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THE SUBCULTURE OF VIOLENCE THESIS

An Example of a Simultaneous Equation Model in Sociology

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ABSTRACT

This paper examines the subculture of violence thesis (Wolfgang, 1958) as an example of a sociological theory with a feedback process. The thesis is operationalized in a simultaneous equation model, which is solved through a technique which uses only a "canned" ordinary least squares computer program. The findings do not support the subculture of violence thesis.

SIMULTANEOUS EQUATION MODELS IN SOCIOLOGY:

AN EXEMPLARY INVESTIGATION OF THE SUBCULTURE OF VIOLENCE THESIS

Introduction

Many propositions and hypotheses in sociology explicitly or implicitly hold that two or more variables are related in a way such that each variable "causes" the other ones. Two kinds of theory are particularly fruitful of such propositions. Social systems theories are likely to be explicit about the mutual causation implied in their hypotheses, for it is exactly from such feedbacks that the adjusting, self governing, and "functional" aspects of the systems notions derive. Interaction theories which assume individual A influences individual B and *vice versa* are another class of theories which involve feedback ideas.

Although mathematical models have been developed which incorporate feedback mechanisms in both the system and the interaction tradition (Coleman, 1964, especially Chapters 3, 6, and 9) there is only a modest, but growing, literature which applies them to specific empirical problems. (For examples of that literature see Duncan, Haller and Portes, 1968; Mason and Hatler, 1968; Hauser, 1971, 72; Henry and Hummon, 1971; Land, 1971; Woelfel and Haller, 1971; Anderson, 1973; Kohn and Schooler, 1973; Beaver, 1974; Beck, 1974; Hout and Morgan, 1975; Williams, 1976.) We believe that the growth of this literature is, in part, hampered by uncertainty about how to handle the estimation problem for the necessary simultaneous equations. This paper presents an example of a theory which seems to us to require investigation *via* simultaneous equations and provides an example of how to use two stage least squares procedures to estimate parameters.

Econometricians regard the two stage least squares estimation procedures as an effective tool. It seems particularly well suited to use by those of us who are newly exploring such models for two reasons. First, estimation can, in a pinch, be accomplished using regression programs for ordinary least squares which include a "transformation of variables" part. Second, problems of identification can arise in less than obvious ways in models of this kind and two stage least squares procedures give a clear indication when such problems are present.

In this paper we explore the applicability of the simultaneous equation technique to a problem in the subcultural explanation of deviant behavior. Although subcultural theory does not directly fit into the perspective of social systems theory or of social interaction, it has some characteristics of both. Behavior defined as deviant by a dominant culture is seen as being encouraged and even required by a subculture. The subculture is seen as enforcing its norms at least in part through interpersonal processes, or "interactions," in which support or sanction for behavior is given. This feedback may then be seen as affecting the frequency with which the behavior takes place. The process we have in mind can perhaps best be understood through our example.

Violence and Peer Esteem: An Exploration of Simultaneities

Of the many explorations of adult interpersonal violence (which may be defined as acts of physical aggression directed at persons, excluding acts under the *aegis* of, or directed against, political, parental, or other authority), one which has received a great deal of attention in both the scholarly and popular literature is the "Subculture of Violence Thesis" of Wolfgang (1958) and Wolfgang and Ferracuti (1967). This thesis holds that violence emerges from normal interpersonal processes among peers in certain groups, and that within these groups violent behavior is often positively rather than negatively sanctioned. Response to provocation is the norm, and a person who regularly declines to fight is said to be likely to be ostracized. Wolfgang and his colleagues have not had data on the distribution of values relating to adult interpersonal violence in the United States, but relying on official data on violent crime they have inferred that the demographic groups with the "most intense" subculture of violence would be males, non-whites, persons in the lower and working classes, and young adults.

A previous paper has examined this thesis in part by looking at the relationship between a man's fist fighting with other men and his perceived respect by others. Given Wolfgang and Ferracuti's emphasis on peer enforced conformity, Erlanger (1974) argued that within the subcultural group persons who adhered to the subcultural values would be more likely than those who did not to be liked, respected, and accorded high status. But regression analysis showed a zero or slightly <u>negative</u> relationship between fist fighting and perceived respect in samples of both poor and non-poor black men in Milwaukee,[1] and this finding was taken as evidence against the subcultural thesis.

