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# Structural Differentiation and Rural Development

By Richard G. Stuby\*

This article enlarges on the concept of structural differentiation as defined below, and it presents the results of one attempt to measure the concept as it relates to the issues of rural development.

Modern, industrialized, or "developed" societies are characterized by a profusion of highly specialized functional units, extreme division of labor, and rationality of production. Less developed or "underdeveloped" societies are characterized by a lack of these. Similarly, within any given society, and regardless of the form of political economy, we note varying levels of agglomeration, specialization, and division of labor among the society's functional units. At one pole of this variation we observe developed, urbanized areas with many highly specialized firms, organizations, governments or service structures. At the other pole we find the less developed rural hinterland with only a few firms, organizations, governments or service structures, each of which has more generalized functions.

Urbanized areas thus not only differ from rural areas in the sense of a larger, more concentrated population, but they also differ in that the socioeconomic structure of firms, organizations, governments, and institutions which support that population is more differentiated. One possible way of defining the level of development for an area, then, is to

Structural differentiation, a concept used here to measure differences between rural U.S. counties, can assist policymakers in determining degrees of rural development. The Guttman scale of structural differentiation, derived from Dun and Bradstreet retail establishment data, is examined for its validity as a measure and its ability to discriminate among counties. Valid, stable scales of differentiation can be built from secondary data sources and may help in research. They must be further refined in terms of their relationship with population size and density, economic growth, and individual quality of life.

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Rural development  
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measure its degree of structural differentiation. The higher the degree of structural differentiation, the higher will be the level of development. This is not to say that structural differentiation is development, rather, that it may be a useful empirical referent for the historically elusive concept of development. If structural differentiation can be empirically measured or indexed, we may be more able to consider development at the conceptual level.

## THE ROOTS OF STRUCTURAL DIFFERENTIATION

The concept of structural differentiation as it relates to rural development has its roots in the writings of Durkheim, Tonnies, Redfield, Becker, and Sorokin (see 19 and

20).<sup>1</sup> The polarities in these writings—mechanical-organic solidarity; *gemeinschaft-gesellschaft*; folk-urban; sacred-secular, familistic-contractual—all describe, in some sense, undifferentiated versus differentiated society.

The organic, urban, secular, contractual, *gesellschaft* society is characterized by a profusion of units, each with specialized functions, extreme division of labor, and rationality of production that describe modern, industrial, developed societies. The other poles—organic, folk, sacred, familistic, *gemeinschaft*—are associated with rural, agrarian, preindustrial, or underdeveloped societies.

Despite the fact that these polarities inherently refer to a set of underlying continuums, researchers have often focused on the poles rather than the entire range of the continuum. As recently summarized by Warner:

... in societies that are industrial, it can be misleading to speak of rural society and urban society as alternative social entities that can be compared with each other. That implies reification of separate social systems, which appears to be less and less tenable as the future unfolds (25, p. 307).

If the holistic view of society is accepted, variables must be developed to express differences along meaningful and quantifiable dimensions of that society. Yet it is here that the rural-urban continuum and

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<sup>1</sup> Italicized numbers in parentheses refer to items in References at the end of this article.

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the other descriptive polarities fall short. The rural-urban continuum has been called "real but relatively unimportant" (5). Moreover, whatever reality it may have has been shown to be a multidimensional concept that resists measurement (1).

Structural differentiation represents an alternative theoretical construct with enough solidity to be used as a variable in development issues relating to the rural-urban continuum. It is a concept which cross cuts academic disciplines as well as historically important theoretical constructs. It is a structural variable, applicable to all social systems regardless of differences in size, location, or time period. As it can function as a time series variable, it can focus on the dynamic processes of growth and specialization of functions within communities or regions. Thus, here, it is viewed as a generalized concept relating to urbanization, modernization, industrialization, or "development," whether the latter be labeled "community development," "economic development," or "rural development."

Structural differentiation may be an important variable in heuristic models of the development process as well as an objective indicator of the level of development itself. While these two aspects of differentiation are not easily separated, the focus of this article will remain on the latter; that is, using a scale of structural differentiation as an indicator of development.

