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Reassessing the Association between Gun Availability and Homicide at the Cross-National Level

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Abstract This paper had two objectives. First, to examine the association between gun availability, gun homicide, and homicide in a manner that better accounts for potential simultaneity than previous cross-national research. Second, to examine the manner that the relationship between gun availability and violence is shaped by socio-historical and cultural context. The results lend little support to the notion that gun availability operates uniformly across nations to influence levels of violence. Rather, these results suggest that the nature of the relationship between gun availability and violence is shaped by the socio-historical and cultural processes occurring across nations.

Keywords Gun availability · Homicide · Cross-national · Comparative

Introduction

The relationship between gun availability and homicide continues to be a source of debate among criminologists. Competing perspectives have emerged that view guns as a cause of violent crime, a mechanism to reduce violent crime, and totally unrelated to violent crime. Macro-level research on this issue has yet to establish a consensus. For example, some studies have found a significant association between gun availability and homicide (Cook & Ludwig, 2004; Hoskin, 2001; Kleck, 1979; McDowall, 1991) while others have not (Kleck, 1984; Kleck & Patterson, 1993; Magaddino & Medoff, 1984). As a result, the debate about the relationship between guns and violent crime at the macro-level continues.

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Cross-national research on this issue has been small in number, but has mostly reported a significant positive association between gun availability and homicide (Hemenway & Miller, 2000; Hemenway, Shinoda-Tagawa & Miller, 2002; Hoskin, 2001; Killias, 1993a, 1993b; Killias, van Kesteren & Rindlisbacher, 2001). Despite consistent findings from this research, methodological concerns associated with model specification and variable measurement have led some to dismiss the utility of such research (Kleck, 1997; Wellford, 2004). Critics point out that most of the cross-national research on guns and homicide has failed to take into account potential simultaneity between levels of gun availability and rates of violence. As such, this research cannot definitively determine if a positive association between gun availability and homicide represents an effect of gun availability on violence or an effect of violence on gun availability. Due to these concerns, Wellford (2004, p. 54) characterizes this research as "suggestive but not conclusive."

An additional limitation of cross-national research examining the association between gun availability and homicide is that this research primarily has focused on Western Developed nations. The failure to consider non-Western, non-developed nations makes it difficult to determine the manner that both socio-historical and cultural contexts influence the nature of the association between gun availability and violence. As such, questions emerge about the generalizability of the findings from existing research. Although it is plausible that the relationship between gun availability and homicide operates in a similar fashion across both Western Developed and non-Western Developed nations; it is equally plausible that the nature of the association between gun availability and homicide is contingent upon socio-historical and cultural factors. Proponents of socio-historical approaches to macro-level criminological research contend that the failure to incorporate space and time in cross-national analyses leads to results devoid of context and unable to fully account for how structures of order and disorder across nations shape cross-national variation in violence (Stamatel, 2006). Researchers who call for greater consideration of cultural variables in criminological research contend that the manner that structural factors influence homicide and other forms of violence is conditioned by cultural forces that shape how specific populations respond to structural conditions (Wolfgang, 1958).

Recent research has documented the importance of considering socio-historical and cultural contexts when examining crime at the cross-national level (Pridemore, 2001, 2003; Saar, 2004; Stamatel, 2006, 2009). For example, research on Eastern European nations has found that age structure and economic inequality operate to influence homicide differently in Eastern European nations than in Western Developed nations (Pridemore, 2003; Stamatel, 2009). The authors of this research attributed these differences to the unique changes that have occurred in Eastern European nations in recent decades. Additionally, Ortega, Corzine, Burnett and Poyer (1992) found that the effects of modernity on homicide may vary by region, a proxy for culture. Further, Neopolitan (1994) found that cultural factors explained high rates of homicide in Latin American nations. There is also a body of research that suggests that the symbolism associated with guns in some cultures influences levels of homicide (Kopel, 1992; Springwood, 2007). Despite these findings, no research to date has examined if the manner that gun availability influences violence across nations is contingent upon socio-historical and cultural contexts.

These issues have important implications for international gun control policy. If gun availability levels positively influence homicide rates across nations, without regard to socio-historical or cultural factors, then measures to reduce the availability of guns within nations, as well as the transfer of weapons between nations, should lead to subsequent reductions in lethal violence. This would occur if the lower levels of gun availability decrease the likelihood that crime prone individuals use a gun during the commission of a crime. If, on the other hand, the effect of gun availability on homicide is found to be contingent upon socio-historical and cultural factors, the policy approaches will have to be more nuanced. For example, if gun availability is found to decrease rates of homicide in certain nations, then it would be prudent for policy makers to develop a policy that reduces gun availability among criminal aggressors, but still allows citizen to utilize guns for self-defense.

The aim of this paper is to further clarify the nature of the relationship between gun availability and homicide at the cross-national level. Towards that end, this paper has two objectives. First, to examine the association between gun availability and homicide in a manner that better accounts for simultaneity than previous research. Second, to examine the manner that the relationship between gun availability and homicide is shaped by socio-historical and cultural context.

Theory

No dominant theoretical perspective exists that explains the relationship between gun ownership and homicide. The basis for such a perspective, however, has been proposed by Kleck and McElrath (1991), who suggest that weapons are a source of power used instrumentally to achieve goals by inducing compliance with the user's demands. The goals of a potential gun user are numerous and could include money, sexual gratification, respect, attention, or domination. Importantly, this perspective suggests that guns can confer power to both a potential aggressor and a potential victim seeking to resist aggression. When viewed in this manner, several hypotheses can be derived concerning the relationship between gun availability and homicide at the macro-level. Importantly, applying these hypotheses to the macro-level leads to analyses that are more concerned with aggregate social factors and statistical associations than direct causality (Squires, 2000). Macro-level analysis of the relationship between gun availability and violence is often misconstrued as supporting the contention that guns 'cause' crime. In reality, this research is primarily driven by questions about the role that gun availability plays in facilitating choices and other behavior that may influence levels of criminal violence (Squires, 2000).