However, an important objection can be raised to using the value of the simple regression coefficient to test the subcultural thesis. While it seems clear that the hypothesis requires that fighting cause respect, it also seems clear that it requires that people lacking in respect use fighting as a means to increase it. Without the proposition of a causal path from lack of respect to fighting, the subcultural thesis cannot account for violent behavior, but only for the degree of respect. Thus the subculture of violence hypothesis may be best specified as a system of equations which contains a simultaneous or feedback relationship.

As presented previously, the regression equation was a model of the form:

$$\text{Model 1:} \quad R = a + bF + e \qquad (1)$$

where R is the response to an item tapping perceived esteem by others,[2] F is the response to an item tapping the frequency with which the respondent gets in "angry fist fights with other men," and e is the error term. A simultaneous model, by contrast, would be of the form:

$$\text{Model 2:} \quad \begin{cases} R = a_1 + b_1F + e_1 & (2) \\ F = a_2 + b_2R + e_2 & (3) \end{cases}$$

If both b_1 and b_2 have the same sign, then model 1 will not give a misleading result, although the coefficients will be inaccurately estimated. But if b_1 and b_2 have <u>opposite</u> signs, then model 1 will "hide" the relationship and may well yield an estimate of zero for b. With respect to the subculture of violence thesis, the most likely possibility of this type would be that $b_1>0$, while $b_2<0$. That is, it may be that increased fighting leads to increased respect by peers, but that as one receives these increments of respect, he has less need to fight again. (Less fighting will then mean less respect which will in turn tend to increase fighting until an equilibrium level is reached.)

Thus, in order to check whether the findings based on model 1 are spurious, model 2 must be estimated.

Estimation of model 2 is impossible because the model is not identified. The device commonly used to identify such equations is to find "instrumental" variables which are thought to directly cause one but not the other of the "endogenous"variables, i.e., the ones directly involved in the feedback relationship. After these instrumental variables are selected, the estimation technique of two stage least squares can be used.

Choosing the instrumental variables is an important decision. Variables so chosen must belong in the model in the sense that they must really have a direct effect on the endogenous variables for which no effect is claimed. The stronger the direct effect the better. Finding such variables is often very difficult. To provide an instrumental variable for the equation which predicts respect, we have added a variable indicating the darkness of black respondents' skin color. Numerous studies indicate that for blacks lighter skin color tends to engender greater respect. There is, however, no evidence in the literature to suggest that skin color directly causes fighting behavior. Thus, the first of our equations becomes:

$$R = a_1 + b_1F + b_2S + e_1 \tag{4}$$

To the equation which predicts fighting we have chosen to add age as an instrumental variable. It is clear from many studies of violent behavior that there is a strong direct association between age and violence (see, for example, Wolfgang and Ferracuti, 1967; Mulvihill et al., 1969). It is perhaps a more difficult assumption that age is unrelated to respect. It was our substantive judgment that no such relationship exists in the population under study. We shall return to an investigation of this issue subsequently; for the moment, however, we ask the reader to suspend disbelief. Employing age as an instrumental variable, the second equation of our model becomes

$$F = a_2 + b_3R + b_4A + e_2 \tag{5}$$

Estimating the parameter of equations such as those shown in (4) and (5) should not be accomplished by ordinary least squares. Such estimates are biased because the error term is correlated with the endogenous variables which are independent variables in the equation. Thus, if equations (4) and (5) are presumed to hold simultaneously, the error term e_2 correlated with R. This correlation comes about because e_2 "causes" F in equation (5) and by equation (4) F "causes" R. Thus, e_2 indirectly "causes" R and so e_2 and R are correlated. But the ordinary least squares method requires e_2 be uncorrelated with R in order to yield an unbiased estimate of b_3. The method of two stage least squares attempts to purge the endogenous variables of the error term (when they are used as an independent variable) by making an estimate of their value which is uninfluenced by the error term.

In the following paragraphs we shall describe how to compute two stage least squares estimates for the problem at hand. Because the model given in equations (4) and (5) is just identified, the method of indirect least squares would also be applicable. Indirect least squares would be computationally simpler for our problem and yield results which are identical within rounding error to those we present. We choose to exposit and use two stage least squares because, unlike indirect least squares, it is applicable to over identified models as well as just identified ones. (We caution, however, that two stage least squares is not appropriate to models whose identification is achieved from assumptions about correlations among error terms as, for example, in fully recursive models.)