## GUTTMAN SCALING OF COMMERCIAL DIFFERENTIATION

Previous studies by Eberts (7-9), Sismondo (23), and others (3, 4, 10, 18, 22, and 26) explored structural differentiation on a regional and county basis. They used Guttman scales to indicate the hierarchical differentiation of commercial services, medical specialties, and other institutional dimensions which relate to development. Other researchers (12, 14, 15, and 17), working from the viewpoint of central place theory, have used a differentiation index, based on the frequency of commercial establishments, to index the hierarchy of places.

While both approaches contribute to the present work Guttman scale techniques will be used here to develop

differentiation indexes. A Guttman scale invokes the idea of a hierarchy within the system as, by Guttman scale criteria, an observation exhibiting any given characteristic also exhibits all of the more basic or lower order characteristics (11). Thus, one can conceive of communities, counties, or places as ranging up and down a hierarchy of differentiation, from those with complex structures supporting unique, specialized, higher order functions to those having more simple, diffuse structures supporting only the more common, generalized, lower order functions. Structural differentiation is cumulative. It builds higher order structures on more generalized lower order ones in a sequence that is called "developmental." Thus, a Guttman scale is conceptually appropriate here.

## Data

Data were compiled from the 1969 Dun and Bradstreet DMI file (6). This file contained records on approximately 2.7 million commercial establishments in the United States, coded by commercial function according to the Standard Industrial Classification (SIC) codes (2). The individual firm records were aggregated by FIPS county codes to provide data matrix containing frequencies for each of 1,051 SIC codes for each of 3,072 county units (24).<sup>2</sup> The SIC categories became the variables and the county units, the observations for data processing purposes.

<sup>2</sup> The list of 1,051 SIC codes on the tapes included some erroneous codes, which did not correspond to anything in the SIC manual. They probably resulted from keypunch errors when the file was constructed as they generally occur only once. Due to cost, no attempt was made to clean out these errors. Rather, they were simply noted in the original work tape compilation and not inputted into subsequent analyses.

The 3,072 county units generally correspond to those listed in FIPS PUB 6-2 (U.S. Dept. of Commerce, 1973) with the following exceptions: (1) Independent cities were merged with the county (or former county) in which they were located; (2) the entire State of Alaska was deleted from the file due to very sketchy reporting by Dun and Bradstreet for Alaskan Boroughs and Divisions; (3) Loving, Texas had no entries in the D&B file.



*Does the Guttman scale indicate differentiation well and does it explain variance in independent variables included under the rubric of "development?"*

### Scale Construction

The initial thrust was to construct separate Guttman scales within each of the wholesale, retail, and service SIC major groups. This involved selecting the "best fitting" set of 12 items (SIC codes) within each group according to Guttman criteria.<sup>3</sup> Two additional scales were then constructed. One combined the best fitting set of 12 items from the retail and wholesale scales. The other, included items from retail, wholesale, and service groups.

Guttman scales with similar coefficients were obtained for the retail, wholesale, and service groups. Coefficients of reproducibility were 0.88, 0.88, and 0.89, respectively. Percentages of improvement were 0.16, 0.14, and 0.12, resulting in respective coefficients of scalability of 0.56, 0.53, and 0.53.<sup>4</sup> The combined scales had slightly better coefficients with reproducibilities of 0.89 and 0.90, improvements of 0.17 and

<sup>3</sup> The limitation of 12 items per scale is dictated by the design of the SPSS computer software package.

<sup>4</sup> See (13) for discussion of Guttman coefficients.

0.15, and scalabilities of 0.61 and 0.60. However, differences were not great; thus, the retail scale was selected for further analysis to preserve conceptual simplicity (table 1).

### Evaluation of Scales

Does the Guttman scale indicate differentiation well and does it explain variance in dependent variables included under the rubric of "development?" At stake here are questions of both internal and external validity.

### Internal Validity

Criteria of internal validity are expressed formally by the coefficients of reproducibility (REP), minimum marginal reproducibility (MMR), percentage of improvement (IMP), and coefficient of scalability (CS) (11, 13). Although the coefficients in table 1 are not quite within the conventionally accepted levels of  $REP > 0.90$ ,  $IMP > 0.20$ , and  $CS > 0.65$ , they are close enough to warrant further consideration and attempts at refinement. As

