displaying a progressive increase. Since the inflection of the curve falls approximately at the median, a further test of nonmonotonic relationship would be provided by performing separate analyses on the subpopulations when the data are split at the median (or approximate point of inflection). For convenience correlations calculated in these subpopulations are referred to as split correlations. The use of separate analyses for curvilinear relationships is suggested by Heise (1975:91–2). He states that curvilinearity of this type can be dealt with simply by performing two separate linear analyses, one for the lower values

[9] Since we are not dealing with a probability sample in this analysis, significance figures have no direct or simple interpretation. They are reported for the reader's interest and because it is customary to do so even where they are not really warranted (Noell, 1974a; Sjoberg and Nett, 1968:281–4).

[10] We are sensitive to the fact that how one categorizes (i.e., the choice of cut-points) the data may influence the means. We used quartiles not because of any intrinsic property or a priori knowledge of the means, but rather because of the small number of cases. When the data were broken into deciles and the means were plotted, the same general pattern emerged indicating that the pattern is not merely an artifact of our choice of cut-points. If we use Kasarda's purposive categories (adapted to his data, not *ours*), we find some interesting differences in the data on developed nations.

Using Kasarda's categories:
Lowest to 500,000 = 1;
500,001 to 5,000,000 = 2;
5,000,001 to 25,000,000 = 3;
25,000,001 to Highest = 4.

The category means of all nations are:
3.262, 1.884, 1.899, 3.127
N=6 N=25 N=29 N=10.

Note the interesting differences between nonagricultural and industrial nations:

Industrial (N=24) — More than 2,000 kilos coal

1.910	3.069	3.500	3.867
N=2	N=9	N=7	N=6

Nonagricultural (N=33)

4.252	3.455	3.051	3.429
N=3	N=10	N=13	N=7

The shifting of a few additional cases in this instance *does* affect the pattern of the relationship.

Table 2. Mean Percent Government Employment in Popluation Size Categories for all Nations Combined and for Nations Classified by General Technological Development

SIZE CATEGORY	MEAN PERCENT IN GOVERNMENT	N	MEAN PERCENT IN GOVERNMENT	N
	ALL NATIONS			
140,000– 2,550,000	2.743	18		
2,550,001– 5,750,000	1.250	17		
5,750,001– 15,000,000	2.180	18		
15,000,001–504,000,000	2.539	17		
	DEVELOPED NATIONS			
NONAGRICULTURAL NATIONS LESS THAN 50% IN AGRICULTURE			INDUSTRIAL NATIONS MORE THAN 2,000 KILOGRAMS COAL CONSUMED	
216,078– 2,780,000	4.996	8	4.018	6
2,780,001– 8,600,000	1.674	8	1.467	5
8,600,001– 22,500,000	3.285	9	3.500	7
22,500,001–204,800,000	3.505	8	3.867	6
	NONDEVELOPED NATIONS			
AGRICULTURAL NATIONS MORE THAN 50% IN AGRICULTURE			NONINDUSTRIAL NATIONS LESS THAN 2,000 KILOGRAMS COAL CONSUMED	
140,000– 2,350,000	1.386	9	2.576	11
2,350,001– 5,200,000	.705	10	.705	10
5,200,001– 10,900,000	1.047	9	1.415	13
10,900,001–504,000,000	1.456	9	1.674	12

(of size), and another for larger values (of size). This procedure is adopted here in lieu of developing a curve to fit the overall relationship between population size and the percent employed by government.

The split correlations in Table 3 indicate that the direction of the relationship reverses at the median. At the lower end of the size scale a strong negative relationship is evidenced, while in larger systems the relationship is positive. The distribution of means and the correlations offer consistent evidence of a nonmonotonic relationship between size and the proportion employed in government. The form of this relationship suggests that a threshold effect may be operating. This would indicate that after some critical value of size is reached, the direction of the relationship reverses. Thus the question as to whether economies of scale do or do not obtain may have to be specified by size level. This is especially important for this analysis because one goal of this research is to test for possible isomorphism across system levels. If the specification continues to hold up in later analysis it may well be one of the most important findings, but before over-interpreting this effect, the relationship should be examined when technology is controlled.

