Forces of Production and Direction

A Test of an Expanded Model of Suicide and Homicide

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This research examines the utility of the stream analogy of lethal violence. Based on frustration/aggression thesis and attribution thesis, expanded integrated models of total lethal violence and the suicide-homicide ratio are proposed. Using updated cross-national data, the results of regression analysis indicate that income inequality and economic development remain to be the predictors for the direction of lethal violence expressed as suicide, as the stream analogy predicts, after the divorce rate and unemployment rate are controlled for. The authors' data also reveal that the divorce rate greatly increases the total amount of violence but does not influence the percentage of lethal violence that is expressed as suicide over homicide.

Keywords: *stream analogy; homicide; suicide; lethal violence; divorce*

The stream analogy of lethal violence has a long theoretical tradition that depicts homicide and suicide as two alternative currents of a single stream (Gold, 1958; Henry & Short, 1954; Porterfield, 1949; Unnithan, Huff-Corzine, Corzine, & Whitt, 1994; Unnithan & Whitt, 1992; Whitt, 1985; Whitt, Gordon, & Hofley, 1972; Wolfgang & Ferracuti, 1967). This tradition, however, has been overshadowed by the research practice that examines the correlation of

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homicide and suicide separately as criminology and suicidology have become increasingly separate academic events with two academic associations. In recent years, there is a renewed interest in the theoretical and empirical utility of this conceptualization (Fernquist, 2000; Fernquist & Cutright, 1998; Lester & Leenaars, 1998; Stack, 1997; Unnithan et al., 1994; Unnithan & Whitt, 1992; Vollum & Titterington, 2001; Whitt, 1985). Efforts have been made to account for two major dependent variables: (a) forces of production, which measure the size or stream of the combined total of lethal violence (suicide plus homicide), and (b) forces of direction, which measure the proportion of the total lethal violence, expressed either as homicide or as suicide.

According to the stream analogy of lethal violence, homicide and suicide are two different manifestations of the same event: personal violence. In a homicide, the violence is turned outward toward others, whereas in a suicide, the violence is turned inward to oneself. Stream analogy provides a more comprehensive explanation of the circumstances when personal violence is more likely to turn outward as a homicide or to turn inward as a suicide. Relying on cross-national data, empirical tests of this explanation have identified two major factors, income inequality and economic development, that may predict the total amount of lethal violence and the manner in which lethal violence is expressed. Findings from previous research, however, are equivocal regarding the relationship between the total volume of lethal violence and economic development but are quite consistent regarding the relationship between inequality and preference for lethal violence (Lee & Bankston, 1999; Unnithan et al., 1994; Unnithan & Whitt, 1992). These studies are somewhat limited because of their data and measures. To increase sample size, some researchers have used data with a time span of more than 20 years in their cross-sectional analyses. Furthermore, quite a few theoretically relevant variables, which have been identified in the study within the stream analogy, are not controlled for. For example, Henry and Short (1954) argued that the dissolution of family weakens one's degree of involvement in social relationships that would result in a negative relationship between suicide and marriage and a positive relationship between homicide and marriage. This important hypothesis has never been explored empirically in the stream analogy of lethal violence with cross-national data.

The current study, therefore, intends to advance our understanding of the stream analogy in three major ways. First, built on the studies by Unnithan and Whitt (1992) and Unnithan et al. (1994), expanded models incorporating more appropriate variables from Henry and Short's (1954) thesis to account for both the total amount of lethal violence (production) and the preference of lethal violence (direction) are proposed. Second, using more recent data, the utility of the stream analogy as an explanation of both homicide and suicide is examined in a cross-national context with improved measures. Third, efforts are made to answer empirically to what extent the diverse forms of lethal violence have a similar etiology.

THEORETICAL BACKGROUND

Historically, Western cultural traditions in religion, language, and law conveyed an image of suicide and homicide as morally, ethically, and legally equivalent (for a thorough discussion of the history of the theory, see Unnithan et al., 1994). Ferri (1883-1884) was considered the first to raise the theoretical linkage of homicide and suicide. The direction (or the choice of homicide over suicide) as well as production of homicide and suicide are both acts of personal violence. The stream of lethal violence represents the combined total of suicide and homicide; each of the two channels that it feeds corresponds to one of these two violent deaths. The production of the stream is the total amount of lethal violence (suicide plus homicide), whereas the direction of it is the proportion of that total volume that is expressed as suicide or homicide. This theoretical viewpoint was later reinforced by a different theoretical tradition on lethal violence. Freud (1917/1961), for example, argued that suicide is an impulse to commit murder turned inward on the self.