Table 1—Guttman scale for retail group for 3,072 U.S. counties, 1969

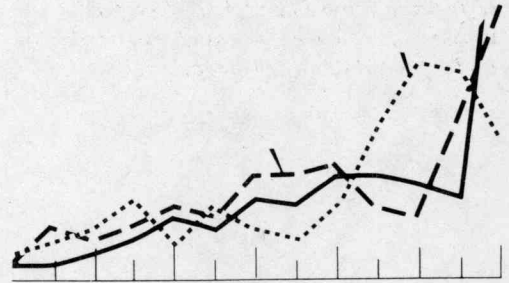
Scale score	SIC code	Scale item	Item distribution (percentage with)	Score distribution	
				N	Percent
12	5671	Custom tailor	14	160	5.2
11	5321	Mail order house	15	103	3.4
10	5993	Cigar store	15	121	3.9
9	5719	Miscellaneous home furnishings	24	182	5.9
8	5714	Drapery-upholstery	23	204	6.6
7	5996	Photo store	35	261	8.5
6	5311	Department store	44	296	9.6
5	5943	Stationery store	54	293	9.5
4	5462	Retail bakery	56	339	11.0
3	5231	Paint store	64	340	11.1
2	5611	Mens wear	75	338	11.0
1	5722	Appliance store	92	304	9.9
0	—	None of the above	—	131	4.3

Coefficient of reproducibility = 0.88.

Minimum marginal reproducibility = 0.72.

Improvement = 0.16.

Coefficient of scalability = 0.56.



these coefficients can be affected by the selection of items used, the process of item selection will be discussed briefly.

The process of constructing an acceptable Guttman scale of retail differentiation depended on finding that particular permutation of items which had the best Guttman fit from the universe of 68 SIC codes under the heading, retail. Several guidelines were used. First the SIC codes were crudely ordered based on general knowledge of the structure and distribution of retail establishments. For example, retail specialties, such as furriers, obviously were expected to appear only in counties containing a major city. If a retail service structure has the complexity and specialization to support a furrier, it probably also includes most other retail establishments. At the other extreme, the presence of gas stations and grocery stores would not discriminate among county units across the United States as each county would be expected to have both of these within its bounds. Within these extremes, some crude ordering estimates were made.

An item-by-item consideration also served to screen items for their applicability to all U.S. counties. Retail establishments that could not reasonably be assumed to exist in all counties were eliminated from consideration. Liquor stores provide a case in point. Because State laws controlling the retail distribution of liquor vary greatly, the position of liquor retail functions in the total retail structure is not consistent across all U.S. counties. In States with private sector, competitive-distribution outlets, a liquor store might be a low-order differentiation item. However, in States with State-operated or other tightly controlled distribution, it would be a higher order item occurring in fewer and larger places.

Second, previous research has shown relatively consistent orderings among several retail functions, particularly those common to fairly rural counties. Thus, some possibilities exist for ordering and selecting items for the rural end of the scale (7-10). However, the regional or local character of this research resulted in a range of items that would not adequately discriminate across both metro and nonmetro counties for the United States as a whole.

A third, and perhaps most useful approach, to the selection of scalable Guttman items from among the SIC

codes involved the use of Yule's Q coefficients expressing bivariate, one-way association in a fourfold table (21, p. 249). Both Q and Guttman scales are based on the one-way association between variables.

In a perfect Guttman scale, perfect one-way association exists between all pairs of items. Thus, the values in an inter-item matrix of Yule's Q coefficients from a perfect Guttman scale would all be unity. It follows that a matrix of Q coefficients may be used as a guide to evaluate the potential for Guttman items. The values of Q range from -1.0 to +1.0; a value of +1.0 indicates a perfect one-way association and a value of -1.0 indicates a perfectly inverse association.

Thus, items with negative Q's were automatically eliminated from consideration. Then, items showing low inter-item Q's were evaluated and the most offending were dropped until a pool of suitable items remained for Guttman scale evaluation.

Thus, the item selection procedure basically involved a fitting process to find that permutation of items which empirically yielded the highest internal validity, without sacrificing discriminability.

### Number of Items Used

The number of items included in a scale may also affect both internal validity and discriminability factors. A trade off exists between the number of items used and the internal validity coefficients because errors can be reduced by progressively weeding out the worst-fitting items. However, as the number of items is reduced, say to five or six, the technique may not be sensitive to important variations in the underlying continuum. Such a scale may not be much more useful than a set of subjective, nominal categories. Thus, extreme attempts to purify a scale may reduce its usefulness.

