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An Empirical Assessment of What We Know About Structural Covariates of Homicide Rates: A Return to a Classic 20 Years Later

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Abstract

As the 20-year mark since the publication of an article by Kenneth C. Land, Patricia L. McCall, and Lawrence Cohen, "Structural Covariates of Homicide Rates: Are There Any Invariances Across Time and Social Space?" approaches, the question that these scholars originally posed is raised again: Have researchers been able to identify a set of robust structural covariates that consistently predict crime rates? Subsequent to the publication of this piece, numerous scholars have replicated and extended its conceptual, methodological, and empirical work in various ways—with more than 500 citations to date. In response to this attention, the authors first review the advances made by the Land et al. article. This is followed by a review of findings from studies published over the past 20 years to determine which structural predictors identified in the Land et al. piece continue to be prominent in the study of homicide and which structural predictors have surfaced in recent years as influential to crime rates. Using data on U.S. cities for the years 1970, 1980, 1990, and 2000, the authors then present a systematic empirical assessment of the explanatory power of the covariates of homicide rates identified in the Land et al. study. Twenty years later, we find support for the claims of invariance established in Land et al. and acknowledge the contributions of this piece to the macrolevel study of homicide rates.

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Introduction

Almost 20 years have passed since Land, McCall, and Cohen's 1990 article (for brevity, hereafter the notation LMC is used) "Structural Covariates of Homicide Rates: Are There Any Invariances Across Time and Social Space?" appeared in the *American Journal of Sociology*. Since its publication, the article has been cited in more than 500 journal articles (according to ISI Web of Knowledge) and has contributed to sociology and criminology theoretically as well as methodologically. In the majority of these studies, social scientists recognize the benefits of following LMC's methodological procedures for addressing statistical problems when using aggregate-level data. Criminologists and sociologists who study variations in crime rates have expanded empirical knowledge of structural forces associated therewith by utilizing both the theoretical and methodological guidelines articulated in the LMC article.

Overall, the accumulated literature published since the LMC work reveals the synergistic accomplishments of sociologists toward developing an ecological understanding of crime and related phenomena. The purpose of this article is to identify key contributions of the LMC work, focusing on the role that this work has played in subsequent studies and the new concepts that have since been developed in the body of research on covariates of crime. In addition, we replicate and extend forward in time the empirical analyses reported in the LMC article. Specifically, that study reported analyses at the U.S. city, metropolitan area, and state levels for the decennial census years 1960, 1970, and 1980. Focusing on cities, we replicate the LMC analyses for the years 1970 and 1980 and then extend the analyses forward in time to include both 1990 and 2000.

The 1990 Article

Advances in the social sciences do not emerge in a vacuum. A constellation of conceptual and empirical work produced during the late 1970s and 1980s shaped the focus and substantive conclusions of the LMC study. This time period witnessed a reinvigorated interest in ecological studies of crime. Briefly, the bodies of research that were the impetus of the 1990 article included (a) the then ongoing debates regarding the comparable worth of absolute versus relative deprivation in explaining variations in crime rates (e.g., Bailey, 1984; Messner, 1982) and (b) the underlying force accounting for higher homicide rates in the southern region—whether influenced by structural poverty or a southern culture of violence (Corzine & Huff-Corzine, 1989; Loftin & Hill, 1974; McCall, Land, & Cohen, 1992). Most notably were studies by Messner (1983a, 1983b) on regional variations in urban homicide as well as the Blau and Blau (1982) piece disentangling the importance of ascribed status and relative deprivation

on violent offending. These works gained the attention of criminologists interested in documenting the social and economic factors underlying serious criminal offending. Nevertheless, research on these topics generated inconsistent findings that left these debates unsettled. LMC (1990) was the first study to systematically identify the methodological sources of these inconsistencies and offer an empirical examination of the linkages between social, demographic, and economic structural covariates and homicide rates after accounting for the methodological confounding.

Highlights of the LMC Study

In a detailed review of 21 extant ecological studies of homicide, LMC found that the vast majority of those studies had three methodological commonalties, in addition to the inconsistent findings they generated. First, they were based on relatively small samples of cities, metropolitan areas, or states—Usually less than 200 cities were sampled with even smaller numbers of metropolitan areas and states. Second, they were based on data from a single time period—usually a decennial census year such as 1960 or 1970. Third, with respect to the application of statistical techniques, almost all of these studies employed multiple regression techniques with various state-, metropolitan area–, or city-level structural (demographic, ecological, and socioeconomic) covariates used as regressors to explain interunit variation in crime rates.

The fact that these research design characteristics were virtually uniform across this body of literature provoked empirical questions pertaining to the generalizability of the explanations of crime rates they produced. For instance, does sampling variability due to relatively small samples produce instability of findings? Do the findings generalize across time periods? Do differences in the operationalization of concepts account for the inconsistencies? Should a general theory of crime find support across different units and levels of analysis?

To address these questions and try to solve the conundrum of inconsistencies in findings, LMC created a data set for which the units of analysis were based on available 1980 Uniform Crime Report offense statistics and census publications. The resulting product was a data set containing homicide rates and covariates of crime that were commonly used in extant ecological studies of crime rates for a large sample of cities (904), metropolitan areas (259), and states (50) across three decennial periods: 1960, 1970, and 1980. Armed with data that included standardized definitions of concepts over time and across geographic areas, they addressed the questions stated above by testing the explanatory effects of the theories underlying these models.

What surfaced from the work of LMC (1990) were three important contributions: (a) methodological contributions: references to collinearity, corrective statistical procedures, principle components analysis/index construction, the partialling fallacy as well as other justifications involving the choice of level of aggregation and transformations of the dependent variable; (b) implications of findings concerning structural covariates of crime/homicide: acknowledging inconsistencies of past research and the consistency found in more recent literature; and (c) greater attention to the

selection and/or expansion of structural characteristics: including urban disadvantage and resource deprivation, racial composition, family structure/divorce, and various other social and economic characteristics to name a few. We next consider each of these three themes.