Kasarda's (1974a:24) method of case selection suggests a possible use for our first measure of general technological development: nations in which less than half of the population is engaged in agriculture will be classified as developed, and those in which more than half are engaged in agriculture can be classified as undeveloped. This procedure results in 33 nations being classified as developed (nonagricultural) and 37 nations being classified as undeveloped (agricultural).

Table 2 shows that the same nonmonotonic pattern is present even though the mean level of employment in government is higher for nonagricultural nations than for all nations. The split correlations in Table 3 also are similar to those found in all nations. They are negative for small systems and positive for large systems. Nonagricultural nations thus exhibit the same pattern of relationship that was found in all 70 nations, and while the correlations are rather small at the upper end of the size scale, the pattern of relationship appears to be holding when technology is, in some measure, controlled. The

Table 3. Correlations of Population Size and the Percent Employed in Government for Small and Large Nations When Classified by Agricultural Employment and Per Capita Kilograms Coal Equivalent Consumed

	ALL NATIONS		AGRICULTURAL		NONAGRICULTURAL		NONINDUSTRIAL		INDUSTRIAL	
	SMALL	LARGE	SMALL	LARGE	SMALL	LARGE	SMALL	LARGE	SMALL	LARGE
PERCENT IN GOVERNMENT BY POPULATION	−.49	.11[a]	−.42	.18[a]	−.50 (−.61)	.20 (.25)[a]	−.58	.08[a]	−.37 (−.37)	.19 (.19)[a]
LOG OF THE PERCENT IN GOVERNMENT BY POPULATION	−.53	.16[a]	−.41	.23[a]	−.55 (−.74)	.18 (.23)[a]	−.56	.14[a]	−.39 (−.39)	.20 (.20)[a]
PERCENT IN GOVERNMENT BY THE LOG OF POPULATION	−.46	.26[a]	−.52	.29[a]	−.51 (−.46)	.05 (.17)[a]	−.62	.19[a]	−.22 (−.22)	.03 (.03)[a]
LOG OF THE PERCENT IN GOVERNMENT BY THE LOG OF POPULATION	−.50	.32	−.47	.31[a]	−.58 (−.57)	.03 (.17)[a]	−.59	.22[a]	−.24 (−.24)	.09 (.09)[a]

NOTE: Population cutting points: All Nations, 5,750,000; Agricultural Nations, 5,200,000; Nonagricultural Nations, 8,600,000 (in parenthesis 5,200,000); Nonindustrial Nations, 5,200,000; Industrial Nations, 8,600,000 (in parenthesis 5,200,000).

[a] Not significant at .05 level.

complementary subset of nations, those in which 50% or more of the population is engaged in agriculture, also provide comparable results. In Table 2 the same pattern of mean government employment for the different size categories is present and in Table 3 the split correlations are negative for smaller systems and positive for larger systems.

An alternative control for general technological development is provided by the per capita energy consumption in kilograms of coal equivalent. Following Lenski and Lenski (1974:296), 2,000 kilograms per capita is used as a rough cutting point between developed (industrial) and undeveloped (nonindustrial) nations. This results in 24 nations being classified as developed and 46 being classified undeveloped. The same nonmonotonic pattern of relationship between size and administration emerges in these subcategories of nations as is clearly shown in Tables 2 and 3. The employment of this second measure of development does not materially alter the pattern of relationship initially found in the data. There are some minor differences in the data sets when the different measures of development are used, but the pattern of relationship remains the same. This is illustrated quite clearly in a combined plotting of the category means displayed in Figure 1. The same U-shaped pattern is found in all subsets of the data. The procedures for grouping the data into developed and undeveloped make it impossible for this pattern to be due to the same one or two extreme values.