In the United States, the viewpoint that homicide and suicide are the same event of different channels has not been very popular, partially because of Durkheim's opposition to the idea and partially because of the academic division of labor between criminology and suicidology. Within the stream analogy tradition, however, predominant interpretations of the forces of production and directions of lethal violence have been largely derived from a

modified neo-Freudian frustration-aggression framework (see Hendin, 1995; Unnithan & Whitt, 1992). Henry and Short (1954) proposed a frustration-aggression thesis to describe suicide and homicide as two mutually related alternative aggressive responses to frustration. They argued that research on homicide is quite incomplete and can be misleading unless suicide is taken into account as an alternative response to life's frustration. Later, this version of the frustration-aggression thesis emerged as one of the earliest integrated lethal violence theories that simultaneously employed sociological, economic, and psychological perspectives (Unnithan et al., 1994).

In particular, Henry and Short (1954) suggested that suicide and homicide could be viewed as two different forms of aggression that arise from the same source and "respond in a consistent way to frustrations generated by economic forces" (p. 15). They proposed that the loss of status as a function of business contractions during the economic cycle could be treated as an objective source of frustration, thus a possible force of the production of lethal violence. They introduced a correlate of lethal violence called "the strength of relational system." It is believed that this system is able to predict the manner in which an individual expresses aggression. A "relational system," according to Henry and Short, is a variable conceptualized to reflect a person's degree of social relationship with the others. Such a system could be measured by including elements such as marital status and ecological distribution. Specifically, there should be a negative relationship between suicide and strength of the relational system, and there should be a positive relationship between homicide and the strength of the relational system.

Over the years, the stream analogy garnered less attention than most theories that attempted to explain suicide or homicide in isolation (see Unnithan et al., 1994, for detailed discussion). There have been only a few empirical studies that have simultaneously considered both the amount and direction of lethal violence (Fernquist & Cutright, 1998; Lester, 1996; Lester & Leenaars, 1998; Stack, 1997; Unnithan, 1983; Unnithan et al., 1994; Unnithan & Whitt, 1992; Whitt et al., 1972). Nevertheless, some evidence has been found in support of the stream analogy of lethal violence. Unnithan and Whitt (1992) and Unnithan et al. (1994) provided two more recent tests of the stream analogy at the cross-national

level. They proposed a modified version of an integrated model of suicide and homicide by incorporating attribution theory into Henry and Short's thesis of frustration-aggression. According to this thesis, persons and groups faced with frustration will choose suicide to the extent that they attribute the cause of their problems to themselves and to the extent that they are depressed and feel helpless. Other individuals and groups will opt for homicide if they tend to attribute the cause of their problems to others and to the extent that they feel angry as opposed to depressed. Income inequality and economic development are the two major constructs they used to explain both the total amount and the direction of lethal violence. They tested the hypotheses that (a) greater income inequality raises the level of "systemic frustration for a substantial proportion of the population" and thus increases the size of the stream of violence and (b) income inequality diverts blame away from oneself and therefore decreases the proportion of violence expressed as suicide (Unnithan et al., 1994; Unnithan & Whitt, 1992).

Unnithan and Whitt (1992) also tested the hypothesis that "economic development channels blame for frustration inward, with lethal violence increasingly expressed as suicide" (p. 186). They made no prediction about the relationship between economic development and the total amount of lethal violence. They also suspected that the contradicting influence of economic development on suicide and homicide might produce a relatively constant amount of total violence.