Methodological Contributions of the Study

LMC (1990) began their analyses by estimating nine models (one for each of the three levels of aggregation and for each time period). They employed ordinary least squares (OLS) techniques to estimate regression coefficients for each model that contained 11 covariates of homicide. Based on LMC's review of prior theory and empirical studies till the late 1980s, the covariates included (a) a measure of absolute poverty, the percentage families with incomes below the official poverty line; (b) a measure of relative inequality, the Gini index of income inequality; (c) population size; (d) population density, as measured by population per square mile of area of the ecological unit; (e) a measure of the average economic living standard, median family income; (f) a measure of family structures, the percentage of children 18 years old or younger not living with both parents; (g) a measure of racial composition, the percentage Black population; (h) a measure of the level of domestic discord, the percentage divorced males; (i) a measure of economic distress, the unemployment rate; (j) a measure of the prevalence of young adults, the percentage aged 15 to 29; and (k) a dichotomous dummy variable for location of the city, metropolitan area, or state in the Southern region. Although some consistencies emerged across the nine models for the percentage divorced, percentage Black, population size, and southern region, 6 of the 11 remaining covariates did not provide consistent and invariant results.

Collinearity and the Partialling Fallacy

Prior to the 1990 article, several criminologists had identified the problem of collinearity among structural covariates in previous homicide studies, but few scholars had taken on this issue directly, much less acknowledged this problem as a potential culprit underlying the inconsistent findings emerging across studies. Furthermore, none had identified the related, yet separate, problem of the partialling fallacy in this literature until Land and his colleagues suggested its influence.

The partialling fallacy, originally identified in ecological studies of juvenile delinquency by Gordon (1968), can be due to modest levels of collinearity. It may occur when a regressor/covariate, denoted X_1, is more highly correlated (at, say, 0.7) with another regressor, X_2, than either is with the outcome variable (say, 0.55 and 0.5). In this case, regression estimation algorithms typically will assign all explained variance to the one of the two regressors that is (possibly very slightly) more highly correlated with the outcome variable, X_1, and no explained variance to the other regressor, X_2, even though both regressors are measuring attributes that share more variance than either has in common with the outcome variable of the regression. This may lead to the likely erroneous inference that one of the regressors is not contributing to the

explained variance in homicide when in fact it is a substantively important covariate. Moreover, in another study with a slightly different sample that reverses the degree of the correlations of the two regressors with the outcome variable, a reestimation of the regression may assign all explained variance to the other of the two regressors, X_2 in this case—leading to the apparent lack of consistency among studies.

LMC noted that such partialling fallacies were important factors in the inconsistencies of empirical findings on structural covariates of homicide (and other crimes) among the accumulating set of studies published through the late 1980s. The partialling fallacy thus may mitigate against the research goal of cumulative knowledge. It is crucial to identify these statistical problems that plague aggregate-level analyses; likewise, it is essential that the researcher acknowledge the problem and find a way to rectify the problem to ensure that consistent substantive inferences are made.

Correcting for Collinearity and Partialling Fallacies

Although there is no consensus on any one procedure for dealing with statistical estimation and inferential problems associated with collinearity, not addressing the issue can magnify standard errors and result in uncertain parameter estimates in any multivariate model. LMC chose to adopt a principle components/composite index approach to reduction of shared variance in the regressor or covariate space—that is, the vector space spanned by the matrix of covariances or correlations among the regressors.

The LMC (1990) article explained that principal components analysis was applied to the structural covariates in the vector space spanned by the regressors to ascertain whether this would give insights into how many relatively independent or orthogonal (and hence uncorrelated) sources of variation actually were present in this space. This is one possible approach to methodological adjustments for collinearity. If the number of principal components is small relative to the number of regressors, and if the components can be given a substantive interpretation, then this can be very useful in solving the collinearity problem (see, e.g., Maddala 1977).

LMC (1990) also emphasized that the application of principal components analysis in this way and the construction of corresponding component scores should be distinguished from the specification of a latent-variable/factor-analytic/covariance-structure model (see, e.g., Kim & Mueller, 1978, for a discussion of the distinction). The latter approach requires the assertion of the existence of latent variables that are characteristic of cities, metropolitan areas, states, or other geographical units of analysis that account for the intercorrelations among certain structural covariates. LMC concluded from their review of the theoretical and empirical literature, up to the time of their study, that sufficient support for such an assertion did not exist. Therefore, they asserted only that the empirical correlations among the structural covariates were sufficiently similar across time and levels of analysis so that component scores that simplify the geometric space spanned by the covariates could be consistently defined and substantively related to social theory.

Operationally, the LMC principal components analysis proceeded in the conventional manner to identify components (dimensions in the vector space spanned by the

columns or rows of the variance-covariance or correlation matrix of the regressors) accounting for substantial variance in the regressor space and having substantial component loadings for two or more regressors. Using a relatively conservative rule for defining a component score, namely, that regressors possess component loadings of .5 or greater across levels of analysis and time periods, resulted in the identification of two component scores/indices that successfully simplified the regressor spaces, with most of the remaining correlations among regressors less than .4 in absolute value, levels that are not likely to create collinearity problems or partialling fallacies. LMC labeled one of these component scores/indices the population structure component. It comprised population size and population per square mile (density) of the units (cities, metropolitan areas, states) of analysis. The second index, following the conceptual notion in Williams and Flewelling's (1988) article, was named the resource deprivation/affluence component. It combined the values of five regressors that were highly collinear in the regressor vector space, namely, the absolute measure of the prevalence of poverty (the percentage of the population with incomes below the official poverty line), the Gini index of inequality of incomes, the percentage of the population that is Black, the percentage of children not living with both parents, and median family income (the component loading for the latter was negatively correlated with the component). Although this solution did not satisfy (especially) those researchers looking to resolve the debate over whether it is absolute or relative deprivation that is the key factor in determining crime rates, an empirically strong, positive correlation between the poverty and inequality measures may have accounted for a great deal of the inconsistencies found across prior studies that allowed these variables to be considered independently/separately in the same regression model.