The two stage least squares estimate is computed in the following way. In the first stage, one regresses each endogenous variable on all of the instrumental variables using ordinary least squares. The equations for these regressions, called the reduced form equations, are:

$$R = a_3 + b_5 S + b_6 A + e_3 \tag{6}$$

$$F = a_4 + b_7 S + b_8 A + e_4 \tag{7}$$

From the ordinary least squares estimates for the parameters of the reduced form equations, one generates calculated values for the variables, to wit:

$$\hat{R} = \hat{a}_3 + \hat{b}_5 S + \hat{b}_6 A \tag{8}$$

and

$$\hat{F} = \hat{a}_4 + \hat{b}_7 S + \hat{b}_8 A \tag{9}$$

where carats indicate an estimate. If one is using a "canned" regression program, this transformation to create the new variables $\hat{R}$ and $\hat{F}$ begins the "second stage" of the two stage least squares procedure. To complete this stage one computes ordinary least squares estimates for the "structural" equations but substitutes calculated values (i.e., $\hat{R}$ or $\hat{F}$) for the endogenous variables when they appear as independent variables. Thus, to complete the second stage of a two stage least squares estimate of the parameters of equation (4), one computes ordinary least squares estimates of the parameters of the equation:

$$R = a_1 + b_1 \hat{F} + b_2 S + e_9 \tag{10}$$

and for equation (5):

$$F = a_2 + b_3 \hat{R} + b_4 A + e_{10} \tag{11}$$

These estimates are then taken as estimates of the parameters of equations (4) and (5). (If one actually uses two passes through an ordinary least squares program to estimate these parameters he will find that the structural coefficients are correctly calculated but several other statistics of interest <u>cannot</u> be taken directly from the second stage printout. Perhaps the most serious of these problems is that the variance of the regression coefficients are in error and hence any tests of significance of a difference from zero which may appear are in error. The Appendix describes how these and other useful statistics can be estimated from a third pass of the data.)

The Findings

The previous paper (Erlanger, 1974) analyzed poor (income of less than \$5000) and non-poor (income of \$5000 or more) blacks and poor and non-poor whites separately. Since the earlier findings for poor and non-poor blacks were similar, the two groups are combined in the present analysis in order to increase the N. However, men who were not in blue collar jobs are dropped from the present analysis, yielding an N of 207. Whites could not be included in the present analysis because of the absence of a suitable instrumental variable for respect in the data set.

Table 1 presents the basic correlation matrix, and Table 2 presents coefficients estimated for the reduced form equations (8) and (9). Table 3 presents the two stage least squares estimates of the structural parameters for equations (10) and (11). The model is diagrammed in Figure 1, where both structural and standardized regression coefficients are shown.

Our finding is that fighting has a slight, but negative, influence on respect. This finding is consistent with and a bit stronger than that previously reported. Thus, increased fighting diminishes respect in this simultaneous equation model, rather than increasing it, as predicted by the subculture of violence hypothesis. Further, we find that the coefficient for the path from respect to fighting is not different from zero, and the sign of this coefficient is not in the direction predicted by the hypothesis.

To what extent do these findings depend on our somewhat debatable assumption that age directly influences fighting but not respect? If we allowed age to influence respect, the equation for respect would be under-identified, and hence the coefficients in equations (10) would not be estimable. The assumption of no effect of age on respect, then, is used to identify the equation for respect. Without this assumption, the value of $\hat{F}$ is a linear combination of variables already in the structural equation for R. Thus, the independent variables are colinear and one cannot estimate parameters. (If one gets confused and attempts to compute the second stage regression in that situation, most regression programs produce a reasonably clear error message.)

However, the equation for fighting is identified by the assumption of no direct effect of skin color on fighting. The inclusion of a path from age to respect does not modify this identifying restriction. Thus our finding of a zero effect of respect on fighting is not contingent on the assumption of no effect from age to respect. It is possible, however, that the value and even the sign of the path from fighting to respect would be modified if we relaxed this assumption. Since we have reliably shown that the system of equations is not simultaneous -- having found a zero path from respect to fighting -- we can reestimate the respect equation including age by ordinary least squares, if we are willing to specify that the covariances between the error terms are zero. That equation is given by:

$$R = 3.366 - 167F^{**} - .112S^{**} + .015^{*}A$$

Thus, although the inclusion of age in the equation for respect (and specification of zero covariance between errors) reduces the absolute value of the coefficient for fighting, it remains of the same sign and significantly different from zero.

There are several additional substantive issues which may be raised about the analysis which we would like to comment on briefly.