The results of multivariate regression analyses (Unnithan et al., 1994; Unnithan & Whitt, 1992) using cross-national data support their hypotheses of the relationships between inequality and development and the tendency of suicide over homicide but not the relationships between inequality or development and total lethal violence. In addition, they found a significant curvilinear relationship between inequality and the proportion of lethal violence expressed as suicide. Their study only offers a partial support for stream analysis. Their data and their statistical models, however, weaken their findings. Their cross-sectional analyses contain the national data with a time span as far apart as 20 years. Under this design, the temporal ordering may be violated, or confused to say the least. There are only two independent variables in their model, which may result in biased estimates because of

omitted-variable bias. Gujarati (1992) demonstrated conclusively that excluding a relevant variable will result in biased and inconsistent coefficients, incorrectly estimated error variance, biased standard errors of estimators, and invalid hypothesis-testing procedure.

Furthermore, Unnithan and Whitt (1992) and Unnithan et al. (1994) relied on Henry and Short's (1954) thesis of frustration-aggression as a theoretical beginning point, but Henry and Short's thesis is largely buried in their attribution theory. Their data do not include the key variables of Henry and Short's thesis, such as divorce and unemployment. As a result, it is not certain whether their findings are spurious or not. Estimates based on comprehensive models are less likely to be biased and are more solid (Cao, Deng, & Barton, 2000; Johnston, 1984).

The present study attempts to address some of the weaknesses found in previous studies. Our proposed model is tested with macro-level data. Our study contributes to the literature in several ways. First, our proposed integrated model includes not only the variables from Unnithan and Whitt (1992) and Unnithan et al. (1994) but also, more important, the variables derived directly from Henry and Short's (1954) thesis. Two such new variables are identified in our data: the divorce rate and the unemployment rate. As discussed earlier, results from more comprehensive models are considered less biased and more generalizable. Second, the data are updated in our analysis. This updating is meaningful because of the importance of historical contingency in the study of social relationships (Carlson & Michalowski, 1997). It is also meaningful because of our use of a different measure of income inequality—Gini Index—in our model. This measure of income inequality is considered "the best single measure of income inequality" (Morgan, 1962, p. 270). Finally, the effects of missing data in our independent variables are tested and controlled for.

Specifically, the current research tests whether the relationships found in the studies of Unnithan and Whitt (1992) and Unnithan et al. (1994) would remain when divorce and unemployment are controlled for. According to Henry and Short (1954), married persons have presumably stronger relational systems than nonmarried persons. The dissolution of family weakens one's degree of involvement in social relationships. As a result, divorced persons should have higher rates of suicide than

married persons. In turn, the strength of the relational system should lower the risk of suicide but raise the risk of homicide. In the best documented relationship between suicide and divorce, Stack (2000) reported that 78% of all previous empirical studies (132 studies on divorce and suicide from 1880 to 1995, including the cross-sectional research on cities, counties, states, and nations) present a positive impact of divorce on suicide. Time-series research (1950-1985) also shows that a positive relationship between divorce and homicide exists for 7 out of 10 countries, and a positive relationship between divorce and suicide exists for 7 out of 12 nations in their data set (Lester & Yang, 1998). Based on the empirical evidence, our study tests the hypothesis that divorce, in relation to marriage, is positively related to the total lethal violence rates.

Past cross-national studies have yielded inconsistent findings with regard to the relationship between the unemployment rate and the crime rate. Clinard and Abbott's (1973) study of Sweden and Kampala Uganda indicates no significant relationship between unemployment and crime. Krohn's (1976) cross-national analysis involving fewer than 40 nations, on the contrary, found a moderately positive relationship between the unemployment rate and homicide rates. Lester and Yang (1998), using time-series data of 13 nations to test Henry and Short's (1954) proposed relationships between unemployment and suicide and homicide, found a weak trend for suicide rates to rise as the unemployment rate increases and a positive and largely insignificant trend for homicide. Within the United States, the unemployment rate is found to relate to the homicide rate, but this relationship is contingent on the period of economic development (Carlson & Michalowski, 1997). In light of the frustration-aggression hypothesis proposed by Henry and Short, it seems reasonable for us to view unemployment as a source of frustration generated by economic forces. Therefore, it is hypothesized that where the unemployment rate is high, a larger proportion of the population is frustrated and the total amount of lethal violence would likely be high. Because the effect of the unemployment is stronger for suicide than homicide (Lester & Yang, 1998), it is hypothesized that the effect of the unemployment rate would channel more people to choose suicide over homicide.