This solution to collinearity—by reduction and simplification of the regressor space—subsequently has been adopted by many social scientists who have conducted ecological studies including these or conceptually similar variables. Many of these studies, loosely referring to the component scores identified by LMC as factors, do not attend to the subtleties of the LMC distinction between a principal components analysis to simplify the regressor space and the postulation of underlying, theoretically meaningful dimensions that is required by the related principal components factor analysis technique. Strictly speaking, the indices identified and used in LMC are component scores, additive composites of the measured values of the regressors weighted by their respective component scores from the components analysis. Elevating these scores to the status of factors implicitly involves the postulation that they define latent variables that characterize the underlying dimensionality of the social, demographic, and economic structures of geographical units of analysis, such as neighborhoods, cities, metropolitan areas, and states.

Revised Model Specification

The nine models in the 1990 article were reestimated after substituting the two composite indexes for 7 of the 11 original variables. The resulting model specifications

included the resource deprivation/affluence index, population structure index, percentage divorced, unemployment rate, percentage aged 15 to 29, and the southern region dummy variable. Land and his colleagues discovered consistent and invariant findings across these equations for three of the six regressors—resource deprivation/affluence index, population structure index, and percentage divorced males.

One of the major implications of these findings was that the theoretical presumption of relatively invariant relationships of covariates on crime rates across social space and time periods appeared to be supported by use of large samples, standard definitions, and the reduction of collinearity among the structural indicators—with the latter of these accounting for many of the inconsistencies found in previous homicide studies. Other important substantive findings are elaborated below.

Substantive Implications of the Findings

Beyond methodological consideration, the findings from LMC's study highlighted the importance of Wilson's (1987) influential work on concentrated disadvantage and incorporated concepts used by Williams and Flewelling (1988) in their work examining homicide data disaggregated by victim/offender relationship and nature of precipitating incident. Having resolved statistical estimation problems associated with macrolevel studies (discussed above), Land and his colleagues were able to bolster Wilson's arguments about the ever-deteriorating plight of urban-dwelling African Americans by providing empirical evidence of worsening economic hardships for those living in urban centers during the 1970s. Wilson (1987) described the social isolation and concentration of disadvantage experienced by urban poor minorities during the 1970s and 1980s when industrial relocation left many urban residents stranded without employment and resources to find employment, whereas more affluent minorities abandoned urban centers and moved to suburban settings. Borrowing from Williams and Flewelling's (1988) conceptual model, the resource deprivation/affluence index of LMC included conceptually distinct yet empirically indistinguishable indicators of absolute and relative deprivation as well as family structure and racial composition. This composite measure of deprivation has been replicated in numerous subsequent studies and continues to emerge as one of the, if not the most, consistent and robust indicators of serious criminal activity in urban areas.

A constellation of other influential sociological works emerged around the same time as the LMC piece that evolved together and contributed to this line of criminological research. Among these developments was the renewed attention to Shaw and McKay's (1942) classic formulation of social disorganization by the work of Bursik (1988) and Bursik and Grasmick (1993) as well as that of Sampson and colleagues (Sampson & Groves, 1989; Sampson, Raudenbush, & Earls 1997). These developments clarified the link between structural characteristics and crime rates in socially disorganized neighborhoods as a result of the breakdown in social control. Furthering these developments, Sampson and colleagues' conceptualization of *collective efficacy* benefited from LMC's identification of classic covariates of crime that proved to consistently explain

the variation in homicide rates over time as well as across various units of analysis, including research at the neighborhood level. That is, ensuing studies that tested these neighborhood-level theories also referenced LMC's (1990) well-known covariates as essential contextual aspects of crime. These established structural and ecological covariates of crime provided researchers with a baseline model on which contributions such as collective efficacy were tested at neighborhood levels of analysis. This body of research also benefited and advanced with the statistical development of spatial analyses and multilevel modeling techniques (e.g., Morenoff, Sampson, & Raudenbush, 2001; Sampson, Morenoff, & Earls, 1999). Multilevel modeling provided researchers with a tool to explore the way individual-level effects on crime (and other social phenomenon) were contextualized by these neighborhood ecological forces.

Expanding the Knowledge Base of Structural Covariates

In the past 20 years, theoretical developments as well as changing social and economic trends have led researchers to introduce novel structural indicators into homicide and violent crime studies. Some of the more successful of these efforts have examined the influence of racial inequality, concentrated poverty, residential racial segregation, social capital, collective efficacy, industrial shifts/labor market conditions, sex ratio/male capital, disengaged youth, and racial threat on criminal behavior.

Racial Inequality and Racial Composition

The influential work of Blau and Blau (1982) spurred a host of studies exploring the nature of inequality and racial inequality, in particular, and its relation to criminal offending. Messner and Golden (1992) offered one of the best examples of how to build upon Blau and Blau's ideas by regressing race-specific homicide offending and interracial homicide rates on a racial socioeconomic inequality scale, while controlling for established correlates of homicide. They found that racial inequality was related to race-specific (intraracial) offending but not to interracial homicide. Using different measures of racial inequality from Messner and Golden, Parker and McCall (1999) found that racial inequality predicted Black interracial homicide offending rates but no other intra- or interracial offending rates. Some researchers explored the importance of racial inequality on race-specific crime by incorporating measures of intra- as well as interracial inequality into their models. Results of these studies are mixed, and more research is needed to determine the nature of the relationship between racial inequality and homicide. As LMC found, inconsistencies across these studies may be due to varying measures of racial inequality and model specifications.

Concentrated Poverty

Following the efforts of Land and his colleagues, one of the most salient concepts to be developed in the study of urban violence was that of concentrated poverty

(also referred to as concentrated disadvantage; see Sampson et al., 1997). This concept was elaborated after Wilson (1987) introduced the notion along with the growing social isolation of the urban poor. The central place of economic deprivation in this line of research led many to adopt the statistical procedure recommended by LMC to deal with collinearity as researchers attempted to measure the various dimensions of disadvantage. Krivo and Peterson (1996) studied census tracts in Columbus, Ohio, to test Wilson's and Sampson and Wilson's claims that concentrated poverty rather than racial segregation were central in understanding urban disadvantage. Wilson claimed that White neighborhoods with concentrated poverty would have similar plights as poverty-stricken Black neighborhoods. This and subsequent work of Krivo and Peterson (2000) provided support for both aspects of segregation (class and race) and pioneered the study of concentrated poverty, especially in relation to race-specific urban violence, in the field of criminology. A flurry of studies on the subject emerged in the 1990s and further established the association between concentrated poverty and violent crime (see Lee, 2000, for a review).

