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Old Wine in New Bottles:
The Utility of Data Reanalysis in the Social Sciences*

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Aphorisms and old wives' tales have fallen by the wayside as the behavioral revolution in the social sciences continues sorting through the mass of contradictory hypotheses and conventional wisdom taught us by past generations. At the same time, however, we are engendering a new crop of conventional "truths" which are based on primitive data handling techniques and which have since been replaced by considerably more sophisticated and powerful routines. We have seen the tedious process of hand computation progressively give way to efficient computer programs borrowed from the natural sciences, and, more recently, to the vast data handling capacities of the new programs written especially for the social sciences.¹

How do old findings stand up under the scrutiny of the new routines? Thus far few of us have attempted to answer this question. Understandably, reanalysis of data is not popular since social scientists often prefer getting out into the field and collecting their own material, focusing on previously unasked questions. Furthermore, book publishers seek material on new, uncharted terrain, shying away from "warmed over" research. At the same time, however, the ever spiraling costs of survey research and the steadily diminishing size of research budgets are realities which we must face. Data banks offer a convenient solution to these problems. In such archives we have stored the equivalent of millions of dollars worth of research costs; they are "banks" in the economic as well as the storage sense of the word. It seems logical, then, to draw on some of that stored capital and subject it to the scrutiny of modern data analysis.

To provide an example of what is being suggested, this research note briefly discusses the results of such reanalysis. The research costs amounted to nothing more than the service charge involved in reproducing a set of archival data on punchcards and the computer time used in the analysis. Obviously, there were no interview costs. Yet despite these minimal expenditures, the payoffs were significant since the published findings of the original researcher, who was working a decade ago without the benefit of the powerful statistical models of the 1970s, were found to be at variance with the findings provided by the reanalysis.

It is important to emphasize at the outset that this paper in no way intends to demean the original research; rather, it is meant to be illustrative of the utility of data reanalysis. The data in question were collected by Robert C. Williamson in Costa Rica in 1960, and the results of the analysis were reported two years later in *Social Forces*.² Williamson investigated social and psychological attitudes of middle and lower class Costa Ricans living in San José, and found that there were statistically significant differences between the two classes.³ Specifically, Williamson found that "the middle class in Central America, more than the lower, is equipped symbolically to react to social change, is more aggressively upward mobile, is possibly better adjusted to reality, and is more positive in outlook to the present and future."⁴ His findings were not at all surprising since they reinforced the al-

*The author wishes to thank Paul Beck, James Malloy, and Michael Margolis for their helpful suggestions on earlier drafts of this paper.

ready well-established notion that attitudes possessed by members of the middle-class in Latin America are, in general, more suitable for modernization than are those of the lower class.⁵

Williamson's analysis relies completely upon statistically significant (Chi-square) differences between the two classes. The data reanalysis began by examining these differences for strength of relationship. Although statistical significance tells the researcher that the differences obtained in the survey are larger than those which would be expected if there were no difference in the population, it does not make any statement about the *strength* of relationship between the variables. Thus, while a statistically significant relationship may emerge, especially as the sample size becomes fairly large, the relationship may prove to be so weak as to make it largely devoid of *theoretical* significance. Unfortunately, much of the conventional wisdom upon which the new empirical social sciences are based has been derived from tests of statistical significance unaccompanied by measures of the strength of relationship. Williamson's article provides a good example of this. He reports that 36 out of 46 relationships are statistically significant, leaving the reader with the impression that there are striking differences between the lower and middle classes in San José. Yet an examination of the strength of relationship reveals a different picture. Replicating the Williamson study, this time examining the strength of relationship, we find that the majority of the 36 statistically significant relationships demonstrate (Tau-*b*) correlations of .19 or lower, and that only three of the 36 are higher than .32.⁶

Since the complete data set is available on punchcards, the reanalysis of Williamson's study can go beyond simply computing the correlation coefficients based on the summary tables reported in the article. With the raw data at hand, we can correct some of the weaknesses present in the original analysis and in so doing apply more sophisticated statistical models to the data. Two of the most glaring weaknesses in the original analysis are discussed here and are eliminated in the reanalysis.