The fact that this nonmononotic relationship continues to be present when development is introduced as a control suggests that this pattern of effect is at least partially independent of general technological development. And although there is considerable overlap between the data sets when alternative indicators of development are used—the employment of either indicator results in the same pattern of relationship in two *independent* data sets: one consisting of developed nations and the other consisting of undeveloped nations. The fact that developed nations have, on the average, a higher level of administration than undeveloped na-

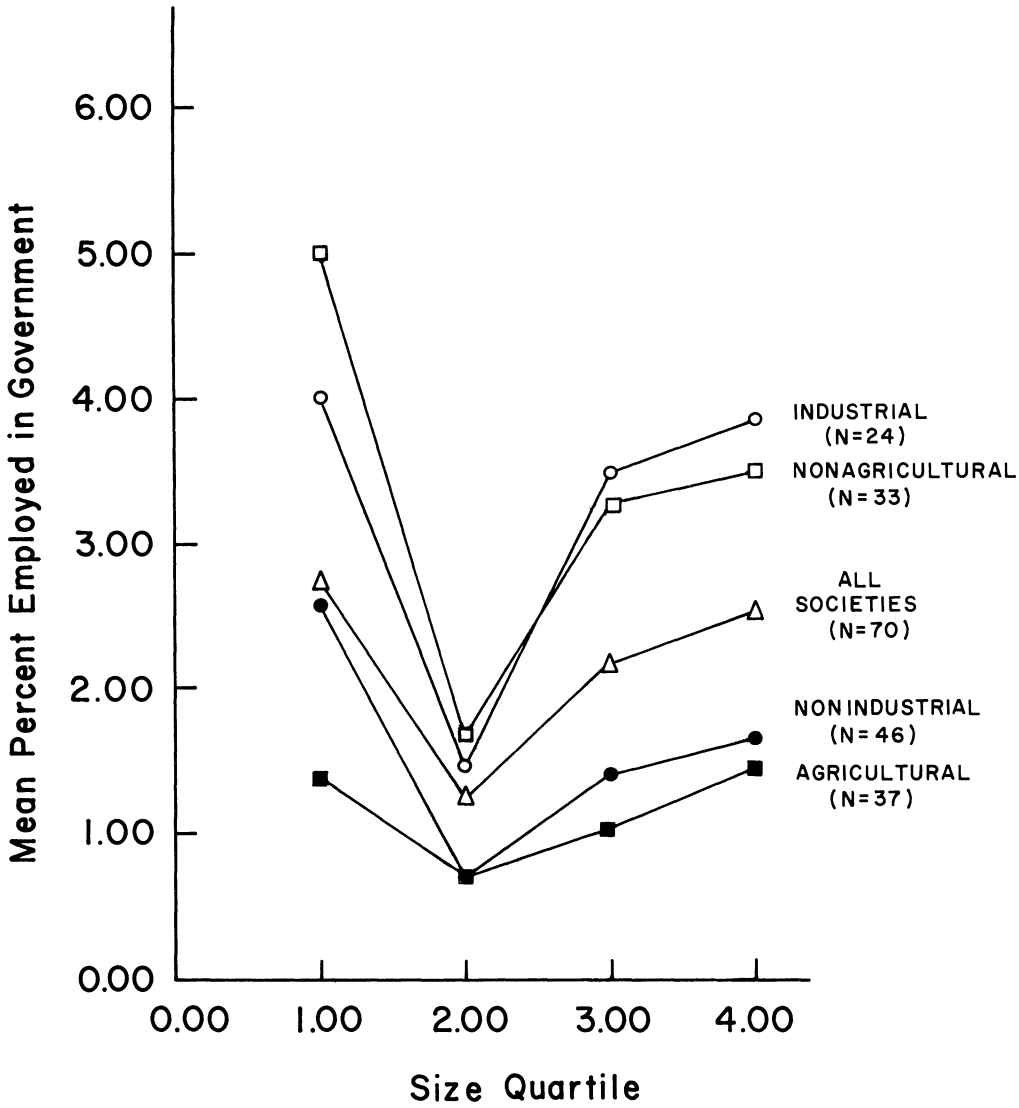

Figure 1. The mean level of government employment by population size quartile

tions is consistent with a major constraint on the size of government—the wealth of the system and its ability to support tertiary employment. But finding the same pattern of relationship within these two sets of nations indicates that although technology may operate as a general constraint on the system, it does not explain the nonmonotonic trend of government employment that accompanies increasing population size.[11] One could certainly argue that an economy of scale is manifested in small nations, but in the face of the evidence adduced thus far, one could not maintain that economies of scale continue to operate in large systems. This change in direction, or nonmonotonicity, while not directly predicted by the Mayhew-Levinger model (although a reversal at some point *is suggested* by Blau [1970; 1972] and *found* by Kasarda [1974a]), may well be compatible with it,

[11] The persistent nonmonotonic trend found here, caused much consternation and brought up the possibility that some of the choices of indicators and the adjustments for military personnel might conceivably have caused us to systematically under- and overestimate the relative size of governments for

and with the hypothesis developed from it.[12] The addition of a tipping-point may well complicate the discussion, but it does not disconform the hypothesis.