To capture the concentrated disadvantage dimension of urban settings, researchers followed the practice of using principal components to resolve collinearity problems and reduce shared variance in the regressor space. Although the components of these indices vary somewhat across studies, many of the variables included are the same as those in LMC's index, and the component index often is similarly referred to as a *resource deprivation* or *resource deprivation/affluence* index. This widely used statistical procedure (principal components or factor analysis) to reduce collinearity employed by researchers conducting empirical analyses of structural forces has led some more recently to reference this as conventional practice without citing LMC. Substantively, the result of these dozen or so studies on the topic has consistently established the importance of concentrated poverty, or resource deprivation, with its robust support across studies examining rates of urban violence and homicide, including racially disaggregated rates. However, the lack of variance explained in minority, particularly African American, models of crime rates has led some researchers to explore other factors, such as racial residential segregation.

Racial Residential Segregation

Debating the relative importance of class versus race in characterizing the concentrated poverty of urban areas, Massey and Denton (1993) contributed to understanding the intricate measurement and relational implications of various aspects of racial residential segregation that also played a major role in sociological and criminological studies during the early 1990s (Massey & Denton, 1988, 1993; Massey & Eggers, 1990; Massey, Gross, & Shibuya, 1994). Building on the work of Wilson (1987), social scientists have documented the deleterious effect of the spatial concentration of poverty on urban residents, African Americans in particular, as a result of the shifts in industries on which many un- and semiskilled urban residents were dependent. During this economic transition, abandoned workers with few resources were left with the

meager employment opportunities of city centers and the further concentration of poverty within already plagued urban neighborhoods. The influx of service jobs, an industry largely polarized into administrative and high-tech positions on one end and retail service–type jobs with little security and pay on the other, did not bring economic relief to many of these displaced workers.

Criminologists not only explored the impact of racial residential segregation on urban crime rates but they also tested these ideas vis a vis Wilson's (1987) concepts of social isolation and concentration effects. From Massey and Denton's work, the connection between racial isolation/segregation, concentrated poverty, and urban crime was further explored and developed. Lee and Ousey (2007) provided an articulation of the different hypotheses:

> William Julius Wilson (1987) asserts that economic restructuring and the outmigration of the black middle class caused both an increase in the concentration of poverty and a rise in violent crime rates among urban blacks. In contrast, Douglas S. Massey and Nancy A. Denton (1993) primarily associate the concentration of black poverty and violent crime with racially-based housing discrimination that locked blacks into spatial contexts offering few economic opportunities and little connection to mainstream economic, political, and cultural life. A major contribution of both frameworks is the emphasis on an important dimension of stratification—residential segregation—which can undermine the social organization of communities and therefore the social control of violent crime. Despite this shared insight, the emphasis of these perspectives differs in (at least) one fundamental way: while the Wilsonian argument stresses that segregation by social class within the black community is particularly harmful for community organization and informal social control, the argument extracted from Massey and Denton suggests that segregation by race is of primary consequence. (p. 241)

Many of these ideas have been empirically examined in the criminological literature and widely supported (see Krivo & Peterson, 1996, 2000; Kubrin, 2003; Kubrin & Weitzer, 2003; Lee & Ousey, 2007; Ousey, 1999; Parker, 2004; Parker & McCall, 1999; Phillips, 1997, 2002; Sampson et al., 2008; Sampson, 1987b; Sampson & Wilson, 1995; Shihadeh & Maume, 1997; Shihadeh & Ousey, 1996, 1998; Stewart & Simons, 2006; Velez, Krivo, & Peterson, 2003; Wadsworth & Kubrin, 2004). Subsequently, a number of studies have examined the combined (or concentrated) effects of residential segregation with concentrated poverty in studies of crime (Akins, 2003; Fabio et al., 2006; Lee & Ousey, 2005; Parker, 2001; Parker & McCall, 1999; Peterson & Krivo, 1993) as well as the potential links to local labor markets and deindustrialization (Bellair & Roscigno, 2000; Bellair, Roscigno, & McNulty, 2003; Crutchfield, 1989; Crutchfield & Pitchford, 1997; Krivo & Peterson, 2004; Lee & Slack, 2008; Parker, 2004, 2008; Shihadeh & Ousey, 1998).

The LMC's article has influenced other areas of research in the social sciences. However, the developments identified above in criminological research are some of its major influences. With these developments outlined, the indicators used to operationalize many of these concepts and the methodology employed in these analyses are described next. That is, noting the LMC's findings of invariance over time and social space through 1980, has this consistency extended to the 2000s? To address this question, we replicate the LMC study with data for more recent decennial years.

The LMC Model Replicated and Applied to More Recent Data

The original model specification of LMC henceforth is termed the baseline model. Estimates of this model are given for cities as the unit of analysis for four recent decennial census years: 1970, 1980, 1990, and 2000. As LMC established relative invariances across city-, metropolitan area–, and state-level models, we use city-level data to examine invariances across more recent periods of time. Detailed data definitions and sources are given in Appendix A. The sample comprises 699 cities in 1970, 901 cities in 1980, 932 in 1990, and 841 in 2000. The difference between the numbers of cases available in this study relative to the 1990 study is due to different sources used to derive these data.[1]

Variables and Model Specification

The dependent variable is the city homicide rate computed using the 3-year average centered on each decennial year and then log transformed to correct for heteroskedasticity. The model includes the population structure and resource-deprivation/affluence indices as described in LMC (1990). The latter is comprised of percentage Black, percentage families living below the poverty level, Gini index of family income inequality, median family income (log transformed), and the percentage of children (less than 18 years of age) that are not living with both parents. Appendix B displays the results of the principal components analysis for variables comprising the resource deprivation/affluence index. Population structure is an additive index created by combining the total resident population and population per square mile variables, both log transformed. The other covariates in the model are directly comparable to the original LMC piece and include the percentage divorced males, percentage of the population aged 15 to 29, the unemployment rate, and a dichotomous indicator of location in the southern region.