The facilitation, triggering, and weapon instrumentality hypotheses have been put forth to explain why gun availability and homicide should be positively associated. The *facilitation* hypothesis suggests that gun availability is positively associated with homicide because the availability of guns provides encouragement to potential attackers or to persons who normally would not commit an attack. This encouragement is derived from the fact that the possession of a gun can enhance the power of a potential aggressor; thereby increasing the chances that a violent

crime will be successfully completed. Guns can also facilitate crime by emboldening an aggressor who would normally avoid coming into close contact with a victim or using a knife or blunt object to stab or bludgeon someone to death. This is particularly important in situations when the aggressor is smaller or weaker than the victim. In such cases, the aggressor's possession of a gun can neutralize the size and strength advantage of an opponent (Cook, 1982; Felson, 1996; Kleck, 1997). The triggering hypothesis suggests that gun availability triggers aggression among potential offenders. This "weapons effect" is said to occur because angry people are likely to associate guns with aggressive behavior (Berkowitz & Lepage, 1967). Similarly, it has been suggested that the presence of a gun is likely to intensify negative emotions such as anger (Berkowitz, 1983).

The weapon instrumentality hypothesis suggests that gun availability increases the lethality of violent crime. This occurs when increasing gun availability increases the likelihood that an aggressor substitutes a gun for another weapon or no weapon at all during the commission of a crime. The end result is often homicide (Cook, 1991; Zimring & Hawkins, 1997). The basic premise of the weapon instrumentality perspective is that the use of a gun during the commission of an assault or robbery (1) increases the likelihood of death or serious injury; (2) provides aggressors with the opportunity to inflict injury at long distances; and (3) makes it easier to assault multiple victims than the use of other weapons that are commonly used to commit violent crime (i.e. knife or bat).

Another perspective on this issue suggests that the availability of guns is negatively associated with homicide (Cook, 1991; Kleck, 1997; Lott, 2000; Lott & Mustard, 1997). From this perspective, increased levels of gun availability empower the general public to disrupt or deter criminal aggression (Cook, 1991; Kleck, 1997) Kleck (1997) suggests that gun availability can disrupt criminal aggression in two ways. First, an armed victim can prevent the completion of a crime by neutralizing the power of an armed aggressor or by shifting the balance of power in favor of the victim when confronted by an unarmed aggressor (Kleck, 1997; Kleck & Delone, 1993; Tark & Kleck, 2004). Second, an armed victim can use a weapon to resist offender aggression and avoid injury (Kleck, 1997). Increased levels of gun availability may also reduce crime by deterring potential aggressors (Kleck, 1997; Wright & Rossi, 1986). Aggressors may refrain from committing crime due to fear of violent retaliation from victims. This deterrence can be both specific and general. For instance, a criminal aggressor may refrain from committing future attacks because they were confronted with an armed victim during a previous experience. Alternatively, an aggressor may refrain from committing a criminal act if they believe that a large proportion of the pool of potential victims is armed (Rengert & Wasilchick, 1985). When applied to the macro-level, this perspective suggests that gun availability should be negatively associated with homicide. This is because in nations where citizens have greater access to guns, potential victims will be better able to deter or disrupt the acts of criminal aggressors.

The third perspective discussed here suggests that gun availability and homicide are unrelated (Kleck, 1997). The absence of an effect can be the result of two things. First, gun availability simply may not influence homicide. From this perspective, the use of a gun simply may reflect an aggressor's greater motivation to seriously harm a

victim (Wolfgang, 1958). This suggests that factors other than gun availability motivate gun use and that a lack of access to a gun will simply cause an aggressor to substitute another weapon to achieve a desired outcome. Second, an effect between gun availability and crime may not be detected because defensive gun use may offset the effects of guns being used for criminal aggression (Kleck, 1997).

Cross-national Research on Guns and Homicide

Cross-national research examining the relationship between gun availability and homicide has been small in number (D. Hemenway & Miller, 2000; Hoskin, 2001; Killias, 1993b; Killias et al., 2001; Krug, Powell & Dahlberg, 1998; Lester, 1991). With the exception of Hoskin (2001), these studies have employed bivariate correlation analyses to examine the relationship between gun availability and homicide. On the surface, several of these studies seem to provide support for the proposition that gun availability and homicide are positively associated; thereby supporting the contention that increasing gun availability increases the likelihood of homicide. For example, Killias (1993b) found a positive correlation between gun availability—measured using an aggregated survey measure of gun ownership—and national homicide rates in 14 Western Developed nations. Additionally, Hemenway and Miller (2000) found a positive association between two indicators of gun availability—percentage of suicides committed with a gun and Cook's gun availability index—and homicide in a sample of 26 high income nations. It is important to note that the results from these studies are suggestive but not conclusive. As a result, critics of these studies have either rejected the findings or provided alternative explanations (Kleck, 1997; McDowall & Loftin, 1983).

Criticisms of this research can be placed in two categories. The first category involves criticism of the overreliance of correlation coefficients in the examination of this relationship. The overreliance of correlation coefficients precludes the establishment of causality. For example, Kleck (1997) notes that a significant association between gun availability and homicide can be interpreted to represent the effect of violent crime on gun availability. The overreliance on correlation coefficients also makes it impossible to control for other important predictors of homicide at the cross-national level. Due to this some researchers have concluded that "Cross national research holds little promise for assessing the impact of gun levels on violence levels" (Kleck, 1997, p. 254). But the failure to establish causality and control for other variables does not mean that research performing bivariate analysis is worthless. Rather, this research serves an important exploratory step in examining the relationship between gun availability and homicide. The analyses performed in previous research may be viewed as one step in the career of a casual relationship (Kenney, 1975). When viewed in this way, the finding of a significant association would suggest the need to explore the relationship with more rigorous statistical approaches in the future. Hoskin (2001) attempted to control for potential simultaneity between gun availability and homicide by using two-stage least squares regression to examine the gun/homicide relationship. His results suggest that gun availability levels influenced rates of homicide, but his failure to include proper

instruments for gun availability lead to serious questions about the veracity of his results.[1]

The second category of criticism deals with the composition of the sample included in the analysis. There is evidence that the significant results detected are due to the inclusion of the United States in the analyses. For instance, Hemenway and Miller (2000) found that the association between gun availability and homicide dropped to insignificance when the United States was excluded from the analysis. Additionally, Hemenway et al. (2002) found that firearm availability only influenced homicide rates when the United States was included in the analysis. Additionally, Kleck's (1997) reanalysis of the Killias (1993a) data found that the results dropped to insignificance when the United States was excluded.