Reducing the number can also inflate the internal validity coefficients. If 12 items are spaced along a continuum, more overlap will occur in their endorsement-nonendorsement distributions, than if, say, six items were spaced along the same continuum. Fewer and more discrete cut points tend to submerge scale errors in the larger aggregate, which reduces the overall percentage of error and produces spuriously high coefficients.

As an illustration, examine the retail scale shown in



table 1. The original 12 items were partitioned arbitrarily by assigning the even-numbered items to one six-item scale and the odd-numbered items to another. Thus, three sets of items range along the same continuum and the Guttman coefficients for them can be directly compared (table 2).

Both of the six-item scales partitioned from the original 12-item scale show better internal validity coefficients, particularly in improvement and scalability. Yet both of the shorter versions use items common to the larger. Ultimately, one must simply decide which aspect of the scale, discrimination or internal validity, to use. However, my decision was to work with scales having 10 or more items, even at the expense of slightly lower internal validity criteria, on the assumption that larger numbers of items produce more discriminating Guttman scales.

### Stability

At the outset, I noted that an attempt was made to use only SIC codes which applied to all counties. Thus, the intent was to find a set of terms whose internal validity would not be seriously affected by regional disaggregations. To test for this, counties were disaggregated to Census regions and the Guttman scale coefficients were recomputed for each region using the 12 items in the retail scale (table 3).

There were only slight differences in internal validity across regions. These differences suggest that some improvement in Guttman scales might be made by tailoring new scales to regions for intraregional analyses.

Table 2—Comparison of Guttman coefficients for three versions of the retail scale

Guttman coefficient	Original 12-item scale	Six odd-numbered items	Six even-numbered items
Reproducibility	0.88	0.90	0.92
Minimum marginal reproducibility	.72	.71	.73
Improvement	.16	.19	.19
Scalability	.56	.65	.70

Similarly, when the coefficients were recomputed for several of the larger States, internal validity deteriorated slightly. Again, intrastate analyses may be enhanced by tailoring the Guttman model to the particular State. However, comparative analyses across regions, larger States, or various types of counties would not be jeopardized by the instability of the retail scale reported here.

### External Validity

Even though the internal validity criteria were not satisfied, in the scale shown, to the extent one would like, they are sufficiently satisfied to ask another, perhaps more important question. That is, does the scale correspond to the real world and measure what it purports to measure, or, does it have external validity?

Table 3—Guttman coefficients for retail scale by Census region

Guttman coefficient	North-east	North Central	South	West	United States
Reproducibility	0.86	0.88	0.87	0.88	0.88
Minimum marginal reproducibility	.70	.75	.73	.70	.72
Percentage of improvement	.16	.12*	.14	.19*	.16
Scalability	.54	.52	.52	.61	.56

\* Does not equal REP minus MMR because of rounding error.

*One test of external validity can be made by seeing how the differentiation scales relate to levels of urbanization, given the generally accepted high correlation between urbanization and "development."*

### Differentiation and Urbanization

A traditional way of examining the external validity of a scale is to measure its abilities against other indexes relating to the same phenomenon. One test of external validity can be made by seeing how the differentiation scales relate to levels of urbanization, given the generally accepted high correlation between urbanization and "development."

This test can be done crudely by comparing Guttman scale scores for counties in Standard Metropolitan Statistical Areas (SMSAs) to those in nonmetro counties. However, Hines, Brown and Zimmer developed a more refined classification of counties which has proven useful in discriminating among them in terms of educational levels, labor force participation, family income, migration rates, fertility, and median age of population (16). They first subdivided metropolitan SMSA counties into three categories based on population size in 1970:

- (1) *Large* - metro counties with at least 1 million population
- (2) *Medium* - metro counties with 250,000 to 999,999 population
- (3) *Small* - metro counties with less than 250,000 population.

Similarly, nonmetropolitan counties were subdivided into three categories:

- (1) *Urbanized* - nonmetro counties with at least 20,000 aggregate urban population
- (2) *Less Urbanized* - nonmetro counties with 2,500 to 19,999 aggregate urban population
- (3) *Completely Rural* - nonmetro counties with no urban population.

Metro counties were further classified according to whether they were (1) the "core" county of their respective SMSA, or (2) one of the "fringe" counties in the SMSA.