It was hypothesized that the proportion in government would increase with increasing system size, and there is at least some evidence that is the case; but only after some critical value of size is reached. This would suggest that there is, in fact, an economy of scale operating until some critical tipping-point is reached, at which point the trend reverses and the proportion in government begins to *increase* with further increase in size.[13] The notion of tipping-point or critical value of size is not totally unexpected in organizational research. Other theorists and researchers have suspected them, and this was at least part of Kasarda's motivation for doing a three-level analysis of the effects of size on administration. It is not surprising to find only a small increase in the relative size of administration in large systems, indicating *attenuation* and *reversal* of the trend of declining administration, but it is surprising that this increase is only manifested at the upper end of the size distribution of nations. Blau's model is consis-

certain size categories. Examination of the data indicated that this was not the case, however. Using a reduced set of data comprised of the 48 nations which were not adjusted or in any way affected by our collection choices, produced nearly identical means for the various subsets of nations, and would not cause the modification of any of the conclusions presented earlier. Even the removal of "outliers" in categories did not reduce the nonmonotonic trend appreciably. The respective category means in the reduced data set were:

All nations: 3.01 (N=12), 1.63 (N=10), 2.25 (N=13), 2.84 (N=13);
Industrial: 4.34 (N=5), 1.73 (N=3), 3.91 (N=5), 4.02 (N=5);
Nonindustrial: 2.60 (N=7), .88 (N=4), 1.44 (N=9), 1.73 (N=10);
Nonagricultural: 5.46 (N=6), 1.59 (N=4), 3.12 (N=8), 3.56 (N=7);
Agricultural: 1.19 (N=6), .88 (N=4), 1.27 (N=7), 1.67 (N=6).

This, of course, does not remove indigenous error of which we are not aware; but the consistency of the pattern and the number of opportunities we have given it to be disproved makes it less and less plausible that this is an artifact.

[12] Anderson and Warkov (1961:26–7) also infer from the slope of the decline in administrative ratio with increasing hospital size that the relationship between size and administration in hospitals may be U-shaped.

[13] As indicated in the text, critics who have contended that there *may be* statistical or methodological problems that result from correlating system size with the administrative ratio of a system have offered alternative methods of analysis that are free of those "problems." One such method originally proposed by Akers and Campbell (1970) and discussed by Freeman and Kronenfeld (1973) is to regress the logarithm of the number of administrators on the logarithm of system size. This double-logarithmic transformation allows one to determine whether the administrative component grows proportionately or disproportionately with increases in system size simply by inspecting the regression coefficient. If the regression coefficient is less than 1.0, it indicates that administrative employment grows at a slower rate than the organization increases in size. If the coefficient is greater than 1.0 it indicates that administrative employment grows at a faster rate than the organization increases in size. The first instance illustrates an *economy of scale* in administration, and the second indicates a *diseconomy of scale* in administration (Moore, 1975). If the regression coefficient is 1.0, it indicates that administrative employment grows proportionately with increases in system size. This double-logarithmic transformation has been used in biological contexts to test the "principle of allometry (i.e., that parts tend to maintain relative growth rates which when measured as proportion of the relative growth of the total system are invariant)" (Svalastoga, 1974). Because of their identity with the econometricians' *elasticity coefficients* (Johnston, 1972:51–2), the slopes of the regression equations estimated with the doubly logarithmically transformed data can be interpreted as a measure of their relative growth rates. Thus a slope of 1.00 indicates that the two variables change proportionately, or that Y changes at a rate of 100% for every change in X. A slope of 1.6 would indicate that Y grew 60% faster than X, and a slope of .60 would indicate that Y grew at only 60% of the rate of X (Svalastoga, 1974:55). This broadens the interpretation put on this coefficient by Freeman and Kronenfeld (1973), and may prove useful in interpreting the coefficients reported below.