Critics of this research also point out that it has primarily focused on Western Developed nations. Importantly, in the one situation when non-Western or lower income nations were included in the analysis the relationship between gun availability and gun homicide dropped from significance (Killias et al., 2001). In the same study, gun availability was found to have no association with homicide when all nations were included. Hepburn and Hemenway (2003) argued that inconsistent results emerge when high income and non-high income nations are included in the same analysis because differences in socioeconomic status may affect levels of lethal violence in these nations. Although this assertion seems plausible, an alternative proposition is that gun availability and homicide only exhibit a significant association in certain cultural and socio-historical settings.

Expanding Existing Theory and Literature to Account for Socio-Historical and Cultural Factors

Macro-level criminological research can be divided into three categories (Messner & Rosenfeld, 1999; Stamatel, 2006). The first involves social-structural approaches to the study of homicide. This research views homicide rates as social facts that are distributed in patterned ways. Patterns of homicide are influenced by the social structure, which describes the positions or statuses that people occupy and the behavioral expectations attached to these statuses (Messner & Rosenfeld, 1999). From a social-structural perspective, gun availability can be viewed as a material social fact that operates somewhat independent of socio-historical and cultural factors to influence gun homicide and homicide rates. A positive association between gun availability and homicide would be hypothesized to exist cross-nationally, in spite of socio-historical and cultural differences between nations.

The second approach involves research that examines how cultural processes influence rates of homicide. Proponents of this perspective argue that variation in homicide rates can be explained by values, norms, and beliefs held by members of a

[1] When considering the relationship between gun availability and homicide, instrumental variables must meet three conditions. First, they must be highly correlated with actual levels of gun availability. Second, they must not be correlated with the error term. Third, they must not affect homicide rates. Hoskin (2001) did not include instrumental variables that meet these conditions in his models. Nor did he provide results from post estimation tests that can support the notion that his instruments were valid. This raises the possibility that the models reported by Hoskin (2001) were misspecified.

society.[2] Although there are numerous cultural theories that attempt to explain crime, virtually all of these approaches to crime suggest that, at least in certain situations, some societies—or subgroups within society—are more accepting than others of the use of the violence in upholding certain values (Corzine, Huff-Corzine & Whitt, 1999; Reed, 1982; Wolfgang, 1958). In essence, it is culture that establishes how people within society interpret and respond to certain events and provocations (Swidler, 1986; Unnithan, Huff-Corzine, Corzine & Whitt, 1994). Thus, cultural processes may influence knowledge of weapons—including how to identify and use them—as well as situational definitions of when it is appropriate to use a weapon to injure or kill someone (Corzine et al., 1999; Kopel, 1992).

The third approach involves consideration of how socio-historical factors influence homicide (Stamatel, 2006). Socio-historical research is primarily concerned with how space and time shape structures of order and disorder across nations, and the implications that this has for cross-national variation in violence. Both political boundaries and geographic characteristics shape the social organization of societies. Consideration of time is important because social forces are temporally linked; and the occurrence and sequence of important historical events within specific political and geographic boundaries may influence the levels of violence within societies. From the socio-historical perspective, the manner that gun availability is associated with crime is influenced by the history and geography of a nation, as well as the occurrence of important temporal events. In nations where the gun historically has been viewed as a civilizing force against indigenous populations (i.e. cowboys and Native Americans); or in nations with vast and diverse geographic boundaries that make the development of gun sports possible; or in nations where the occurrence of certain temporal events lead to the breakdown of collective security; citizens may come to the view the use of guns as a viable option when responding to interpersonal disputes.

Although most cross-national research has been social-structural in nature, there is evidence in the criminological literature that both cultural and socio-historical processes influence cross-national variation in homicide. (Bennett, 1991; Gartner, 1990; Neopolitan, 1994; Ortega et al., 1992; Unnithan et al., 1994). Results of this research suggest that important structural predictors of crime do not necessarily operate uniformly across nations. This notion is further supported by historical and ethnographic firearm research that documents the greater glorification and toleration of gun use and gun violence in some societies than in others (Cox, 2007; Kohn, 2004; Kopel, 1992; Unnithan et al., 1994) . Taken together, this research suggests that an examination of the manner that socio-historical and cultural processes shape the nature gun/homicide relationship is warranted.

The Current Study

The current study has two objectives. First, to examine the association between gun availability and homicide in a manner that better accounts for simultaneity than previous research. Second, to examine the manner that the relationship between gun

[2] For a detailed discussion of cultural theories of homicide see Corzine et al. (1999)

availability and homicide is shaped by socio-historical and cultural context. To address these objectives, the analysis proceeds in the following manner. First, the relationship between gun availability, gun homicide, and homicide is examined for the entire sample of nations. Examining the effect of gun availability on gun homicide is necessary to determine if the greater availability of guns increases the likelihood that societal members will make a gun their weapon of choice when committing a violent assault. Importantly, a significant relationship between these two variables doesn't suggest weapon instrumentality. It is possible that citizens in these nations choose guns as their weapon of choice when they intend to seriously harm or kill their victim. A significant relationship between gun availability and homicide, however, would suggest greater weapon lethality.