First, the method used in categorizing respondents into classes in the original analysis was faulty. Williamson started out his analysis by dividing the respondents into two classes, and then proceeded to cross-tabulate attitudes with these classes.⁷ However, he does not make clear the precise standards he employed in making the categorization of classes. We do not know exactly what level of occupation, education, residence and style of living the respondent had to achieve in order to be considered "middle class." Furthermore, we do not know how Williamson classified ambiguous cases (e.g., the individual with little formal education holding a white-collar job). In the reanalysis, Williamson's coding categories of lower and middle class were ignored, and in their place were substituted six indicators of socioeconomic status (SES). These indicators (urban or rural background, quality of housing, home sanitation facilities, number of children, monthly family income, and weekly frequency of eating meat) not only offer much more refined and objective measures of SES than does the simple two-class typology, but also enable the investigator to place the respondents along a continuum of lower-to-middle class without having to create an arbitrary and perhaps artificial cutting point between the classes.

The second weakness in the original analysis involves the question of level of measurement. Because his analysis did not go beyond the cross-tabulation technique, Williamson treated his data as if they were all at the nominal level of measurement. In fact, much of the data he collected are of a higher level of measurement (ordinal and interval); thus he needlessly "threw away" much valuable information. In the reanalysis full advantage is taken of the data by using higher level measures of association whenever appropriate.

The reanalysis of the data set proceeds in two stages, beginning with a look at the variables which form ordinal scales, and then moving to a higher level of measurement, with attention focused on the interval level data. The first set of correlations is presented in Table 1.⁸ In this table seven different attitudinal (i.e., dependent) variables are correlated with six indicators of SES. Examination of the table reveals a very weak strength of relationship between SES and attitudes: of the 42 Tau-b's reported, only eight are higher than .20, with the highest correlation reading .36. Yet the correlations reported in Table 1 will

Table 1
SES and Attitudes in Urban Costa Rica:
Nominal and Ordinal Data

	Confides with mate	Visits of children with godparents	Church attendance: husband	Church attendance: wife	Frequency of confession	Participation in voluntary associations	Occupational satisfaction of husband	N (varies due to non-response)
Level of statistical significance (X^2) reported by Williamson	<.05	<.02	ns	<.01	<.20	<.001	<.001	245*
Social background of respondent (urban or rural)	-.01	-.14	-.13	.14	.09	.05	.11	99-214
Quality of housing	.09	-.09	.02	-.16	.09	.04	.23 (<.005)	99-214
Home sanitation facilities	.15	-.02	-.04	-.16 (<.02)	.03	.27 (<.005)	.34 (<.001)	102-216
Number of children	.01	.01	-.02	.00	-.05	.03	-.00	102-214
Monthly family income	.21	-.13	.02	-.15	.14	.36 (<.05)	.23	99-204
Weekly frequency of eating meat	.14 (<.001)	-.19 (<.01)	-.02	-.16 (<.05)	.06	.32	.21 (<.02)	102-215

Correlations are all Tau-b's. Numbers in parentheses are Chi-square levels of statistical significance at the 0.5 level or better.

*Variations in non-response are not reported. N of 245 indicates total sample size reported by Williamson. This table is based upon the archival data set which contains an N of 222.

not tell the researcher anything about the broader population of San José from which the random sample was drawn, unless he applies a test of statistical significance. Applying the Chi-square test of significance we find that only nine of the 42 correlations are statistically significant at the .05 level or better. Of these nine, three are not in the predicted direction. Williamson, on the other hand, reported that six of the seven variables listed in Table 1 were statistically significant when cross-tabulated with lower and middle classes, leaving one with the impression that on these dimensions the classes have clearly distinguishable attitudes.⁹