Table 4 shows the distribution of Guttman scale scores for the retail scale within each of the seven Hines, Brown, and Zimmer urbanization categories. Mean scale scores within categories range from a low of 1.99 for completely rural nonmetropolitan counties to a high of 11.96 for large metro core counties on the 12-item retail scale.<sup>5</sup> Category differences are more striking if median

category scores are considered rather than means.<sup>6</sup> Thus, the structural differentiation scale behaves as expected for rather large aggregates of observation.

The dissimilarities in the category distributions are perhaps best seen in the chart, however, which presents the percentage-scale score distribution of the 3,072 county observations for each major urbanization category in the retail scale.<sup>7</sup>

The metro counties show extremely skewed distributions compared with the nonmetro counties. Furthermore, the medium-sized and large metro distributions are quite similar; the lesser metro counties show a slightly less skewed distribution. However, the three nonmetro categories exhibit extremely dissimilar distributions, supporting the idea that the scale discriminates well among nonmetro counties.

The extreme skewness and larger standard deviations within the metro categories at first glance might seem to indicate a validity problem, as one would generally expect metropolitan counties to cluster tightly at the upper end of the differentiation scale. However, SMSA designations are based on the functional interrelationships among sets of counties, rather than solely on the individual county characteristics.

Thus, counties with predominately rural population characteristics have been included in SMSAs. For example, a county may have a totally rural population (no places of 2,500 or more) and yet be included in an SMSA if 30 percent or more of its labor force commutes to an adjacent core metro county. Once again, the county is not "urban" in character but it depends on a metro county for most of its high-order, commercial functions, as well as much of its basic employment. Thus, some counties with "metro" designations are not necessarily "urban" or "developed." This important difference is of course submerged when simple metro-nonmetro designations are used for inter-county com-

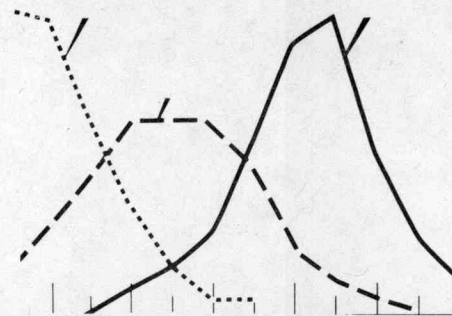
and medium-sized metro counties on the data tape used to produce this table.

<sup>6</sup> The median may be a more meaningful measure of location here as several of the category distributions are highly skewed.

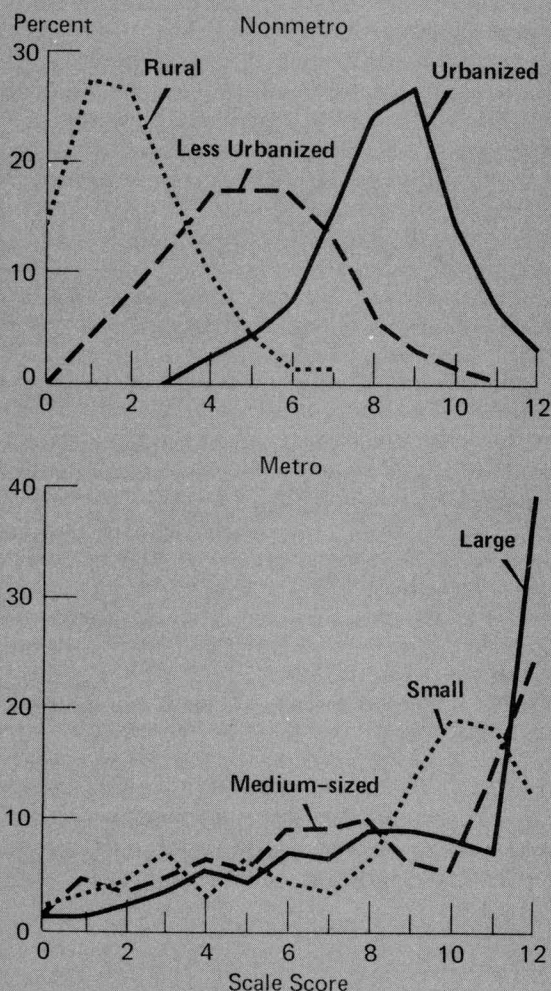
<sup>7</sup> Metro fringe and core counties are not disaggregated in the chart.