Results

Table 1 contains descriptive statistics—means, standard deviations, and ranges—of all variables for all years in the analysis. A number of characteristics of the data

Table 1. Descriptive Statistics for U.S. City Homicide Rates and Structural Covariates and Index Components: 1970, 1980, 1990, and 2000

	1970	1980	1990	2000
Variable				
Homicide rate	6.7	8.6	8.1	6.1
(per 100,000	[7.7]	[9.7]	[11.1]	[8.2]
population)	(0, 58.5)	(0, 75.2)	(0, 136.0)	(0, 81.6)
Logged homicide	1.3	1.5	1.6	1.5
rate	(1.3)	[1.3]	[1.1]	[0.9]
	(–.7, 4.1)	(–.7, 4.3)	(–.7, 4.9)	(0, 4.4)
Population	19.3	19.0	19.1	19.2
structure	[1.2]	[1.1]	[1.1]	[1.2]
index	(16.1, 26.1)	(14.5, 25.8)	(15.7, 25.9)	(14.8, 26.1)
Resource	28.8	38.8	33.9	42.4
deprivation/	[21.0]	[26.6]	[26.9]	[28.5]
affluence index	(–3.6, 116.9)	(0.75, 174.6)	(–4.3, 165.7)	(–2, 166.5)
Percentage	3.2	5.9	7.8	9.0
divorced	[1.3]	[1.8]	[2.3]	[2.5]
males	(0.4, 9.6)	(1.4, 12.7)	(1.8, 15.2)	(1.8, 16.6)
Percentage	24.6	29.3	24.8	22.4
aged	[6.2]	[7.0]	[6.6]	[6.8]
15 to 29	(14.7, 63.3)	(9.6, 74.0)	(11.8, 66.3)	(8.4, 74.4)
Unemployment	4.5	6.4	6.5	6.4
rate	[1.6]	[2.9]	[2.9]	[2.8]
	(1, 13)	(2, 25)	(2, 31)	(1.5, 19.7)
South	0.26	0.26	0.26	0.27
	[0.44]	[0.44]	[0.44]	[0.44]
	(0, 1)	(0, 1)	(0, 1)	(0, 1)
Index components				
Population	117,204	100,184	105,743	121,738
size	[369,564]	[301,519]	[308,438]	[351,437]
	(25,131, 7,894,851)	(25,075, 7,071,639)	(2,537, 7,322,564)	(1,855, 8,008,278)
Population	4,652.4	4,026.6	3,966.3	4,119.8
per square	[3,981.1]	[3,531.6]	[3,526.7]	[4,055.4]
mile	(258, 44,081)	(52, 39,709)	(130, 45,822)	(153.4, 52,977.8)
Percentage	10.4	11.4	12.7	14.2
Black	[13.4]	[15.6]	[16.6]	[17.7]
population	(0, 72)	(0, 96)	(0, 99)	(0, 94)
Median family	44,984	44,025	50,103	51,949
income (in 2000	[9,676]	[10,816]	[16,109]	[17,883]
constant dollars)	(21,683, 96,022)	(19,630, 95,156)	(18,196, 126,873)	(23,519, 1,55,246)
Percentage	13.2	15.0	10.0	10.1
families in	[6.2]	[7.2]	[6.6]	[6.0]
poverty	(2.1, 41.7)	(2.3, 45.6)	(0.51, 40.4)	(0.7, 32.8)
Percentage children	18.7	26.1	25.1	32.6
not living with	[7.4]	[10.4]	[11.0]	[12.4]
both parents	(4.2, 46.7)	(6.9, 67.9)	(4.1, 69.6)	(6.2, 76.6)
Gini	.36	.37	.39	.41
index	[.04]	[.04]	[.05]	[.05]
	(.24, .48)	(.24, .55)	(.27, .59)	(.29, .58)
n	699	901	932	841

Note: Means, standard deviations [in brackets], ranges (in parentheses), and sample sizes (*n*s).

merit comment. First, the average city homicide rates are lowest for 1970 and 2000 (6.7 and 6.1 per 100,000 population, respectively) with high intervening levels for 1980 and 1990 (8.6 and 8.1). However, the ranges of variation of the rates increase across the years, with upper bounds going from 58.5 in 1970 to 75.2 in 1980 to a peak of 136.0 in 1990 before falling back to 81.6 in 2000. The means, standard deviations, and ranges of these rates also are indicative of highly skewed frequency distributions that, after natural logarithmic transformations, are much more bell shaped. Second, of all the regressors, the population structure index shows the most stability across the decennial years, with means, standard deviations, and ranges that are quite comparable from year to year. Third, both the resource deprivation/affluence index and the percentage of the population consisting of divorced males show increases in means, standard deviations, and ranges for 1980, 1990, and 2000 as compared to 1970. Fourth, by comparison, the percentage of the population aged 15 to 29 shows a peak in its mean in 1980, relatively constant standard deviations, and peak ranges in 1980 and 2000. Fifth, means and standard deviation of unemployment rates are higher in 1980, 1990, and 2000 than in 1970 with highest ranges in 1980 and 1990. Finally, the proportion of cities in the South varies little from sample to sample.

Table 1 also gives descriptive statistics for the variables that comprise the population structure and deprivation/affluence indices. Means and standard deviations increase across the decennial years for the percentage of the cities' populations that are Black, median family income, and the percentage of children not living with both parents. By comparison, the means and standard deviations of the percentage of families living with incomes below the poverty line generally decrease across the years, and the means of the Gini index increase slightly (indicating increases in income inequality) but standard deviations are relatively constant.