METHOD

Sample

Data on lethal violence are collected from the reports of the *World Health Statistics Annual* (World Health Organization, 1989-1995). Homicide and suicide rates are selected for the 5-year time period from 1989 to 1993. All countries with at least 1 completed reporting year within this time period on the relevant lethal violence statistics constitute the pool of sample nations (i.e., both homicide and suicide rates for at least 1 year have to be available to be included in the analysis), totaling 64 countries/regions. The majority of countries included in this sample (72% or 46 countries) have complete lethal violence data for 2 to 4 years during this time period. Seven (or about 11%) of these countries have completed data for all 5 years, whereas 11 countries (or 17%) have only 1 year of complete data for both homicide and suicide (see Appendix A for a list of all the countries and the number of years complete data were available for each country[1]).

Countries are the units of analysis in this study. The nature of our sampling procedure may render inappropriate significance tests in analyses, meaning that the results of our significance test should not be applied to the general population of all the nations. Nevertheless, Bennett (1991) and Krahn, Hartnagel, and Gartrell (1986) argued that in such circumstances, the significance test might serve as a criterion to distinguish important from unimportant effects or to decide whether a variable or variables should be included or excluded from a particular statistical model.

Dependent Variables

Based on the stream analogy literature, there are two dependent variables: the lethal violence rate and the suicide-homicide ratio or tendency of suicide over homicide. The lethal violence rate is the sum of a nation's homicide rate per 100,000 populations and its suicide rate per 100,000 populations. The tendency of suicide over homicide is calculated by dividing the suicide rate by its corresponding lethal violence rate in that year or the proportion of suicides in the suicide and homicide total. The lethal violence rate represents the total volume of violence in one nation (production),

whereas the tendency of suicide over homicide refers to the preference of suicide over homicide (direction).

Independent Variables

There are four independent variables in our model. They are income inequality or Gini, economic development or GNP, the divorce rate, and the unemployment rate. First, a new construct—Gini Index—is adopted as our income inequality measure. Past cross-national studies that have incorporated income inequality (Gini Index) were limited to a few available data sources that have not been updated since the 1970s.[2] Given the theoretical importance of income inequality, not only should the measurement of inequality be closely examined, but also an updated set of inequality data is essential to the meticulous analysis of the relationship between lethal violence and income distributions. This study, therefore, introduces a rather different measure of income inequality that makes the maximum use of the easily accessible income distribution data provided by the annual World Development Reports. A new set of Gini coefficients using the latest income distribution data for sample nations and maximizing the points is calculated (see Appendix B for the formula of calculation and the figure illustrating the Lorenz curve).

Second, the GNP per capita is used as our measure of economic development. In their research, Unnithan and Whitt (1992) and Unnithan et al. (1994) also used GNP per capita as an indicator of economic development. The distribution of this measure is, however, highly skewed. To correct the skewed distribution, GNP per capita in each nation is transformed into natural log form. The transformation reduces the effect of outliers and increases the likelihood of bivariate normality.

Third, data on unemployment rates, marriage rates, and divorce rates were taken from the United Nations (1990-1995) *Demographic Yearbook*. Stack (1978) offered a caution on the validity of the unemployment data and pointed out that some nations use sample surveys of the labor force, as in the United States, but others rely on the rate of unemployment restricted to union members, or as recorded by the number of people who show up at

unemployment offices. If we omit this variable in our model because of the incomparable data sources, our model may be accused of underspecification. If this study includes this variable, the worst accusation is a biased estimate. This study decides to risk the latter error.

Finally, a refined measure of divorce rate from the *Demographic Yearbook* (United Nations, 1990-1995) is constructed. Our measure uses the number of divorces per 1,000 population as its numerator and the number of marriages per 1,000 population as its denominator. The original measures were raw because not everyone in the population is at risk of divorce and/or marriage. Those who are younger than legal age for marriage should be excluded from the population base used to calculate either marriage or divorce rates. By combining the two raw measures of divorce and marriage, the proportion of people who are divorced is resulted. This measure also helps mitigate the effect of simultaneous high divorce rate and marriage rate in some nations. By using this variable, it is expected to distinguish the emphasis on the divorce component, which is commonly viewed as generating more distress and frustration and which is more closely tied to the frustration-aggression hypothesis.