The second objective will be met by examining the association between gun availability, gun homicide, and homicide across three groups of nations that are culturally and socio-historically distinct: Western nations, Latin American nations, and Eastern European nations. Examining Latin American Nations is important because previous research has argued that these nations are characterized by a machismo culture that increases the use of weapons and the likelihood of violence (Neopolitan, 1994). Examining Eastern European nations is important because previous research has found that the transition to market capitalism has led to the breakdown of collective security in many of these nations (Pridemore, 2005; Stamatel, 2009). Under these circumstances it is plausible that gun violence has become more likely in these nations.

Although it is recognized that the nations in each respective category are not entirely homogenous, it is assumed that nations are more similar to neighboring nations than nations in different cultural regions. Placing nations in categories, rather than looking at the effects of each nation separately, is necessary because data on the socio-historical and cultural processes of interest here are not available for a cross-national sample. This approach has been taken in previous cross-national research attempting to assess the effects of socio-historical and cultural processes on crime (Neopolitan, 1994; Ortega et al., 1992).

Data and Methods

This study provides a methodological improvement to existing cross-national work on guns and homicide. Specifically, we are able to model the effects of gun prevalence on homicide with special attention being paid to variation over both time and space.

Data

To test these arguments we collected annual national-level data for the years 2000 to 2005 on gun homicide, characteristics of nations, and meaningful controls. The use of yearly data is a methodological improvement to cross-sectional studies of guns and homicide for several reasons. First, by using time-varying data effects can be estimated more efficiently (Hsiao, 2003). Second, variation from year-to-year can be captured. Finally, the time-series design allows for claims of causality which are stronger than analyses which cannot account for temporal ordering.

This full sample used in this study contains data on 43 nations measured over 6 years. An investigation of the data showed no systematic patterns to missing data. Regional subsamples varied in the number of nations. Table 5 in the Appendix shows the composition of both the baseline set of nations as well as the specific regional groupings. Our choices of nations to include were determined by data availability. We note that the total number of nations included in the analysis is similar in size to other work in cross-national criminology (Hoskin, 2001; Messner & Rosenfeld, 1997; Pratt & Godsey, 2003; Pridemore, 2008).

Variables

Independent Variable

Gun availability was measured by the rate of gun suicides in each nation per 100,000 inhabitants for the years 2000 to 2005. These data were collected from the WHO ICD-10 raw data files. Suicide data were aggregated for each nation for the years 2000 through 2005. Each year of the suicide rate was operationalized by taking the number gun suicides for that particular year, dividing it by the national population for the same period of time, and multiplying that number by 100,000. The gun suicide rate is considered the proxy of choice for examining gun availability levels across macro-level units (Azrael, Cook & Miller, 2001). Confidence in the validity of this measure is further bolstered by the fact that it is highly correlated with Krug et al.'s (1998) cross-national indicator of the gun suicide rate. For the 21 nations that are included in both our dataset and Krug et al.'s (1998) dataset, the Pearson correlation is .93 and the Spearman's rho is .96.

Dependent Variables

Data for *gun homicide* were collected from the WHO ICD-10 raw data files. The *gun homicide* measure represents the proportion of homicides in each respective nation that involved the use of a firearm. It was operationalized as the number of gun homicides per 100,000 inhabitants for the years 2000 to 2005, respectfully. Due to data limitations, no distinction could be made between hand guns and long guns. The *homicide* measure was operationalized as the rate of homicides per 100,000 population for the years 2000 to 2005, respectfully.

Control Variables

The control variables included in the analyses of this study were selected to isolate the effects of gun availability on homicide and gun homicide. The following control variables were included in these analyses: economic inequality, GDP/capita, male population between the ages of 15 to 34 (*young males*), social support, urbanization, sex ratio. For all of the control variables, data were taken for the years 2000–2005. Data for *GDP/capita, social support,* and *urbanization* were taken from the World Development Indicators website (World Bank, 2011). *Economic inequality* was operationalized using the Gini index. There are numerous sources for this variable. Because of the yearly observations used in this analysis, we chose the net Gini

indicator from the Standardized World Income Inequality Database (SWIID).[3] This dataset standardizes the United Nations World Income Inequality Database while drawing from other sources and also providing yearly data. The net Gini indicator is a measure of inequality after all transfer payments are taken into consideration.[4] Controlling for this indicator is important because previous research has found economic inequality to be one of the most robust predictors of crime across nations (Pratt & Cullen, 2005; Messner, Raffalovich & Sutton, 2010). Gross Domestic Product was included as an indicator of the level of development within a nation. Previous research has found that Developed nations have lower levels of violence than developing and underdeveloped nations. Development was operationalized as GDP per capital in 1000 s of U.S. dollars. This figure was then log transformed to correct for skewness. Social support was operationalized as the percentage of the nation's GDP spent on healthcare.

Urbanization was operationalized as the proportion of national citizens who live in urban areas. This indicator measures the population density within a nation. Data for *pop15to34* and *sex ratio* were taken from the UN Demographic Yearbook. *Young males* is an indicator of the proportion of male citizens between the ages of 15 to 34. Previous research has found that nations with larger young populations have higher rates of homicide. *Sex ratio* was operationalized as the ratio of men per 100 women in society. Sex ratio has been found to be an important predictor of violence both within and between nations (Pratt & Cullen, 2005) Table 6 in the Appendix presents descriptive statistics for the nations in the sample. Correlations are based on the pooled sample. Means and standard deviations for all variables are presented.

Model Specification

Several statistical controls were included in the models to account for the time-series and cross-sectional structure of the data. First, we used an AR(1) error structure to account for any autocorrelation among observations. Models also use fixed effects for nations; the use of fixed effects for nations is a reasonable way to control for unobserved heterogeneity across the units of analysis. We also include a linear effect for time in all models. Finally, we allow for heteroskedasticity between panels but do not make the assumption of correlation between them. Overall, these models are fairly conservative and have been employed elsewhere in time-series cross-sectional comparative criminological research (Sutton, 2004). These modeling features also address the known major issues related to modeling variation across space and time (Worrall & Pratt, 2004).