Table 2 contains the OLS regression results estimated using robust standard errors for the four time periods, 1970 through 2000. Consistent with findings reported in LMC (1990), population structure, the resource deprivation/affluence index, percentage divorced males, and the southern region are all statistically significant in the theoretically predicted direction in each of the four time periods. Also consistent with the original findings, the percentage young (15 to 29) and the unemployment rate are statistically significant in some but not across all four models. The unemployment rate is directly related to the homicide rate in the 1990 and 2000 models, and the percentage young is inversely related to the city homicide rates in 1980. These results are consistent with those of the original publication.

Thus, corroborating the LMC (1990) findings, a set of remarkable consistencies—in terms of statistically significant relationships of certain demographic, social, and economic structural characteristics of cities with their homicide rates—emerges from this replication of their analyses for 1970 and 1980 and a corresponding extension to the more recent years 1990 and 2000. These structural characteristics include the resource deprivation/affluence index, the population structure index, the percentage of the male population that is divorced, and the southern region.

Table 2. LMC (1990) Structural Covariates of Homicide Model Replicated and Extended

	1970	1980	1990	2000
Constant	–4.190	–4.392	–4.530	–2.493
	(–7.35)**	(–7.15)**	(–11.27)**	(–8.17)**
Population structure	.200	.233	.235	.136
	[.188]	[.200]	[.241]	[.184]
	(6.97)**	(7.48)**	(12.01)**	(8.84)**
Resource deprivation/affluence	.029	.019	.019	.018
	[.480]	[.383]	[.460]	[.596]
	(12.06)**	(11.05)**	(14.28)**	(17.69)**
Percentage divorced males	.226	.160	.084	.048
	[.235]	[.221]	[.174]	[.136]
	(8.70)**	(8.84)**	(7.68)**	(5.92)**
Percentage ages 15–29	.005	–.016	–.004	–.004
	[.025]	[–.086]	[–.024]	[–.034]
	(0.86)	(–3.25)**	(–.94)	(–1.62)
Unemployment rate	–.028	.019	.048	.039
	[–.036]	[.041]	[.126]	[.123]
	(–0.99)	(1.30)	(4.09)**	(3.51)**
South	.498	.701	.520	.170
	[.173]	[.232]	[.207]	[.085]
	(5.07)**	(7.88)**	(10.21)**	(3.91)**
R^2	.530	.488	.649	.670
n	699	901	932	841

Note: Metric regression coefficients, standardized coefficients [in brackets], and t-ratios (in parentheses) of structural indexes/covariates of homicide rates (transformed with natural logarithm) for U.S. cities: 1970, 1980, 1990 and 2000. t-ratios estimated with robust standard errors.
*$p \leq .05$, one-tailed; **$p \leq .01$, one-tailed.

Beyond the criterion of statistical significance, variations in the numerical values of the metric and standardized regression coefficients given in Table 2 tell an interesting story about both consistency and change in the nature of urban homicide rates in the United States across these four decennial periods. For instance, the metric coefficients for the population structure index, which combines measures of a city's population size and density, change from relatively large values in 1970 (.20) and 1980 (.23) to substantially smaller values in 1990 (.24) and 2000 (.14). The corresponding standardized coefficients are .19, .20, .24, and .18. Taken all together, these coefficients indicate that larger, more densely populated cities, on average, consistently have larger homicide rates. However, this relationship has decreased in the most recent decades, especially for the year 2000, as the mean and variance of city homicide rates declined as compared to 1980 and 1990 (Table 1). Accordingly, the regression coefficients for the population structure index in 1990 and 2000 imply that, although larger, more densely populated cities still are more likely to have higher

homicide rates, the distance between their rates and those of smaller, less dense cities is not as great as in the previous two decades.

The story told by a corresponding analysis of the estimated coefficients for the resource deprivation/affluence index in Table 2 is somewhat different. The metric coefficients for this covariate across the four periods are .03, .02, .02, and .02; by comparison, the corresponding standardized values are .48, .39, .46, and .59. In other words, the metric coefficients imply that, on average, the relationship of a city's homicide rate to its standing on the deprivation/affluence index declined by about one third from the 1970 level to a steady level across the 1980, 1990, and 2000 years. However, the standardized coefficients show an increased relationship for 1990 and 2000 as compared to 1970 and 1980. As the standardized coefficients adjust the metric coefficients for the standard deviations of the regressor and outcome variables, and as the year 2000 mean homicide rates are the lowest of the four decennial years, they imply that a standard deviation unit of change in the deprivation index in 2000 yields a larger fraction of a standard deviation of change in the homicide rate in that year than in any of the other 3 years, especially 1980. Also, note that 1980 has the smallest standardized coefficient for the deprivation index—indicating that a standard deviation of change in the deprivation index, net of other covariates, was associated with the smallest fraction of a standard deviation of change in homicide rates. What accounts for this? Recall from Table 1 that the means of both the percentage of cities' populations consisting of young adults (ages 15 to 29), the ages of highest violent crime rates, and the homicide rate per 100,000 population are largest in 1980. This greater general prevalence of young adults in the populations of U.S. cities in 1980 thus is associated with U.S. city populations generally more at risk of violent crime and, together with the smallest standardized regression coefficient for the deprivation index, less influenced by the level of deprivation/affluence in that year. That is, in 1980 the high prevalence of young adults in the populations of U.S. cities generally was associated with a higher mean homicide rate across the cities. The result was that variations among cities in levels of deprivation were, net of the other structural covariates, less closely associated with variations in their homicide rates.

The sequences of estimated regression coefficients for the percentage divorced males and South regressors in Table 2 indicate yet another pattern of changes. In both cases, the metric and the standardized regression coefficients decline across the decennial years. For the percentage divorced males, the metric regression coefficient in the year 2000 (.05) is less than one fourth its value in 1970 (.23), whereas the standardized coefficient in 2000 (.14) is less than 60% of its value in 1970 (.24). Moreover, the decline in the sizes of both sets of coefficients is most dramatic from the 1970 and 1980 years to 1990 and 2000. A similar pattern of breaks between the earlier 2 years and the later 2 is evident for the South indicator variable as well. In addition, the *t* ratios for the South covariate in 2000, although still at a highly statistically significant levels, is substantially smaller than in previous decades.