Treatment of Missing Values in the Independent Variables

Researchers have long debated the proper method for treating missing values in explanatory variables (Cao & Maume, 1993; Cohen & Cohen, 1975; Donner, 1982; Glasser, 1964). For years, researchers have used a relatively easy treatment by substituting the series mean for the missing values. This procedure is fairly common and has become standard in a variety of statistical analysis packages.

Donner (1982) argued that the coefficient estimations resulting from this procedure tend to be biased if the correlations among the explanatory variables are strong. Such a bias will persist even in larger samples with random patterns of missing data. To deal with the problems of missing data, our independent variables are treated with the "dummy coding plus plugged mean" method proposed by Cohen and Cohen (1975).[3]

RESULTS

Table 1 presents the descriptive summary of all variables in the analysis. The mean level of total lethal violence is 21 deaths per 100,000, and the standard deviation is 15. The mean level of suicide over the total lethal violence is 0.71, and the standard deviation is 0.25. These figures indicate that the distributions of variance in these variables are normal. Occasionally, variables of international data may yield a standard deviation larger than the mean, which means that there is a considerable within-nation variation. Both of our dependent variables seem to have a fair amount of normal variance across the nations.

Appendix C provides the correlation matrix of all the variables, including the four dummy independent variables and the square terms of Gini and GNP. Multicollinearity, however, is a potential problem with ordinary least squares regression analysis at the macro level. Accordingly, the variance inflation factor (VIF) is used to detect whether high collinearity exists between any variables. Some researchers use a VIF score of 4 or greater as an indication of severe multicollinearity (Fisher & Mason, 1981; Judge, Hill, Griffiths, Lutkepohl, & Lee, 1988). Our collinearity statistics shows that none of the VIF values exceeds 3; therefore, multicollinearity is not a problem in our data.

Table 2 presents the results from our expanded models and models with the curvilinear effects of Gini and GNP as controls. The dummy variables of Gini, GNP, and the divorce rate are dropped in our final regression analysis because of their insignificance, meaning whether our analysis includes the missing data will not make a difference. There are four columns in Table 2. Column 1 and column 3 present regression results without curvilinear controls, and column 2 and column 4 provide results with curvilinear controls.

Column 1 presents the complete model of lethal violence without curvilinear controls. It shows that neither income inequality (Gini) nor economic development (GNP) is statistically related to total lethal violence. The unemployment rate is not a significant predictor, either, but its dummy term is significant, meaning that nations with missing unemployment data have significantly lower levels of lethal violence. This effect is quite substantial (–.35). The divorce rate, however, increases total lethal violence. The sign is in

TABLE 1
Descriptive Summary of All Variables in the Models ($N = 64$)

Variable	*Mean*	*Standard Deviation*
Dependent variables		
Lethal violent rate (suicide + homicide)	20.69	14.55
Suicide/(suicide + homicide)	0.71	0.25
Independent variables		
Income inequality (Gini)	0.37	0.07
Economic development (GNP)	8.52	1.19
Unemployment rate (%)	7.98	4.30
Divorce rate	0.27	0.14
$Gini^2$	0.14	0.05
GNP^2	73.91	19.96
Dummy variable (0 = no missing data; 1 = with missing data)		
Gini dummy	0.55	0.50
GNP dummy	0.92	0.27
Unemployment dummy	0.77	0.43
Divorce dummy	0.91	0.29

TABLE 2
Integrated Models of Lethal Violence Rate (LVR) and Suicide-Homicide Ratio (SHR)

	LVR		*SHR*	
Independent Variable	*1*	*2*	*3*	*4*
Gini	.15	.01	–.48*	–.46*
GNP	–.11	–.19	.38*	.36*
Unemployment rate	–.04	–.06	–.11	–.11
Divorce rate	.50*	.54*	.07	.06
Unemployment dummy	–.35*	–.37*	.06	.08
$Gini^2$	—	.22*	—	–.08
GNP^2	—	–.19	—	–.04
Adjusted R^2	.32*	.38*	.54*	.53*
F test	3.49*		.36	

NOTE: Standardized regression coefficients are reported. Column 1 and column 3 present regression results without curvilinear controls, and column 2 and column 4 provide results with curvilinear controls.
*$p < .05$.

the direction predicted by our model. The model explains 32% of the total variance in lethal violence, and most of the explained variance is accounted for by the divorce rate (50%). Other variables contribute relatively small amounts.