<sup>5</sup> Fringe and core were not disaggregated for the small





**Retail Scale Scores of Counties Distributed by Urbanization Categories\***



\*Categories developed by Hines, Fred K., David L. Brown, and John M. Zimmer. *Social and Economic Characteristics of the Population in Metro and Nonmetro Counties, 1970*. Econ. Res. Serv., U.S. Dept. Agr. Econ. Rpt. 272, 1975.

parisons. It is revealed vividly when the differentiation concept is applied through the use of scales such as the one presented here.

The heterogeneity of metro counties can also be seen within the large metro category when fringe and core counties are separated. All but 2 of the 47 core SMSA counties, each having over 1 million in population, scored 12 on the retail scale, which indicates the expected lack of variance and high scores in major metropolitan centers. Yet the 127 fringe counties had scores ranging from 1 through 12. Thus, the variance in scale scores for all metro counties may, in fact, be due to the varying nature of fringe counties and not to error in the scale.

While these results are not in and of themselves conclusive, two salient points emerge. First, the differentiation scale discriminated, as logically expected, across categories of nonmetro counties. These categories were constructed based on degree of urbanization. Second, perhaps more importantly, the differentiation scale discriminated *within* both metro and nonmetro categories. This suggests that the scale reveals a dimension often masked in simple metro-nonmetro or "urbanization" categories, as defined by aggregate population and geographic proximity. Structural differentiation thus appears to be empirically independent of the more traditional demographic measures, yet it exhibits a conceptual, logical relationship to these that enhances its external validity.

## CONCLUSION

It is perhaps too early to make large claims for either the theoretical succinctness of the structural differentiation concept or for the empirical utility of Guttman scales of differentiation. Yet Guttman scales can be constructed which have reasonable validity and discriminate across, as well as within, urbanization categories based on population characteristics. Further refinement and improvement of both the theory and empirical methods outlined here would seem desirable and potentially fruitful.

Refinement should proceed for at least three other variables bound up with the overall concept of development. First, differentiation must be specified as to its relationship to population size and density and their



... if differentiation scales are to be used as social indicators either for research or program purposes, it must be further demonstrated that structural differentiation has some bearing on social well-being or quality of life.

Table 4—Frequency and distribution of retail scale scores by urbanization categories

Scale score	Nonmetro						Metro								United States	
	Rural		Less urban		Urban		Lesser		Medium		Fringe		Core			
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
0	120	14	5	0			3	2	2	1	1	1			131	4.3
1	235	27	52	4			6	3	10	4	1	1			304	9.9
2	221	26	99	8	1	0	7	4	7	3	3	2			338	11.0
3	152	18	159	12	1	0	12	7	10	4	6	5			340	11.1
4	82	10	221	17	6	2	6	3	16	6	8	6			339	11.0
5	31	4	218	17	12	4	11	6	14	5	7	6			293	9.5
6	9	1	223	17	22	7	7	4	22	9	13	10			296	9.6
7	5	1	168	13	49	15	6	3	23	9	10	8			261	8.5
8			77	6	77	24	10	6	25	10	15	12			204	6.6
9			43	3	85	26	23	13	15	6	16	13			182	5.9
10			14	1	45	14	34	19	14	5	14	11			121	3.9
11			1	0	20	6	32	18	37	14	11	9	2	4	103	3.4
12					9	3	21	12	63	24	22	17	45	96	160	5.2
Total	855		1,280		327		178		258		127		47		3,072	100
Mean	1.99		4.98		8.33		8.15		8.21		8.10		11.96		5.19	
S.D.	1.42		2.05		1.71		3.40		3.42		3.02		.20		3.30	
Median	1.33		4.48		7.94		8.91		8.00		7.97		11.48		4.29	

\*Based on work by Hines, Brown, and Zimmer (18).

Note: N = number.

changes. Despite the fact that differentiation and population size and density can be kept conceptually distinct, their empirical interrelationship cannot be ignored. Second, the concept of differentiation must be more carefully articulated as to how it relates to economic growth and the processes of rural development. Is maximum differentiation always desirable? If not, what sort of optimality is desired?

Finally, if differentiation scales are to be used as social indicators either for research or program purposes, it must be further demonstrated that structural differentiation has some bearing on social well-being or quality of life. Part of the success of this enterprise, of course, depends on the development of appropriate indicators of well-being and quality of life as well as improved indexes of differentiation.

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