Taken altogether, these results are consistent with social changes toward less distinctiveness of the homicide rates of cities with respect both to their levels of presence

of divorced males in their populations and with respect to whether they are located in the South. Historically, although divorce rates began rising in the United States in the 1960s and 1970s, the status of being a divorced male in terms of attachments (bonds) to society was quite distinctive in 1970 and 1980 (with means of 3.2% and 5.9%, respectively, in Table 1). However, by 1990 and 2000, much larger percentages of the male population were divorced (7.8% and 9%, respectively), and thus the status was less distinctive and stigmatizing (Thornton & Young-DeMarco, 2001). Along with the greater prevalence of divorced males, there were generally larger proportions of urban populations that were not married and associated emergent accommodations by social institutions (Riley, 1991). With respect to geographical location in the South, a region long documented to have higher homicide rates in general than the rest of the United States, substantial migration of the population to Sunbelt states and cities over the past few decades certainly has changed the mix of their populations. The result, evident in Table 2, is that location in this geographical region is associated with less of an increment in homicide rates than in previous decades.

The negative and mostly null effects in Table 2 for the relationship of a city's homicide rate to the percentage of its population consisting of 15- to 29-year-olds are consistent with findings in LMC (1990). The criminological literature documents the overrepresentation of adolescents and young adults among victims and offenders of crime; therefore, a positive relationship is posited between percentage of the population aged 15 to 29 and the homicide rate. To interpret the negative and null findings, it helps to recognize that this population of young adults can be quite heterogeneous with respect to attachments to mainstream social institutions and thus more or less likely to be involved in crime and homicide in particular. Along these lines, Shihadeh and Thomas (2007) and McCall, Land, and Parker (2009) have shown that young people who are not enrolled in school or college and not in the military or in the labor force are not tied to conventional institutions and are thereby more likely to engage in crime. Because the intent of the regression models estimated in Table 2 is to replicate and extend the original LMC analyses, more disaggregated measures of variations in the presence in cities of young adults who are detached from mainstream social institutions were not introduced. Refinements of the LMC model, such as those in these more recent studies, have improved thereon.

Another indication of the impact of social changes on the relationships of the structural characteristics of cities to their homicide rates can be seen in the estimated metric and standardized regression coefficients for the unemployment rate in Table 2. These show that, net of the other structural features in the models, the unemployment rate of a city, on average, had a null impact on its homicide rate in 1970 and 1980. However, by 1990 and 2000, the metric coefficients for this covariate not only had become statistically significant but they had also doubled in magnitude and the standardized coefficients had tripled. With the continuing changes in the U.S. economy across the decades, the economic bases of some cities prospered while others suffered. These patterns of estimated coefficients indicate that a consequence of these changes is that

a higher unemployment rate became more effective in discriminating among cities with higher homicide rates in recent decades.

A final note of interpretation of the results in Table 2 pertains to the ability of the baseline LMC model to account for variations among cities with respect to their homicide rates, as measured by the coefficients of determination given at the bottom of the table. Generally, these coefficients show that the models account for substantially larger percentages of variance in the homicide rates in 1990 (65% accounted for) and 2000 (67%) than in 1970 (53%) and 1980 (49%). Although every U.S. city has its own local history and history of social, demographic, and economic structures as well as of crime, violence, and homicide, the increasing ability of the LMC model to account for variations among cities in their homicide rates across the decades is consistent with the presence of smaller impacts of these local circumstances. In other words, there is more consistency and homogeneity among U.S. cities in recent decades with respect to the impacts of their structural features on their homicide rates.

Discussion and Conclusion

Twenty years ago, the LMC's article established invariances among a number of covariates of homicide rates over time (1960, 1970, and 1980) and across three levels of aggregation (states, metropolitan areas, and cities). We have reviewed the substantive implications of their work, discussed conceptual contributions made to the field of criminology in general—and to ecological studies of homicide in particular—and updated their study by analyzing data for the large sample of cities included in their original study for two additional decennial time periods, 1990 and 2000. Noteworthy are the remarkably consistent findings spanning 40 years of accumulated ecological evidence on the covariates of homicide rates between the LMC study and the present work.

On the basis of the original LMC study, the replication and extension reported here, and the numerous other studies reviewed above, it can be asserted that we indeed know considerably more today than 20 years ago about how homicide (and other crime) rates of ecological units in the United States—neighborhoods, cities, metropolitan areas, counties, and states—are affected by the social, demographic, and economic structural features of these units. Specifically, the following empirical generalizations are well established.

First, net of other effects, homicide rates are consistently related to the population structure of an ecological unit; higher levels of population size and density are associated with higher homicide rates. This empirical finding is consistent with predictions from crime opportunity/routine activities theory, a core proposition of which is that, other things equal, increases in the concurrence in space and time of attractive targets for crime with motivated offenders in the absence of capable guardians produce increases in crime (Cohen & Felson, 1979; Cohen, Felson, & Land 1980). Generally, these concurrences increase as the size and density of the population of an ecological

unit increase, the result of which is an increase in crime rates in general and the homicide rate in particular.

Second, ecological units such as cities can be arrayed along a scale that pertains to the level of economic affluence or deprivation of the unit and, net of other effects, lower levels of affluence/higher levels of deprivation are associated with higher homicide rates. This finding is consistent with the emphasis of classical strain theory (Cloward & Ohlen, 1960; Cohen, 1955; Merton, 1938) on structurally induced frustrations resulting from the discrepancy between aspiration and expectations. It also can be derived from other criminological theories, such as social-control theory (Hirschi, 1969) and crime opportunity/routine activities theory (Cohen, Kluegel, & Land, 1981). In the case of the former, to the extent that economic deprivation is associated with weaker bonds to society and mainstream social institutions such as the economy and the family, higher crime rates then are expected. Dimensions of social inequality, such as lower income and race, also have been shown, from a crime opportunity perspective, to predict higher criminal victimization rates.