Since this method detects departures from *proportionality,* it can be used to verify the results of the analyses that employed administrative ratio to determine the effects of increasing size on the relative size of the administrative component of nations. The coefficients displayed below confirm the conclusions drawn earlier. Government employment increases at a slower rate than population size in small societies (b=.50477) while in large societies it increases at a faster rate than population (b=1.26928). Further analysis also indicates that the nonmonotonic trend is present within the various categories of general technological development. The respective slopes are: agricultural, small b=.57635, large b=1.24063; nonindustrial, small b=.37897, large b=1.19073; nonagricultural, small b=.66832, large b=1.02299; industrial, small b=.82908, large b=1.07835. A more complete examination of the results of this method of analysis and its rationale are provided in Nolan (1978).

tent with such a threshold, but one might have expected it to be reached at a much lower value of size, perhaps below that of even a small nation. Instead the relative size of administration in societies of increasing size corresponds, in part, to the distribution of administrative ratio found in organizations of increasing size. The difference being that there is a mild increase in administration in the upper size range for nations, while in formal organizations there was only an attenuation in the rate at which the administrative ratio declined.

However, if one is willing to grant that with increasing size and its attendant economies of scale that administrative capacity increases, then one is forced to conclude that the administrative ratio is growing at the same time that it is becoming more *effective*. This would appear to have been the case in the United States, 1900–1949 (Fabricant, 1949; 1952).

> Review of some factors affecting the trend of government productivity—the use of improved technology and equipment, the spread of the merit system, the introduction of centralized purchasing, and various other advances in public administration—leaves the strong impression that the savings effected by their means have been far from negligible. (Fabricant, 1949:24)
>
> . . . [T]he long term trend in government's productivity has probably been upward. (Fabricant, 1949:25)

This leads Fabricant to conclude that even in the much maligned U.S. government bureaucracy, little, if any, increase in government employment has been caused by declining output. Quite the contrary, he maintains that output has probably increased, and Downs (1967) makes a similar point, in a more general context when he argues that bureaus suffer from the fact that they are constantly compared with an idealized and unrealistic picture about how private organizations operate and how employees in them function. The tireless, dedicated employee is a myth in private industry and such comparisons are highly misleading; a comparison of actual outputs would be quite interesting, and conceivably might indicate that the reverse is closer to the truth.

A quite different pattern of relationship emerges, however, with the more direct indicators of population size and concentration. Urbanization is positively related to the relative size of government, and unlike the relationship with population size, this relationship appears to be monotonic. The correlation for all 70 nations is .54, indicating that this variable accounts for about 30% of the variance in the relative size of government. In small systems, those with populations less than 5,750,000, the relationship is slightly attenuated but it does not change sign ($r=.44$). The correlation for small societies may be lower because the cut point of 100,000 would make the urbanization measure more sensitive to variation in large systems, only at the expense of desensitizing it to variation in small systems. This is a result of the fact that nations that do not have a single city of that size are all classified as being 0% urban even though they may differ in population concentration. In large systems, those with populations greater than 5,750,000, where the measure is expected to be more sensitive to actual variation in size and concentration, the relationship increases to $r=.69$, indicating that nearly 47% of the variation in the relative size of government is explained by urbanization. The alternative measure of population distribution confirms the relationship found with urbanization. The correlation between concent, an indicator of the relative concentration of people, and the relative size of government is .30 for all systems (examination of the scattergram indicates that an outlier attenuates the overall correlation) and this correlation is .55 in small societies and .69 in large societies. The results using these two more direct indicators of population concentration and size are therefore different than those that examined the effects of size alone. These associations might be larger and their monotonicity may be due to the fact that these measures simultaneously take into account both population size and population concentration and this might suggest that controlling for population concentration would wipe out the nonmonotonic relationship between population size and administrative intensity. However in Table 5 the same nonmonotonic pattern is clearly present

Table 4. Zero-Order Correlations of the Percent Employed in Government with Measures of Urbanization and Population Concentration and Partial Correlations Controlling for General Technological Development