The ordinal data presented in Table 1 are not very impressive in terms of strength of relationship since Tau-b's on the order of .20 and .30 are weak. There are those who would challenge this view, holding that such correlations are not low but moderate. The question of "weak" or "moderate" is a difficult one to answer, especially in light of the recent controversy over the interpretation of ordinal measures of association. Costner has argued that a measure of association should have a proportional-reduction-in-error interpretation (P-R-E) in order to be meaningful, and therefore urges the use of Gamma. Wilson, on the other hand, has shown that Tau-b also has a P-R-E interpretation and concludes that neither Gamma nor Tau-b is "structurally analogous to the models used for interval variables. . . ."¹⁰ In order to avoid the dilemma posed by this controversy, it would be better to turn to the interval level measures which can be clearly interpreted by examining explained variance.¹¹

The analysis of the data which can be analyzed with interval level statistics reveals a pattern which is substantially similar to the ordinal data analysis presented above. In Table 2 seven different attitudinal variables are correlated with the SES indicators used in Table 1. Almost all of the Pearson r's are quite low and, with the exception of a few cases to be discussed shortly, explained variance stays well below 10 percent.¹²

Table 2
SES and Attitudes in Urban Costa Rica:
Interval Data

	Husband's approval of birth control	Wife's approval of birth control	Marriage of interviewee: civil or consensual union	Residential mobility	Travel outside the city	Number of intimate friends	Approval of classes in Central America	N(varies due to non-response)
Level of statistical significance (X^2) reported by Williamson	<.001	>.01	<.001	<.01	<.001	<.05	<.05	245*
Social background of respondent (urban or rural)	.07	-.01	.32 (<.001)	-.05	.04	.06	.03	163-210
Quality of housing	.01	-.06	.34 (<.001)	-.06	.14 (<.05)	-.13	.06	162-210
Home sanitation facilities	.16 (<.05)	.20 (<.01)	.28 (<.001)	.09	.29 (<.001)	-.00	-.07	160-209
Number of children	.09	.19 (<.01)	.03	.07	.08	-.07	-.01	163-214
Monthly family income	.24 (<.01)	.18 (<.05)	.26 (<.001)	-.14 (<.05)	.35 (<.001)	-.18 (<.05)	-.10	158-190
Weekly frequency of eating meat	.22 (<.01)	.14	.45 (<.001)	-.12	.36 (<.001)	-.08	-.06	163-203

Correlations are all Pearson r's. Numbers in parentheses are T-Test level of statistical significance of .05 or better.

*Variations in non-response are not reported. N of 245 indicates total sample size reported by Williamson. This table is based upon the archival data set which contains an N of 222.

Until this point in the analysis one is struck by the fact that, contrary to expectation, the relationships between attitudes and SES are weak. It would appear that SES differences do not result in strong attitudinal differences in urban Costa Rica. If true, Costa Rica would surely stand out as an exception to the general rule in Latin America. Yet, before this conclusion can be firmly asserted, a final step in the analysis needs to be taken. The independent examination of each SES indicator alone may have deflated the correlations since class is based on a *combination* of indicators (income, background, housing quality, etc., and others not measured in this study) rather than on each one taken by itself. This would imply that all the SES indicators reported here, acting together, might produce a stronger predictor of attitudes than any one indicator acting alone. Multiple correlation coefficients can be used to test this hypothesis by examining the combined effect of all six SES indicators on each attitudinal variable.¹³ The results, which are presented in Table 3, substantiate this hypothesis. In every case the combined SES indicators produce a higher correlation (and thereby explain more of the variance) than any single SES indicator acting alone. Yet, with all six indicators working together to predict attitudes, we still find low

Table 3
Combined SES Indices and Attitudes:
Multiple Correlation Coefficients

	Husband's approval of birth control	Wife's approval of birth control	Marriage of inter- viewee: civil or con- sensual union	Residential mobility	Travel outside the city	Number of intimate friends	Approval of classes in Central America
Combined SES indices (Multiple correlation coefficients)	.30	.33	.54	.18	.44	.25	.12
Percent of explained variance	9	11	29	3	19	6	1
Level of statistical significance (F ratio)	<.01	<.01	<.001	ns	<.001	<.05	ns

N = 222 (varies due to non-response)

multiple correlations in most instances. Of the seven independent variables considered, five yield statistically significant correlations. Only three of these, however, can explain more than 10 percent of the variance, using the combined effects of the six indicators. Thus, even when SES indicators are combined, they end up explaining a very small portion of the total variance.