First, one may ask whether the findings are spurious because of the absence of controls for SES. Potentially, any or all of the four variables reported on could be a proxy for some aspect of SES. This possibility is partially covered by including only blue collar workers in the analysis. However, the procedures outlined have also been repeated, first using income and education as control variables, and then including only men with incomes under five thousand dollars in the analysis. These changes did affect the size of the coefficients (generally reducing them), but did not generate any statistically significant findings different from those presented.

Second, one may ask whether the variable for respondent's skin color should properly be seen as having linear effects, or whether it may have a skewed or curvilinear effect. To examine this possibility the analysis was carried out using a set of dummy variables for skin color, both with and without SES controls. Again, the findings do not affect our conclusion that the reciprocal effects of the subculture of violence thesis are not confirmed.

Finally, the previous paper (Erlanger, 1974) reported on two different indicators of perceived peer esteem, while only one, that tapping perception of "being respected and listened to" is reported on here. Analysis of the other, tapping perception of "being liked and having lots of friends" yielded very similar findings.[4]

Conclusion

In this paper we believe we demonstrate the utility of using simultaneous equations to test hypotheses involving feedback processes and present a straightforward method of obtaining parameter estimates. The particular strength of the technique as we have outlined it is that it can be run on most readily available regression programs and that these programs will fail to give estimates when problems of underidentification are present. In the example explored, we found that the hypothesized feedback relationship did not hold.

The two stage least squares technique does, however, have limitations. Most important, it requires that at least one, and preferably two, instrumental variables be specified. This is often not possible, especially in secondary analysis of data. For example, in the example reported here, for white men no instrumental variable for perceived respect could be specified.

TABLE 1

CORRELATION MATRIX

	(1)	(2)	(3)	(4)
(1) Fighting	---			
(2) Respect	-.17	---		
(3) Age	-.23	.24	---	
(4) Skin Color	.02	-.17	-.19	---

TABLE 2

REDUCED FORM COEFFICIENTS

Dependent Variable	Intercept	Age	Skin Color
Fighting	.974	-.013*	-.012
Respect	3.203	.017*	-.110**

* Significantly different from zero at .05 by a two tailed test

** Significantly different from zero at .05 by a one tailed test

TABLE 3

STRUCTURAL COEFFICIENTS

Dependent Variable	Intercept	Endogenous Variable	Instrumental Variable	Error
Fighting	.624	.109$\hat{R}$	-.015**A	$+e_1$
Respect	4.504	-1.337*$\hat{F}$	-.126*S	$+e_2$

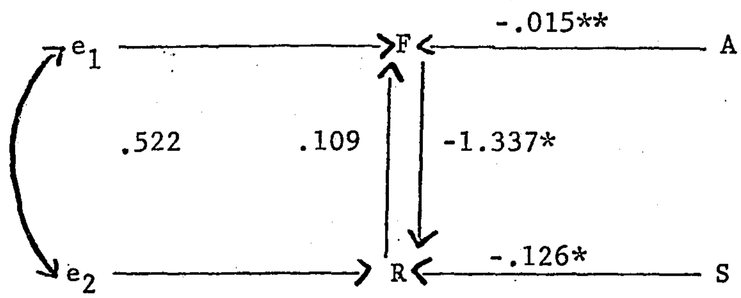
$$r_{e_1e_2} = .522$$

* Significantly different from zero at .05 by a two tailed test

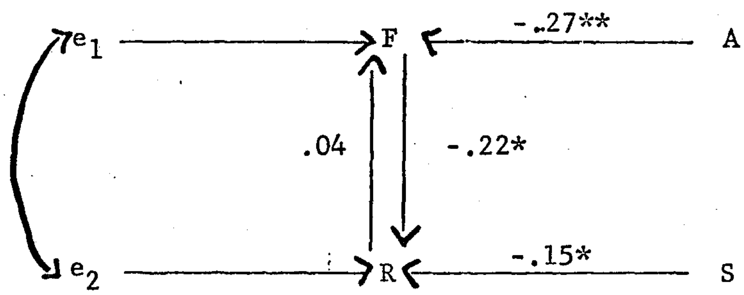
** Significantly different from zero at .05 by a one tailed test.