All models for this analysis can be expressed in the following basic form:

$$y_{it} = \alpha + \beta_{it} + \varepsilon_{it} \tag{1}$$

where subscript i stands for the specific cross-sectional unit (nation) and t stands for time. This model assumes that there are unmeasured differences across nations which are captured in the intercept α which is fixed over time but varies across

[3] Available online at http://www.siuc.edu/~fsolt/swiid/swiid.html

[4] Post hoc analyses conducted using gross Gini indicators did not differ substantially from analyses using the net Gini indicator.

countries. These fixed effects for nations are created by using N dummies for nations and omitting the constant. In these models, β is a vector of all exogenous variables, including lagged variables when appropriate.

One of the issues with studies of gun homicide is the confounding effect of gun availability on gun homicide. One way to control for the effects of gun availability is to use a proxy variable. As noted above, at the cross-national level the most suitable variable is gun suicide. A second issue is the possible reciprocal effects of gun availability and gun homicide. One way to mitigate this issue is through the use of instrumental variables. However, in the absence of a suitable instrument this strategy was not available to us. Instead we followed the example of Cook and Ludwig (2003) and exploited the time-series character of the data. Specifically, we incorporated lagged effects of gun availability on gun homicide and homicide.[5]

Modeling Strategy

The main concern of this paper was a better understanding of the etiology of gun homicide across space. Accordingly, we performed statistical analyses for the entire set of nations in this sample as well as regional subsets; these regions are broadly identified as Western, Eastern European, and Latin American.[6]

Within each sample we included several models. Models 1 and 2 considered the structural factors of gun homicide while including the temporal controls for gun availability and previous levels of gun homicide. Models 3 and 4 are included for comparison with the gun homicide models. These consider the structural factors behind overall homicide rates, and whether levels of gun availability influence total rates of homicide. Results from analytical models are discussed in turn.

Results

Results for this study are reported in Tables 1 through 4. Table 1 reports the analysis of the effects of gun availability on gun homicide and homicide for all of the nations sampled. Model 1 in Table 1 presents a baseline model that examines the effects of the statistical controls on gun homicide. The model reveals that economic inequality, proportion young males, and urbanization all influence rates of gun homicide. Interestingly, the effects of economic inequality, proportion young males and urbanization are opposite of what might be expected. Model 2 shows the effects when lagged levels of gun availability are introduced in the model. Gun availability significantly influences levels of gun homicide. For every unit increase in gun availability, gun homicide decreases .145 units. Model 3 reports the baseline model that examines the effects of the statistical controls on homicide. The results reveal that economic inequality, proportion young males, sex

[5] We also considered the possibility that lagged gun homicide and homicide drove levels of gun availability (i.e. the reciprocal effects of crime on gun availability). These models showed no lagged effects of gun homicide on gun availability.

[6] We also explored combinations of the advanced nations such as including Asian industrial nations or other non-Western nations. Some differences were also found between the models that included industrial nations and those Western nations.

Table 1 Baseline models

	Gun Homicide		Homicide	
	Model 1	Model 2	Model 3	Model 4
Log GDP	−0.010	−0.010	−0.010	−0.011
	(0.025)	(0.025)	(0.009)	(0.009)
Inequality	−0.059**	−0.053**	−0.025**	−0.023**
	(0.014)	(0.014)	(0.005)	(0.005)
Young Males	−9.626**	−10.986**	−4.352**	−4.710**
	(2.804)	(2.791)	(0.982)	(1.063)
Sex Ratio	0.060*	0.062**	0.047*	0.047*
	(0.028)	(0.022)	(0.020)	(0.022)
Urbanization	−0.007**	−0.005	−0.008**	−0.008**
	(0.002)	(0.003)	(0.003)	(0.003)
Social Support	−0.014	−0.042	−0.087**	−0.086**
	(0.019)	(0.024)	(0.011)	(0.012)
Year	−0.028**	−0.030**	−0.021**	−0.021**
	(0.007)	(0.007)	(0.003)	(0.004)
Log Gun Homicide$_{t-1}$	0.033	0.040		
	(0.064)	(0.069)		
Log Gun Availability$_{t-1}$		−0.145**		0.016
		(0.028)		(0.037)
Log Homicide$_{t-1}$			−0.114	−0.055
			(0.060)	(0.071)
Observations	188	188	195	191

*p<.05, **p<.01

ratio, urbanization, and social support significantly influence rates of homicide. As in the previous models, and contrary to what has been found in previous research, economic inequality, young males, and urbanization exhibit effects opposite of what was expected. Gun availability is introduced in Model 4 and is found to have no effect on homicide.

Table 2 reports the effects of gun availability on gun homicide and homicide in Western nations only.[7] The baseline model reports that economic inequality, sex ratio, and urbanization significantly influence gun homicide levels. Importantly, the effect of economic inequality is in the expected direction. In Model 2 lagged gun availability is introduced. The results suggest that higher levels of gun availability increase levels of gun homicide in Western developed nations. Model 3 examines the effects of the statistical controls on homicide. The model reveals that

[7] The number of observations decreased substantially in the regional models. As such, the .10 alpha level was reported in the tables that included these models. This is common in cross-national research (cf. Pratt & Godsey, 2003).