	URBAN N=64 ALL SYSTEMS	CONCENTRATION (CONCENT) N=58
PERCENT EMPLOYED IN GOVERNMENT	.54	.30
	SMALL SYSTEMS	
PERCENT EMPLOYED IN GOVERNMENT	.44	.55
	LARGE SYSTEMS	
PERCENT EMPLOYED IN GOVERNMENT	.69	.69
	CONTROLLING FOR TECHNOLOGY[a]	
COAL	.58 (53)[b]	.33 (53)
SMALL	.47 (19)	.55 (19)
LARGE	.63 (31)	.71 (31)
COALCLOG	.41 (53)	.30 (53)
SMALL	.37 (19)	.56 (19)
LARGE	.50 (31)	.58 (31)

KEY: COAL = Total energy consumed in kilograms coal equivalent regressed on population. COALCLOG = Log of the kilograms coal equivalent consumed per capita.

[a] All correlations significant at the .05 level.

[b] Degrees of freedom in parenthesis.

when controls for concentration are introduced. The nonmonotonic relationship between size and administrative intensity, therefore, is not explained by the relative concentration of the population, and it also can be seen in Table 4 that the monotonic relationship between administrative ratio and direct measures of size and concentration is not explained by general technological development.

Although there are differences between the two analyses of the effects of population size and concentration on administrative intensity, the results of both analyses are consistent with predictions made from the density of interaction model developed by Mayhew and Levinger (1976a) and with Blau's (1970; 1972) formal theory of differentiation. The nonmonotonicity of the size-administrative intensity relationship might be taken as an indication that social systems constitute a separate level of analysis, rather than being merely overly large formal organizations. This would explain why the full range of the size—administrative intensity relationship is found when the analysis is performed on social systems. Being a separate level of analysis (sui generis), social systems do not represent merely the upper range of the organization size scale. Whether this is the case or not, however, in large societies, regardless of technological development, increases in size produce disproportionate increases in government employment. The fact that urbanization and population concentration measures evidence a strong monotonic relationship with administrative intensity suggests that the ecological development of the system has a direct effect on the level of administration which is independent of size.[14]

The primary objective of this research has been to determine the effects of increasing system size on administration, but it has been assumed from the outset

[14] This idea is supported by the fact that associations between the percent urban and the proportion employed in government are higher (r=.66) than those between the total urban population (percent urban × population) and the proportion employed in government (r=.30, and r=.35 with the log of total urban population). Even when both the total urban population and the proportion employed in government are converted to logarithms to correct for skew, the association only increases to .47, while the association between the log of the proportion employed in government and the percent urban is .67. These correlations indicate that the *degree* or *extent* of urbanization is a better predictor of government size than is the actual size of the urban population. Controlling for population concentration or the percent urban does not remove the nonmonotonic pattern of relationship between population size and the proportion employed in government, however.

Table 5. Partial Correlations of the Log of Population Size and the Percent Employed in Government Controlling Relative Population Concentration and Average Distance[a]

	CONTROLLING FOR CONCENTRATION	CONTROLLING FOR AVERAGE DISTANCE	CONTROLLING FOR CONCENTRATION AND AVERAGE DISTANCE
	POPLOG	POPLOG	POPLOG
ALL NATIONS PERCENT IN GOVERNMENT	.30 (55)[b]	.08[c] (55)	.13[c] (54)
SMALL NATIONS PERCENT IN GOVERNMENT	−.43 (20)	−.37 (20)	−.40 (19)
LARGE NATIONS PERCENT IN GOVERNMENT	.43 (32)	.10[c] (32)	.32 (31)

NOTE: Population cutting point 5,750,000.

[a] *Average Distance* is computed in the following way: .52 times the square root of area. Under the assumption that people are uniformly distributed over a square area, this figure reflects the average distance between random pairs in that system. Thus it is an attempt to take into account (a priori) the effects of the average distance between people. For a further discussion of this measure and its limitations see Nolan (1978), for a discussion of its theoretical importance in the density of interaction model see Mayhew and Levinger (1976a).

[b] Degrees of freedom in parenthesis.