FIGURE 1

STRUCTURAL COEFFICIENTS



STANDARDIZED REGRESSION COEFFICIENTS



* Significantly different from zero at .05 by a two tailed test

** Significantly different from zero at .05 by a one tailed test

APPENDIX

Using a second pass through an ordinary least squares program in the fashion described above will produce two stage least squares estimates of the structural parameters. However, the error variances estimated by the second pass are appropriate to e_9 and e_{10} but not to e_1 and e_2, the error terms of the structural equation. The reason is clear enough. The variance of, say, e_9 will be estimated by the second pass as:

$$\frac{\Sigma[R - (\hat{a}_1 + \hat{b}_1\hat{F} + \hat{b}_2S)]^2}{N - 3}$$

i.e., it will involve a calculated value of R which uses $\hat{F}$.

To correctly estimate the variance of e_1, however, one should use

$$\frac{\Sigma[R - (\hat{a}_1 + \hat{b}_1F + \hat{b}_2S)]^2}{N - 3}$$

i.e., to use a value of R calculated from the actual value of F rather than $\hat{F}$.

Because the second stage computation estimates the variance of the wrong error term (say e_9 rather than e_1) all the statistics appearing on the second stage printout which involve that estimate of residual variance are also wrong, e.g., the multiple correlation coefficient, the standard deviation of the regression coefficient, and any tests of significance. Adequate estimation of some of these quantities can be made by making a third pass. The third pass does not involve computing regressions, only variances and correlations. In the third pass, compute <u>via</u> the transformation statements the following values for each case:

$$\hat{\hat{R}} = \hat{a}_1 + \hat{b}_1 F + \hat{b}_2 S$$

and

$$\hat{\hat{F}} = \hat{a}_2 + \hat{b}_3 R + \hat{b}_4 A$$

In these equations, $\hat{a}_1$, $\hat{b}_1$, $\hat{b}_2$, $\hat{a}_2$, $\hat{b}_3$, and $\hat{b}_4$ are the estimates made in the second stage of the two stage least squares procedure. Notice that in the equation these parameter estimates are used with the <u>original</u> values of F and R to yield "calculated" values of F and R, here designated $\hat{\hat{F}}$ and $\hat{\hat{R}}$.

In this pass also compute for each case:

$$\hat{e}_1 = R - \hat{\hat{R}}$$

and

$$\hat{e}_2 = F - \hat{\hat{F}}$$

Then, in the "procedure" part of the pass one can make estimates as follows:

1. One can compute the variance of $\hat{e}_1$ and $\hat{e}_2$ and use them as estimates of the variance of e_1 and e_2, making a correction for degrees of freedom.

2. One could compute the zero-order correlation of R and $\hat{\hat{R}}$ and of F and $\hat{\hat{F}}$ and use them as estimates of the multiple correlations, again making corrections for degrees of freedom if desired. A moment's thought, however, will suggest that there are alternative ways of generating the multiple R^2. For example, one could compute

$$1 - \frac{\Sigma \hat{e}_2^{\,2}}{\Sigma (F - \bar{F})^2}$$

which will yield a different quantity. Perhaps the best rule is not to be too concerned about estimating the multiple correlation in these problems.

3. One can compute the correlation between $\hat{e}_1$ and $\hat{e}_2$ and use it as an estimate of the correlation between e_1 and e_2.

Having computed these quantities from the third pass one can correct the variances (and covariances) of the regression coefficients appearing in the second stage printout as follows:

$$(S_b^2)\left(\frac{\hat{S}_e^2}{\hat{\hat{S}}_e^2}\right)$$

where $\hat{S}_e$ is the "standard error of measurement" usually appearing on the second stage printout, S_b^2 is the variance (or covariance) of the regression coefficient appearing in the second stage printout, and $\hat{\hat{S}}_e^2$ is the error variance computed in the third pass of the data.

With a good estimate of S_b one can now proceed with testing.

In the above paragraphs we have described the procedure for two stage least squares regression estimation as though one were going to accomplish the calculations using a "canned" ordinary least squares program such as that available in SPSS. Of course, it would be less expensive and result in less round-off error to use a program which computes the two stage procedure directly. If such a program is not available, however, the above described procedure will work.

FOOTNOTES

[1]The data are from an ongoing study of correlates of self-esteem directed by Russell Middleton (sponsored by the National Science Foundation); we are grateful to him for permission to use them here. The interviews were conducted by the Wisconsin Survey Research Laboratory. An area probability sample for the Milwaukee city limits was used and interviewers and respondents were matched by race.

[2]The indicator for respect in the equations reported on here is "How do you compare with most men you know on being respected and listened to by other people?" The item had a five point forced-choice response, from "much worse" to "much better."

[3]The original paper also employed a control for "social desirability bias" in the responses. Inclusion of this variable in the various analyses also did not affect the conclusion reported here.

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