Table 2 Western nations

	Gun Homicide		Homicide	
	Model 1	Model 2	Model 3	Model 4
Log GDP	0.002 (0.033)	0.001 (0.030)	−0.010** (0.005)	−0.007 (0.007)
Inequality	0.232*** (0.070)	0.241*** (0.069)	−0.085** (0.033)	−0.090** (0.039)
Young Males	4.566 (7.604)	8.964 (7.120)	−0.329 (3.724)	−1.221 (4.367)
Sex Ratio	0.357** (0.149)	0.258* (0.148)	−0.040 (0.057)	0.064 (0.079)
Urbanization	−0.038* (0.023)	−0.038 (0.027)	0.029*** (0.010)	0.029** (0.013)
Social Support	−0.070 (0.069)	−0.072 (0.073)	−0.025 (0.023)	−0.034 (0.030)
Year	−0.009 (0.026)	0.022 (0.032)	−0.025* (0.014)	−0.040** (0.018)
Log Gun Homicide$_{t-1}$	−0.036 (0.116)	−0.023 (0.115)		
Log Gun Availability$_{t-1}$		0.906*** (0.270)		−0.225* (0.116)
Log Homicide$_{t-1}$			−0.294*** (0.077)	−0.260** (0.107)
Observations	59	59	65	61

*p<.10, *p<.05, ***p<.01

GDP/capita, economic inequality, and urbanization influence homicide. As reported in Table 1, the effect of economic inequality is opposite of what is expected. Lagged gun availability is introduced into Model 4. The results reveal that gun availability significantly influences rates of homicide in this sample of nations. Increases in gun availability are associated with subsequent decreases in homicide.

Table 3 reports the effects of gun availability on gun homicide and homicide for Eastern European nations. The baseline model of the effects of the statistical controls on gun homicide reveals that economic inequality, proportion young males, urbanization, and social support influence gun homicide levels. Importantly, all of these variables influence gun homicide in a manner opposite of what might be expected. Lagged gun availability is introduced in Model 2. Gun availability has a negative effect on gun homicide. This suggests that, in Eastern European nations, increased levels of gun availability reduce rates of gun violence. Model 3 examines the effects of the statistical controls on homicide. GDP/capita, economic inequality, urbanization, and social support all significantly influence rates of homicide. Gun availability is introduced in Model 4. The results reveal that gun availability negatively influences rates of homicide in Eastern European nations (p<.10). Additionally, gun availability seems to mediate the effect of economic inequality on homicide.

Table 4 reports the effects of gun availability on gun homicide and homicide for Latin American nations. Model 1 reports the baseline model that regresses gun homicide on the important statistical controls. The findings reveal that GDP/capita, young males, sex ratio, and social support influence gun homicide levels. Lagged levels of gun availability were added in Model 2. Gun availability exhibits a significant positive effect on gun homicide. Additionally, when gun availability is added to the model economic inequality emerges as significant, thereby suggesting a

Table 3 Eastern European nations

	Gun Homicide		Homicide	
	Model 1	Model 2	Model 3	Model 4
Log GDP	−0.103 (0.201)	−0.341 (0.256)	−0.357*** (0.062)	−0.338*** (0.062)
Inequality	−0.068** (0.032)	−0.091*** (0.032)	0.019*** (0.005)	0.007 (0.006)
Young Males	−29.045*** (6.039)	−24.790*** (6.027)	−0.862 (1.266)	−1.164 (1.224)
Sex Ratio	−0.224 (0.222)	−0.269 (0.209)	0.015 (0.025)	−0.026 (0.031)
Urbanization	−0.018* (0.010)	−0.016 (0.012)	−0.024*** (0.003)	−0.030*** (0.004)
Social Support	0.157** (0.076)	0.113 (0.079)	−0.099*** (0.018)	−0.094*** (0.016)
Year	−0.043 (0.027)	−0.015 (0.031)	0.002 (0.001)	0.004** (0.002)
Log Gun Homicide$_{t-1}$	−0.056 (0.132)	0.016 (0.130)		
Log Gun Availability$_{t-1}$		−0.527*** (0.178)		−0.048** (0.022)
Log Homicide$_{t-1}$			0.201** (0.096)	0.162* (0.094)
Observations	60	60	60	60

*p<.10, **p<.05, ***p<.01

suppression effect. Model 3 examines the effects of the statistical controls on homicide. Only social support is found to significantly influence homicide in these models. Gun availability is added in Model 5 and is found to significantly influence rates of homicide. This suggests that higher levels of gun availability lead to higher

Table 4 Latin American nations

	Gun Homicide		Homicide	
	Model 1	Model 2	Model 3	Model 4
Log GDP	−0.032** (0.013)	−0.035*** (0.014)	−0.004 (0.051)	−0.027 (0.060)
Inequality	−0.010 (0.008)	−0.016* (0.009)	0.032 (0.021)	0.023 (0.023)
Young Males	−8.213** (3.754)	−7.308* (3.785)	−7.203 (5.424)	−8.509 (6.479)
Sex Ratio	0.076** (0.036)	0.075** (0.036)	0.079 (0.053)	0.101 (0.063)
Urbanization	−0.001 (0.001)	−0.001 (0.001)	−0.001 (0.003)	−0.006* (0.004)
Social Support	−0.077*** (0.017)	−0.075*** (0.019)	−0.085*** (0.021)	−0.103*** (0.027)
Year	0.014** (0.006)	0.016*** (0.006)	0.014 (0.012)	0.018 (0.013)
Log Gun Homicide$_{t-1}$	0.069 (0.125)	0.016 (0.127)		
Log Gun Availability$_{t-1}$		0.046* (0.026)		0.237*** (0.071)
Log Homicide$_{t-1}$			0.093 (0.135)	−0.085 (0.144)
Observations	53	53	53	53

†p<.10, *p<.05, ***p<.01

rates of homicide in Latin American nations. Interestingly, urbanization exhibits a significant negative effect once gun availability is introduced in the model. This suggests a suppression effect. The implications of these findings are discussed below.

Discussion

This study examined the relationship between gun availability, gun homicide and total homicide in a cross-national sample of nations. The objectives of this study were to examine the association between gun availability and violence in a manner that better accounted for simultaneity than previous research; and to examine the manner that the relationship between gun availability and homicide is shaped by socio-historical and cultural context. The results suggest that the nature of the relationship between gun availability, gun homicide and homicide is not stable across nations. Instead, the strength and nature of the relationship between gun availability and violence is contingent upon the region of the world that is examined. These findings help clarify why previous cross-national research has not been able to consistently detect a relationship between gun availability and homicide. The countervailing processes occurring in different regions seem to mask the total effects.