[c] Not significant at the .05 level.

that *Development* is also an important determinant of a system's need and ability to support a large administrative component. Levels of industrial and economic development are an important determinant of the system's ability to produce a surplus and maintain a large tertiary sector, and GNP itself is in part an index of the amount of commercial activity in the system. Likewise a high degree of agricultural employment can be seen not only as an indicator of population dispersal but also as an indication that commercial activity is at a lower level than in a more industrial or developed system. Development therefore was anticipated to have an effect on both the level of system activity and on the relative size of governments. This assumption has been bourne out in both analyses presented here. Yet it is obviously the case that the choice of indicators used in these analyses gives differential advantage to either system size or system development as an explanatory variable. Examining only the effects of size (population), shortchanges size in the competition to explain variance in the administrative ratio, while the use of an urbanization measure as an index of size and population concentration obviously shortchanges system development since the measure does not merely reflect population size and concentration but also is related strongly to the system's level of development. The empirical interrelation of these two sets of variables makes it difficult to disentangle and ascertain the relative importance of these analytically separable determinants of administrative growth, but this analysis has presented evidence that both affect the relative size of the administrative component of nations.

CONCLUSIONS

This cross-sectional analysis has presented evidence that at the societal level of analysis a nonmonotonic U-shaped relationship exists between size and administrative intensity. Mayhew and Levinger's (1976a) argument that interaction density can be expected to increase with increases in system size, and Blau's (1970; 1972) argument that structural complexity can be expected to increase with increases in system size have been offered as explanations for the failure of large societies to continue to display economies of scale in administration after a size tipping point is reached. It is thus the case with administrative intensity, and

perhaps with other organizational traits as well, that isomorphism between formal organizations and societies cannot be assumed to exist even though principles of organization continue to hold. Thus the effects of the scale of organization require that extensions of formal organization findings and generalizations be investigated empirically rather than being assumed to hold logically. It also can be seen from this analysis that the discrepancy between Kasarda's (1974a) findings and Noell's (1974a) findings are not merely the result of their respective choice of indicators of administrative intensity (Kasarda, 1947b; Noell, 1974b), since we have here confirmed Kasarda's hypothesis in an analysis that employs Noell's indicator of administration. The fact that disproportionate increases in government employment are found in a number of large societies at varying levels of general technological development also indicates that this growth in administration results at least in part from the imperatives of system size and is not wholly a result of specific political programs, histories, or technological advance as some observers of western industrial societies have implied (Fabricant, 1949; 1952; Lenski and Lenski, 1974).

REFERENCES

Akers, Ronald and Frederick L. Campbell
1970 "Size and the administrative component in occupational associations." Pacific Sociological Review 13:241–51.

Anderson, Theodore R. and Seymour Warkov
1961 "Organizational size and functional complexity: a study of administration in hospitals." American Sociological Review 26:23–8.

Blalock, Hubert M.
1960 Social Statistics. New York: McGraw-Hill.

Blau, Peter M.
1970 "A formal theory of differentiation in organizations." American Sociological Review 35:201–18.
1972 "Interdependence and hierarchy in organizations." Social Science Research 1: 1–24.
1974 On the Nature of Organizations. New York: Wiley.

Blau, Peter M. and Richard A. Schoenherr
1971 The Structure of Organizations. New York: Basic Books.

Boulding, Kenneth E.
1953 "Toward a general theory of growth." Canadian Journal of Economics and Political Science 19:326–40.

Downs, Anthony
1967 Inside Bureaucracy. Boston: Little, Brown.

Durkheim, Emile
1964 The Division of Labor in Society. New York: Free Press.

Fabricant, Solomon
1949 "The rising trend of government employment." Occasional Paper 29. New York: National Bureau of Economic Research.
1952 The Trend of Government Activity in the United States since 1900. New York: National Bureau of Economic Research.

Freeman, John Henry and Jerold E. Kronenfeld
1973 "Problems of definitional dependency: the case of administrative intensity." Social Forces 52:108–21.

Fuguitt, Glen V. and Stanley Lieberson
1974 "Correlation of ratios having common terms." Pp. 128–44 in Herbert L. Costner (ed.), Sociological Methodology 1973–1974. San Francisco: Jossey-Bass.