The two moderately high correlation coefficients should be examined in more detail. The combined SES indicators explain 20 percent of the variance of "travel outside the city," which refers to the frequency of trips of over 30 miles from home, and 29 percent of the variance in "civil vs. consensual union marriages." But the interpretation of these correlations does not necessarily support the view that lower and middle classes differ greatly in

their attitudes since it is not clear if more travel and civil marriages really represent modern attitudes or if they merely reflect the respondents' economic position, since both these variables involve financial expenditures beyond the means of many low-income individuals.

The overall conclusion we can draw from this reanalysis is that the hypothesized attitudinal differences based on class are nowhere as strong as the original study suggests. Attitudes on such things as birth control, medical practice, chaperonage, godparentage, church attendance, confession, number of intimate friends, participation in voluntary associations, approval of classes in Central America, and occupational satisfaction of husband are all highly similar in the lower and middle SES groups. Contrary to the commonly held belief that the middle class distinguishes itself by its modern attitudes, we find a strong homogeneity of values which cut across lower and middle class lines in urban Costa Rica. This finding suggests that other data on attitudinal differences between classes in Latin America must be reexamined with more powerful research tools. At the very least, we should insist that researchers report the strength of relationship as well as levels of significance when presenting their findings. We have too long been lulled into accepting statistical significance as theoretical significance.

NOTES

1. The Inter-University Consortium for Political Research, for example, has developed the OSIRIS II package which can handle upwards of 75 variables at one time. (See Michael Margolis, "OSIRIS and SPSS: New Computer Packages for the Analysis of Social Science Data," *Historical Methods Newsletter* 3 [(March, 1970)], 15-18). The OSIRIS II package implemented on the University of Pittsburgh's IBM 360 system was used in the data analysis presented below.

2. Robert C. Williamson, "Some Variables of Middle and Lower Class in Two Central American Cities," *Social Forces* 41 (December, 1962), 195-207.

3. Williamson's article refers to data collected in El Salvador as well as in Costa Rica. In this research note, however, only the data on Costa Rica are examined. The data set was supplied by the International Data Library and Reference Service, of the University of California at Berkeley.

4. Williamson, "Some Variables of Middle and Lower Class," 207.

5. John J. Johnson, *Political Change in Latin America, The Emergence of the Middle Sectors* (Stanford: Stanford University Press, 1958). In a much more recent article Williamson employs the same data analysis techniques criticized in this paper. Not surprisingly he comes to similar conclusions regarding the "greater receptivity to social change on the part of the middle as opposed to the lower class." (Williamson, "Social Class, Mobility and Modernism: Chileans and Social Change," *Sociology and Social Research* 56 (January, 1972), 149-163.

6. This replication is based on the tables presented in Williamson, "Some Variables of Middle and Lower Class," 198-205.

7. Actually, Williamson first divided the respondents into five classes (lower-lower, lower, upper-lower, lower-middle and middle), but in the article he collapses these five into two (lower and middle). He recognized the existence of an upper class in Costa Rica, but for a number of practical considerations he decided not to conduct the survey in upper class neighborhoods.

8. All of the questions reported in the original article are not dealt with here; rather, one or two principle questions from each dimension Williamson considered have been examined. This limitation was made necessary by space considerations. It should be noted that Williamson's article reports an N of 245 (109 middle-class and 136 lower-class) while the archival data set provides only 222 respondents for the urban sample. Perhaps the original article contains a misprint or some of the cases were inadvertently deleted in the preparation of the archival data set and codebook. The reader is referred to Williamson, "Some Variables of Middle and Lower Class," for details of the questions, survey methods and sample.