Several of the results warrant discussion here. The first concerns the dynamic between gun availability, gun homicide, and homicide. As discussed above, gun availability exhibited a positive effect on gun homicide in Western Developed nations and Latin American nations, and a negative effect in Eastern European nations and in the baseline model. Similar patterns were found with the dynamic between gun availability and homicide. No effect was found in the baseline model, but positive significant effects were found in Latin American nations and negative significant effects were found in Western nations and Eastern European nations.

These results suggest that the extent that guns are considered the weapon of choice for the commission of violence is largely shaped by cultural and socio-historical factors. In Western nations citizens appear to be more likely to view guns as the weapon of choice when committing violence, but apparently this preference for guns does not increase overall levels of lethality. Rather, this preference for use of guns seems to decrease overall rates of homicide. Perhaps Western citizens view guns as a defense mechanism against the aggression of others, rather than a tool to be used with the intent of causing great bodily harm or death. In Latin American nations it appears that gun availability increases both the preference for guns and the lethality of violence. This suggests that citizens of Latin American nations have a preference for gun use, and the sheer availability of guns in these nations increases the likelihood that violent altercations result in death. It may also suggest that a greater use of guns in Latin American violence represents that greater likelihood that Latin American aggressors intend to greatly harm or kill their victims. An entirely different dynamic seems to be occurring in Eastern European nations. It seems

that guns are primarily being used in these nations as a deterrent against potential aggression in an era characterized by weakened collective security.

In addition to the direct effects of gun availability exhibited here, gun availability was found to suppress the effects of urbanization on gun homicide in Latin American nations and to mediate the effects of economic inequality on homicide in Western Developed nations and Eastern European nations. The suppression effect suggests that the effects of gun availability on homicide may not be as pronounced in Latin American nations with high levels urbanization. This finding is somewhat counter intuitive but may suggest that citizens are more likely to benefit from the guardianship of others in densely populated areas of Latin American nations. The mediation effects suggest that the extent that economic inequality influences homicide across in Eastern European nations is contingent upon gun availability levels.

These findings also reveal that the causes of gun homicide and homicide diverge considerably. This was especially the case in the regional models. In some instances, a particular variable that influenced gun homicide was not found to influence homicide. In other instances, the effect was significant for both variables but the effect signs were in opposite directions. This suggests that criminologists must look to develop distinct explanations for the occurrence of weapon violence across nations.

Gun availability was not the only indicator to exhibit variable effects on violence across regions. Several of the control variables operated to influence violence in a similar matter. For example, economic inequality—one of the most robust predictors of homicide at the cross-national level—exhibited strong positive effects on homicide in the models that included Eastern European nations, negative effects in Western nations, and no effects in Latin American nations. This suggests that even the effects of robust predictors of violence, such as economic inequality, are influenced by socio-historical and cultural factors.

One question that emerges from these results concerns the anomalous findings related to our statistical controls and homicide. That is, in some models economic inequality, urbanization, and young males all exhibited effects contrary to what might be expected. It is not entirely clear why this occurred, but the following explanations are given here. First, one potential explanation for the negative effect of economic inequality on homicide is that the relationship is non-linear. A recent article by Jacobs and Richardson (2008) found that the relationship between economic inequality and homicide changes from positive to negative at extreme levels of inequality. The inclusion of Latin American and Eastern European nations in this analysis led to a higher proportion of nations with extreme levels of economic inequality being examined than what is normally the case in cross-national criminological research. Second, the negative relationship between urbanization and homicide that was found in the Eastern European models may suggest that urban areas provide greater protection for potential victims in these societies. This seems especially plausible if a considerable proportion of the homicides committed in these nations occur in rural areas. Third, the negative relationship between young males and violence in Latin American and Eastern European nations may suggest that older adults commit a higher proportion of homicides in these nations than the proportion

committed by older adults in Western nations. Indeed, previous research has found evidence of higher rates of violence among older adults in Eastern Europe (Pridemore, 2003; also see Savolainen, Lehti & Kivivuori, 2008).

Taken together, these results point to the need for greater consideration of the role that cultural and socio-historical factors play in influencing the manner that structural predictors influence homicide. Indeed, one assumption implicit in much of the existing cross-national research is that the effects of important structural predictors such as gun availability and economic inequality are invariant across nations. These finding suggest that this may not be the case. Instead, the unique cultural and socio-historical processes occurring across nations may be more important than many assume.

The results of this study have implications for theory and research on guns and violence. These results suggest that theoretical advancement of this relationship is contingent upon the ability of criminologists to address two issues. First, researchers must identify the macro-social processes that link gun availability to homicide at the cross-national level. Most of the macro-level research on guns and violence is reductionist in nature. Assuming that micro-social dynamics account for macro-level processes, however, limits our ability to address important questions that have emerged from cross-national research. For example, applying the weapon instrumentality hypothesis to the cross-national level leads one to assume that, under all circumstances, increasing gun availability will increase homicide. Such a straight forward application does not allow for consideration of the macro-level factors that may mediate or moderate the effects of gun availability on homicide.

Second, it is time for greater consideration of the role that socio-historical and cultural processes play in influencing the legitimization of violence and the use of weapons in interpersonal violence across nations. Although there currently is no dominant theoretical approach to guide such research, existing research on culture and violence may guide the development of such a perspective. For instance, one possible starting point could be the work of Corzine et al. (1999) who have expanded Swidler's (1986) idea of "culture as a toolkit" to account for macro-level variation in violence (also see Unnithan et al., 1994). Corzine et al. (1999, p. 46) argue that Swidler's (1986) conceptualization of culture provides two paths to understanding the manner that cultural differences across nations or groups might influence levels of violence. The first is knowledge of weapons; which includes how to identify and use them. The second involves the provision of definitions of the situation that influence the likelihood that an actor will decide to use a weapon in physical violence with the intent to injure or kill someone. Such an approach leads one to ask if nations with cultural toolkits characterized by knowledge and acceptance of firearm use and situational definitions that legitimize interpersonal violence have higher rates of homicide?