Column 3 presents the results of the complete model of suicide preference. Income inequality is negatively related to the tendency of suicide over homicide and economic development positively related. Neither of the two new variables, however, is significant. The unemployment rate dummy is not significant either. The explained variance of the model is 54%, and Gini and GNP are responsible for most of the explained variance.

Column 2 and column 4 present results of regression analysis that controls for the curvilinear functions of Gini and GNP. Diagnostics indicate the presence of multicollinearity when the nonlinear and linear terms of income inequality and economic development are included in the same model. Aiken and West's (1991) mean subtraction method was used and removed serious multicollinearity, rendering the results from Models 2 and 4 valid. It is found that the effect of Gini is curvilinear on the total lethal violence rate. The linear effect of the divorce rate and the unemployment dummy remains. When the curvilinear functions are introduced, there is a significant increase in explained variance of total lethal violence, from 32% to 38%.

Attention turns to column 4. The introduction of curvilinear terms makes no statistical difference because neither Gini squared nor GNP squared are significant. The linear effects of Gini and GNP remain the strongest predictors of the tendency of suicide over homicide. Neither the unemployment rate nor the divorce rate is significant. Finally, a small and insignificant reduction in the total explained variance is observed (from 54% to 53%).

DISCUSSION AND CONCLUSION

To better our understanding of suicide and homicide as different manifestations of the same event, an expanded integrated model of suicide and homicide is developed. Our test of the stream analogy with cross-national data provides some empirical evidence for the theory. It is important to note that this is achieved with a newer measure of income inequality, with a different sample, with more recent data, and with more appropriate statistical model specifications.

First, it is found that the stream analogy is indeed helpful in our understanding of lethal violence. The diverse forms of lethal

violence do share a similar etiology (see Table 2). Out of four independent variables, three of them are found to be significant in predicting either the total lethal violence or the tendency of suicide over homicide, and their signs are all in the direction expected by the theory and empirical research.

Second, similar to what Unnithan and Whitt (1992) and Unnithan et al. (1994) found, our data indicate that income inequality and economic development are not related to lethal violence but are related to the tendency of suicide over homicide. Our results are consistent with their findings regarding the effects of inequality and economic development on the tendency of suicide over homicide. High inequality reduces the tendency to express frustration inwardly against oneself and increases the tendency to express frustration outwardly against other people; to express this differently, high inequality increases the proportion of lethal violence that is expressed as homicide rather than suicide. The economic development increases the tendency to express one's frustration inwardly against oneself and reduces the tendency of expressing one's frustration against others. In other words, the economic development increases the percentage of lethal violence that is expressed as suicide rather than homicide. Like Unnithan and Whitt and Unnithan et al., our results also show that inequality and economic development are not significantly related to the lethal violence rate. This is expected from the stream analogy because one of the assumptions of the stream analogy is that suicide and homicide rates should move in opposite directions. In other words, the total amount of lethal violence (suicide plus homicide) should stay constant in a society.

Third, the divorce rate is an important predictor for the lethal violence, but its effect on the tendency of suicide over homicide is insignificant. This means that Henry and Short's (1954) thesis is partially supported by our data. That is, there is evidence of a negative relationship between suicide and the strength of relational system, but there is no evidence of a positive relationship between homicide and the strength of the relational system. Divorce does not only increase suicide but also increases homicide. Given the evidence from the existing literature (Lester & Yang, 1998) and our own analysis, it seems obvious that divorce increases both suicide and homicide in the contemporary societies of the world. Furthermore, the pressure toward one choice of death over the

other is relatively equal. As a result, the effect of divorce on total violence is very strong, but its effect on preference of suicide over homicide is insignificant. Future study, however, should specify the effect of divorce on males and females separately.