9. Although Williamson reports that the relationship between husband's church attendance and class was not statistically significant, it is included here since *both* spouses' attitudes on birth control are examined (See Table 2).

10. Thomas P. Wilson, "A Proportional-Reduction-in-Error Interpretation for Kendall's Tau-b," *Social Forces* 47 (March, 1969), 342.

11. A number of the variables reported in Table 2 (e.g., the yes/no variables), as well as some of the indicators of SES, are not considered by some to be interval level measures. Yet, it has become common practice of late to assume an interval level of measurement for such "dummy variables" in order to be able to apply the more powerful product-moment statistic. One recent example of this, focusing on class, is Robert W. Hodge and Donald J. Treiman, "Class Identification in the United States," *American Journal of Sociology* 73 (March, 1968), 535-547. All variables reported here were analyzed both as ordinal measures and as interval measures; however, the differences in the strength of relationship were only minor.

12. The Pearson r model assumes that the population relationship is linear. Scatterplots prepared by the OSIRIS II package for these data demonstrated that there was no significant departure from linearity.

13. Multiple correlation coefficients should not be computed when the independent variables are highly correlated with each other (Multicollinearity) since the independent contribution of each variable is meaningless. In order to guard against committing this error, the six indicators of SES were correlated with each other. It was found that at best the correlations reach .05, thereby encouraging the use of the multiple correlation coefficient. This lack of strong correlation between the indicators demonstrates that each one was measuring a somewhat different aspect of SES, thereby further discouraging the gross division of classes as presented in the Williamson study.

A Rejoinder by Professor Williamson

Mr. Seligson's processing of my data concerning social class variables in lower and middle class samples in Costa Rica is most welcome. The original study should be viewed in the context of more than a decade ago when almost no quantitative analysis of social class in Latin America was available. As reported in my article, the study was to be considered as an "expanded pilot study" in which samples of lower and middle class residents of San Salvador and San José were interviewed according to a schedule focused on given behaviors and attitudes. The study was completed on a small budget as provided by a Social Science Research Council summer grant and the data were analyzed by the computer processing current in 1960. It is valuable to have Seligson's reanalysis using more sophisticated techniques (although sometimes one wonders what happens to a deck of cards in filing drawers as they move from one university or another, especially when the N of 245 becomes 222!)

It is in order to comment on two central points raised by this inquiry. For one, Seligson proceeds by using specific indicators of socioeconomic status, whereas I chose to divide the respondents into two social classes for the purpose of testing several hypotheses. As Seligson notes, the class identification of arbitrary or borderline cases had to be resolved by the interviewers and myself, but this procedure is not unusual in stratification studies. Indeed, it is difficult to use a totally quantitative approach to social class in any culture. However, I would agree that Seligson's ordinal analysis is more a gain than a loss.

The second point concerns the strength of relationship and whether theoretical significance can be inferred from the data. Unquestionably, Seligson's use of "interval level measures" is of value in pinpointing the structure of the statistical relationship. Although the class differences revealed in the multiple correlation coefficients in Table 3 are not

high by his criteria, I would question the implication that we should deny theoretical significance to these findings. It is an unresolved question as to the point at which theoretical significance begins. In both his and my tests a class pattern is found. Moreover, as I indicated in the article, class differences were less conspicuous in Costa Rica than in El Salvador, or presumably in most parts of Latin America.

My purpose in the study was to explore the use of class variables in the empirical analysis of given data. I would add that historical traditions within Latin American cultures along with national and regional subcultures can be more critical than social class. In other words, there appears to be no fundamental difference between Seligson and myself in our views of the effect of social class. Certainly it is helpful to have investigators rework older data for the purpose of refining statistical relationships.

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