The utility of the approach proposed by Corzine et al. (1999) is further illustrated when it is applied to an explanation of why gun availability is more likely to lead to homicide in Latin American nations than Western Developed and Eastern European nations. Existing cultural explanations of violence in Latin America conceptualize these nations as having higher levels of machismo

(Neopolitan, 1994). This machismo is said to be characterized by aggressive masculinity, domination of women, and the use of violence. The problem with such values based approaches is that they are difficult to empirically test because behavioral manifestations of values are often constrained by how culture organizes and patterns behavior (Swidler, 1986). In other words, people in a certain nation may aspire to solve altercations peacefully, but the "strategies of action" outlined by the culture may encourage, or even require, the use of physical violence. A more fruitful approach may be to examine if the cultural toolkits in Latin American nations are more likely to legitimate the use of a firearm and sanction the commission of interpersonal violence than the toolkits of other nations. Applying this approach to Eastern European nations would lead one to ask if the unique socio-historical changes that have occurred in Eastern European nations in recent decades have led to the development of a cultural toolkit that legitimates the use of weapons for personal defense and to reduce the likelihood of interpersonal violence.

Importantly, the extent to which such questions can be addressed depends on the availability of data. As with all cross-national research, it is often difficult to find valid indicators of cultural processes and other theoretical constructs. Despite this challenge, researchers must continue to look for cross-national data that can be conceptualized to measure socio-historical and cultural processes. Much of the existing cross-national research that has examined socio-historical or cultural processes—including this paper—has used dummy or regional variables as proxies of socio-historical and cultural processes, or tested different regions separately. Although this approach has helped expand understanding of the relationship between these processes and violent crime, its results are suggestive at best and do not provide insight about which socio-historical and cultural processes are at work and how they operate. This approach also says little about variation between nations within the same cultural region. For instance, it is likely that the degree to which cultural processes operate to influence gun homicide is greater in some Latin American nations than others. Existing macro-level criminological research on violence in Latin America, however, gives us little insight about which nations are most affected by such processes. In order to further expand knowledge of how socio-historical and cultural approaches operate to influence cross-national variation in violence, future research must identify specific indicators of these processes and empirically test how they influence homicide across nations.

In addition to the guidance provided by theory, ethnographic research is a potential source of guidance for the development of new indicators of cultural toolkits supportive of gun violence (Anderson, 1999; Horowitz, 1983; Kopel, 1992; Springwood, 2007). These studies are important because they give insight into how macro-level measures of the processes of interest might be operationalized. For example, interviews of young Chicano males in America might give insight into what type of variables might be aggregated to create an indicator of a cultural toolkit that is supportive of violence.

In addition to the implications mentioned above, future research must further explore how the processes examined here operate in African and Asian nations. Like most cross-national research, consideration of the processes occurring in African or

Asian nations was neglected in this study. Nations were included in this analysis solely on the basis of the availability of the gun availability indicator, and is likely that it will take time before more nations report reliable gun suicide data to the WHO. One alternative source of gun availability data is the International Crime Victim Survey, which includes an indicator of whether respondents own a gun. Currently, however, the ICVS provides gun availability data for a smaller number of nations than the WHO.

Future research should also explore potential non-linear relationships between gun availability, gun homicide, and homicide. These examinations should consider non-linear relationships in cross-national samples and samples of specific cultural regions. Examinations of such relationships may be important because it is plausible that gun availability will only be associated with homicide after certain levels of gun availability are reached. It is equally plausible that once gun availability levels reach a saturation phase the strength of the association between gun availability and homicide may become attenuated.

Appendix

Table 5 Nations included in analyses

Baseline Models		Western Models	East European Models	Latin American Models
Argentina	Latvia	Australia	Croatia	Argentina
Australia	Lithuania	Austria	Czech Rep.	Brazil
Austria	Luxembourg	Canada	Estonia	Chile
Brazil	Malta	Finland	Hungary	Costa Rica
Canada	Mexico	France	Kyrgyzstan	Dominican Republic
Chile	Moldova	Germany	Latvia	Ecuador
Costa Rica	Netherlands	Luxembourg	Lithuania	El Salvador
Croatia	New Zealand	Netherlands	Moldova	Mexico
Czech Republic	Nicaragua	New Zealand	Poland	Nicaragua
Dominican Republic	Norway	Norway	Romania	Panama
Ecuador	Panama	Spain	Slovakia	Paraguay
El Salvador	Paraguay	Sweden	Slovenia	Venezuela
Estonia	Poland	UK		
Finland	Romania	USA		
France	Slovakia			
Germany	Slovenia			
Hungary	Spain			
Israel	Sweden			
Japan	UK			
Korea	USA			
Kyrgyzstan	Venezuela			

Table 6 Correlations and descriptive statistics for nations included in analysis (N=233)

	1.	2.	3.	4.	5.	6.	7.	8.	9.
Log Gun Homicide									
Log Homicide Rate	0.352**								
Log Gun availability	0.506**	−0.001							
Log GDP	−0.072	−0.604**	0.274**						
Inequality	0.479**	0.740**	−0.140*	−0.475**					
Young Males	0.182**	0.774**	−0.336**	−0.678**	0.620**				
Sex Ratio	0.449**	0.033	−0.162*	−0.071	0.370**	0.215**			
Urbanization	0.111	−0.034	0.289**	0.372**	0.112	−0.246**	−0.095		
Social Support	0.289**	−0.365**	0.457**	0.448**	−0.202*	−0.530**	0.065	0.158*	
Mean	−1.547	1.193	−0.261	9.455	35.381	0.314	96.154	0.110	7.517
Standard Deviation	0.988	1.170	1.202	0.926	9.138	0.034	3.982	11.801	1.937

*p<.05, **p<.01

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