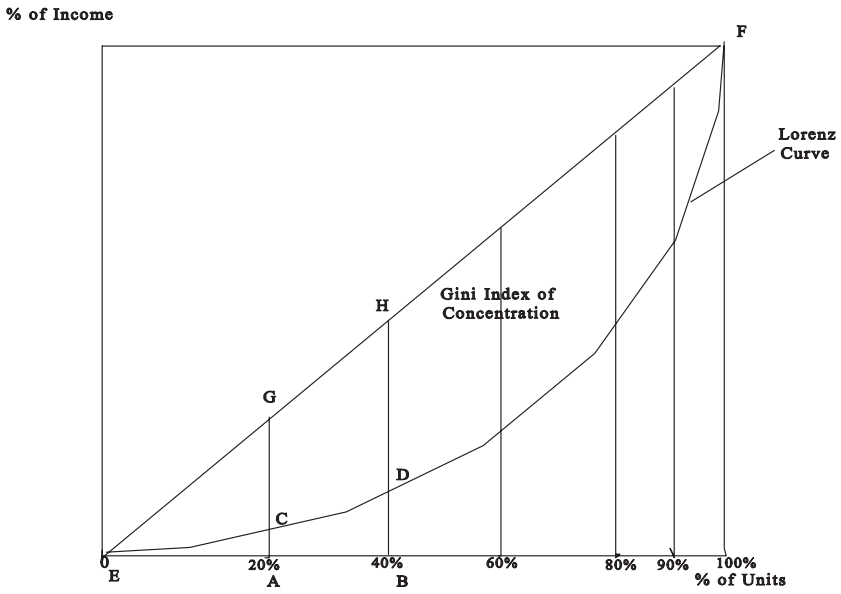
Our findings should be interpreted with caution. Using cross-national data, comparability of data is always a concern. This is particularly so for certain variables more than for others. For example, Stack (1978) pointed out that the unemployment rates in some nations are quite incomparable. As a result, it is important to see our findings on unemployment as tentative and suggestive. Data on other variables, such as homicide and suicide, are not without their own problems. Lester (1996), however, concluded that official statistics from nations of the world were sufficiently reliable and valid so that cross-sectional research was meaningful. Another concern is whether it is sensible to extend a Western theory into nations where the cultures are different. For example, the stream analogy may be seen as largely influenced by Western religion that treats suicide and homicide as equivalent. In nations such as China, where Judaic-Christian influences are quite recent, the applicability of the theory may be limited.[4]

In summary, this research agrees with Unnithan and Whitt (1992) and Unnithan et al. (1994) that the stream analogy has a role to play in future research of lethal violence. Theoretically, it provides unique insight into our understanding of lethal violence. By visualizing homicide and suicide as two channels of a single stream, additional causal patterns of lethal violence can be sought in addition to the traditional approach of viewing homicide and suicide in isolation. Researchers, however, should also note that the phenomena of homicide and suicide are very complex. Some recent studies have shed light on the relationship between gender and causes or direction of lethal violence (Fernquist & Cutright, 1998; Kennedy & Forde, 1999; Vollum & Titterington, 2001). Although it is unfortunate that some researchers ignore the stream analogy, it would be even more unfortunate if researchers restrict themselves by this analogy. Fruitful insight can only be achieved both by relying on the stream analogy and by separate analysis of homicide and suicide.

APPENDIX A
List of Nations (N = 64) and the Number of Years Complete Lethal Violence Data Were Available