Heise, David R.
1975 Causal Analysis. New York: Wiley.

Johnston, J.
1972 Econometric Methods. 2nd ed. New York: McGraw-Hill.

Kasarda, John D.
1974a "The structural implication of social system size: a three-level analysis." American Sociological Review 39:19–28.
1974b "On social system properties: an alternative view." American Sociological Review 39:886–8.

Kasarda, John D. and Patrick D. Nolan
1978 "The use of administrative ratios in organizational research: conceptual and methodological issues." Unpublished paper.

Kimberly, John R.
1976 "Organizational size and the structuralist perspective: a review, critique, and proposal." Administrative Science Quarterly 21:571–97.

Lenski, Gerhard and Jean Lenski
1974 Human Societies: A Macrolevel Introduction to Sociology. New York: McGraw-Hill.

MacMillan, Alex
1975 "Ratio variables, spurious correlation, and inference in sociological research." Mimeo. Queens University at Kingston, Ontario.

Mayhew, Bruce H.
1973 "System size and ruling elites." American Sociological Review 38:468–75.

Mayhew, Bruce H., Roger Levinger, J. Miller McPherson and Thomas James
1972 "System size and structural differentiation in formal organizations: a base line generator for two major theoretical propositions." American Sociological Review 37: 629–33.

Mayhew, Bruce H. and Roger L. Levinger
1976a "Size and the density of interaction in human aggregates." American Journal of Sociology 82:86–110.

1976b "On the emergence of oligarchy in human interaction." American Journal of Sociology 81:1017–49.

Mitchell, Brian R.
1965 Historical Statistics of Canada. Cambridge, Eng.: University Press.

Moore, Frederick T.
1975 "Economies of scale: some statistical evidence." Pp. 125–36 in Edwin Mansfield (ed.), Microeconomics. 2nd ed. New York: Norton.

Noell, James J.
1974a "On the administrative sector of social systems: an analysis of the size and complexity of government bureaucracies in the American states." Social Forces 52:549–58.
1974b "System level and system property." American Sociological Review 39:885–6.

Nolan, Patrick D.
1978 "Population size, the density of interaction and the relative size of the administrative component of nations." Ph.D. dissertation, Department of Sociology, Temple University.

Paxton, John (ed.)
1972– The Statesman's Year-Book. New York:
1973 St. Martin's.

Pearson, Karl
1897 "On a form of spurious correlation which may arise when indices are used in the measurement of organs." Proceedings of the Royal Society of London.

Rupprecht, Erhardt O.
1974 "How big is government?" Finance and Development 11:29–33.

Rushing, William A.
1966 "Organizational size and administration: the problems of causal homogeneity and a heterogenous category." Pacific Sociological Review 9:100–8.

Sachs, Moshe Y. (ed.)
1971 Worldmark Encyclopedia of Nations. New York: Worldmark Press; distributed by Wiley.

Schuessler, Karl
1974 "Analysis of ratio variables: opportunities and pitfalls." American Journal of Sociology 80:379–96.

Sjoberg, Gideon and Roger Nett
1968 A Methodology for Social Research. New York: Harper and Row.

Svalastoga, Kaare
1974 The Social System. Denmark: Akademisk Forlag.

The Europa Yearbook
1973 London: Europa Publications.

Taylor, Charles L. and Michael C. Hudson
1972 World Handbook of Political and Social Indicators. New Haven: Yale University Press.

Thompson, D'Arcy
1917 On Growth and Form. Cambridge, Eng.: Cambridge University Press.

Thompson, James D.
1967 Organizations in Action. New York: McGraw-Hill.

United Nations
1971 Production Yearbook. New York: United Nations.
1973 Statistical Yearbook. New York: United Nations.

Urquhart, N. C. (ed.)
1962 Abstract of British Historical Statistics. Cambridge, Eng.: University Press.

U. S. Department of State
1969 Status of the World's Nations (August).

Webb, Eugene J., Donald T. Campbell, Richard D. Schwartz, and Lee Sechrest
1966 Unobstrusive Measures: Non-Reactive Research in the Social Sciences. Chicago: Rand McNally.