Third, net of other effects, ecological units with higher prevalence of divorced males have higher homicide rates; similarly, higher unemployment rates often are associated with higher homicide rates. Because divorce weakens or breaks the bonds of men with marital and family institutions and unemployment is indicative of detachment from regular work connections to economic institutions, these findings are consistent with social-control theory. Neosocial disorganization theory (Beaulieu & Messner, 2010; Sampson, 1987a, 1987b; Sampson & Groves, 1989) also identifies various informal social control and community processes by which higher rates of disrupted families reduce supervision and guardianship for children, household property, and street-corner peer groups, thus potentially leading to increased violent crime and homicide. Moreover, higher unemployment rates may be associated with higher levels of deprivation and thus may work to produce higher homicide rates through strain mechanisms as well.

Fourth, net of other effects, the geographical location of an ecological unit in the South is associated with higher homicide rates. As noted in the regression estimates reported above, however, the regional distinctiveness of the South with respect to homicide rates has declined across recent decades.

In sum, variations of homicide rates among U.S. cities are affected by social structural characteristics that work through several processes—specifically through crime opportunity/routine activities, strain, and social control mechanisms—that have been well established to affect crime rates in prior theory and research. The four findings stated here have been replicated repeatedly and can be asserted with high levels of confidence. They and the LMC conceptual models and methodological procedures provide a platform on which to build, refine, and generalize in studies at levels of analysis ranging from neighborhoods within cities to cities themselves, counties, metropolitan areas, and states. For these reasons, the LMC article will continue to have a major presence in sociological and criminological studies for years to come.

Appendix A

Data Definitions and Sources

The data source from which most covariates were collected is Sociometrics' (1998) *Contextual Data Archive (CDA) From the 1970, 1980, and 1990 Census Extract Data (1998)*. The 2000 data (not available from CDA) were derived online from the U.S. Bureau of the Census American Fact Finder's 2000 STF3 detailed tables (Census), and a few measures for 1970, 1980, and 1990 were also obtained from the U.S. Census. Other covariates were collected from the Minnesota Population Center's National Historical Geographic Information System (NHGIS). The variables in these analyses were obtained from sources specified below. More specific information is available on request from the authors.

Data Definitions

Homicide rate. (Number of murder and nonnegligent manslaughter offenses/total resident population) × 100,000. Source: FBI and/or Fox and Swatt, 2008, Victim file.

Population size. Number of total resident population. Source: CDA, Census.

Population per square mile. (Total population/land area in square miles). Source: CDA, Census.

Percentage Black population. (Number of Black population/total resident population) × 100. Source: CDA, Census.

Percentage of the population 15 to 29 years of age. (Number of 15- to 29-year-olds/total resident population) × 100. Source: NHGIS.

Percentage divorced men. (Number of divorced men/number of men 16 years old and over) × 100. Source: NHGIS.

Percentage of children not living with both parents. (Number of children 18 years old and under not living with both parents/number of children 18 years old and under) × 100. Source: Census.

Median family income (in 2000 constant dollars). Source: Census (1970, 1980, 2000), NHGIS (1990).

Percentage of families living below the official poverty level. Source: Census (1970, 1980, 2000), NHGIS (1990).

Gini index of income concentration for families: For 1970, 15-category family income distribution was used; for 1980, 17-category family income distribution was used; for 1990, 25-category family income distribution was used; for 2000, 16-category family income distribution was used to compute the Gini Index of Income Concentration:

$$Gi = (\sum X_i Y_{i+1}) - (\sum X_{i+1} Y_i),$$

where X_i and Y_i are respective cumulative percentage distributions (Shryock & Siegel, 1976). Source: CDA, Census.

(continued)

Appendix A (continued)

Percentage unemployed. (Number employed in civilian labor force/number in civilian labor force) × 100. Source: CDA, Census.

South region: Dummy variable for southern geographic location as defined by U.S. Census bureau. Source: Census.

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Appendix B

Principal Component Factor Scores for Resource Deprivation/Affluence Covariates for U.S. Cities

Regressors	1970	1980	1990	2000
Percentage Black	.766	.793	.769	.771
Percentage children not living with both parents	.923	.934	.933	.940
Percentage families in poverty	.942	.946	.942	.944
Median family income (constant US$), logged	−.866	−.852	−.834	−.849
Gini index of income inequality	.838	.731	.744	.764
Eigen value	3.778	3.656	3.599	3.672

Note: Only factor scores >.5 reported.

Author's Note

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Notes

1. Since the creation of the data set for the Land, McCall, and Cohen (LMC) study, researchers no longer have to key in data by hand from published government documents. In addition to using the Bureau of the Census's American Fact Finder to download U.S. census data, data sets compiled by Sociometrics and by the National Historical Geographic Information System (NHGIS) were employed to collect the variables for this study. From these sources, sample sizes are larger than those derived for our homicide rates. By and large, the restriction on the number of cases is limited by the number of cities for which homicide data are available. Listwise deletion of missing data further limits the number available for analysis. Various measures and estimates of these data were examined to enable as many cities to be included in these analyses as possible. Whereas homicide statistics for the original 1,050 cities was derived from the 1980 Uniform Crime Reports, this number was reduced in the original study due to the missing homicide data circa 1980 (for 1979 and 1981, for example) used to create the 3-year average for each time point. The rates used in the present analyses represent cities for which homicide data were available for at least 2 years circa the decennial time point. Analyses were replicated employing only homicide rates for which all 3 year's worth of data were available, but no substantive differences were found between the two measures; therefore, the measure offering more inclusive city samples is used. Homicide (victim) data for the decennial points 1990 and 2000 were derived from the Supplemental Homicide Reports (SHR) compiled by James Fox and made available via Interuniversity Consortium for Political and Social Research. Homicides were aggregated for city agencies, and missing data were compared with published Crime in America (Uniform Crime Report) publications to determine whether these missing data were actually zero homicides because agencies with no homicides for the year would not have submitted the SHRs. There are fewer cities for which homicide data are available than our covariates. Using at least 1 year to compute the homicide rate, data are available for 954 in 1990 and 887 in 2000. The most recent time point has lost a number of cases because many agencies in Illinois no longer report Uniform Crime Report statistics to the FBI.

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