Country	*Number of Years*	*Country*	*Number of Years*
1. Albania	2.00	33. Mauritius	2.00
2. Argentina	2.00	34. Mexico	2.00
3. Armenia	4.00	35. Netherlands	3.00
4. Australia	4.00	36. New Zealand	3.00
5. Austria	4.00	37. Nicaragua	1.00
6. Belarus	3.00	38. Norway	3.00
7. Brazil	1.00	39. Poland	4.00
8. Bulgaria	4.00	40. Portugal	4.00
9. Canada	3.00	41. Puerto Rico	3.00
10. China	3.00	42. Russian	5.00
11. Colombia	2.00	43. Singapore	3.00
12. Costa Rica	2.00	44. Slovenia	5.00
13. Czechoslovak	5.00	45. Spain	2.00
14. Denmark	4.00	46. Sweden	3.00
15. Estonia	4.00	47. Switzerland	4.00
16. Finland	3.00	48. Tajikistan	1.00
17. Germany	4.00	49. Trinidad	2.00
18. Greece	4.00	50. Ukraine	4.00
19. Hong Kong	5.00	51. United States	2.00
20. Hungary	4.00	52. Uruguay	2.00
21. Iceland	3.00	53. Uzbekistan	2.00
22. Ireland	3.00	54. Yugoslavia	2.00
23. Israel	3.00	55. France	3.00
24. Italy	2.00	56. United Kingdom	3.00
25. Japan	4.00	57. Belgium	1.00
26. Kazakhstan	5.00	58. Romania	2.00
27. Korea Republic	1.00	59. Macau	1.00
28. Kyrgyzstan	2.00	60. Venezuela	1.00
29. Latvia	5.00	61. Chile	1.00
30. Lithuania	5.00	62. Ecuador	1.00
31. Luxembourg	2.00	63. Panama	1.00
32. Malta	3.00	64. El Salvador	1.00

APPENDIX B
Lorenz Curve and Gini Index Estimation



The Gini is actually the proportion of the triangular area on a Lorenz diagram that falls between the Lorenz curve and the diagonal (EF). The diagonal indicates a perfect equality. The closer the Lorenz curve to the diagonal, the less the inequality. The larger the proportion between the diagonal and the Lorenz curve, the more the inequality. Our Gini coefficient is estimated by using the following formula:

$$\text{Gini} \approx 1 - \Sigma\,(\text{BE} - \text{AE})(\text{CA} + \text{DB}).$$

Theoretically speaking, Gini coefficient ranges from 0 (*perfect equality*) to 1 (*perfect inequality*).

APPENDIX C
Correlation Matrix of All Variables in the Analysis

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1. Lethal violence rate	1.00											
2. Suicide-homicide ratio	–.23	1.00										
3. Gini	.07	–.63*	1.00									
4. Gini dummy	–.05	.13	.00	1.00								
5. GNP	–.14	.60*	–.35*	.33*	1.00							
6. GNP dummy	.10	–.10	.00	.32*	–.14	1.00						
7. Unemployment rate	–.05	–.08	–.10	–.08	–.03	.29*	1.00					
8. Unemployment dummy	–.40*	.26*	–.05	.39*	–.44*	–.02	.00	1.00				
9. Divorce rate	.41*	.34*	–.27*	.05	–.36*	.02	–.01	.01	1.00			
10. Divorce dummy	–.09	.15	–.17	.03	.24	.11	–.02	–.05	.00	1.00		
11. $Gini^2$	.07	–.33*	.46*	–.43*	–.13	.14	–.01	.17	–.25*	–.02	1.00	
12. GNP^2	–.14	–.10	–.07	–.19	–.26*	.21	–.03	–.05	–.01	–.26*	–.06	1.00

*$p < .05$.

NOTES

1. Researchers have used data based on a 5-year period (Avison & Loring, 1986; LaFree & Kick, 1986) or 6-year period (McDonald, 1976; Messner, 1989). The present study agrees with Menard's (1986) suggestion of not using observations more than 5 years apart.

2. These data sources mainly include Bornschier and Ballmer-Cao's (1979) study of income inequality, Jain (1975), Paukert (1973), and Taylor and Hudson (1972).

3. Cohen and Cohen (1975) used a "dummy coding plus plugged mean" method for treating missing data. They suggested that missing observations in an independent variable can be treated by substituting the mean of the series, along with a dichotomously coded dummy variable, into the regression model. They claimed that this strategy "segregates the missing data effect from those of known groups, leaving their regression coefficients a function only of present data, while capitalizing on the total *n* for statistical power in significance tests" (pp. 285-286).

4. In our sample, only 3 countries/regions (i.e., China, Korea, and Japan) belong to this category. We decided to keep them in our analysis for the following two reasons. First, none of them are statistical outliers in any sense. Second, although including or excluding them has little impact on the overall patterns of our findings, we argue that their inclusion should be welcomed because these countries/nations represent close to one quarter of the world's population.

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