THE IMPACT OF POLICE LEVELS ON CRIME RATES: A SYSTEMATIC ANALYSIS OF METHODS AND STATISTICS IN EXISTING STUDIES

Hyeyoung Lim
Western Illinois University, USA

Hoon Lee
Sam Houston State University, USA

Steven J. Cuvelier
Sam Houston State University, USA

This article investigated whether increased policing levels reduce crime rates, focusing on methodological and statistical specifications which should be addressed to examine the relationship. A total of 256 findings out of 58 relevant studies were systematically analyzed. Although the types of crime rates used in each study varied, most of the findings produced negative relationships rather than positive ones between police levels and crime rates regardless of their significance levels. The overall results of this study, however, could not support firm conclusions on the deterrent impact of increased police levels on crime rates because most reviewed studies did not control essential variables and failed to resolve methodological issues in their analysis. A better specified and sophisticated research design and statistical techniques are needed to identify the relationship between police levels and crime.

Do police prevent crime? The literature has not generally supported an association between levels of police presence and crime rates, which is contrary to popular belief and apparently one of the best-kept secrets in modern life (Bayley, 1994; Gottfredson & Hirschi, 1990; Sherman, 1992, 1995; Sherman et al., 1997). Police supporters have argued that it is unrealistic to expect effective crime prevention without sufficient numbers of police officers on the street. Increases in police

1

personnel and budget, consequently, are often cited as a primary crime prevention strategy despite the lack of empirical support.

There have been steady increases in police manpower and expenditure over the past several decades in the United States. The Violent Crime Control and Law Enforcement Act of 1994, for example, authorized funding for employing 100,000 new police officers, which represents an increase of approximately 14 percent (Marvell & Moody, 1996). Moreover, the Bureau of Justice Statistics has reported that police budgets increased 179 percent between 1982 and 1996 (Kovandzic & Sloan, 2002). The increase in police officers and funding in the United States is based in part on the assumption that additional police deters crime by making criminals recognize the greater likelihood of arrests and sanctions (Ehrlich, 1972).

Deterrence concepts and assumptions, however, have been challenged by a growing body of research that has found little empirical support for them in crime prevention. Cameron (1988) reviewed 22 studies of the police-crime relationship and found no support in 18 studies and even positive relationships in two others. Marvell and Moody (1996) reviewed 36 published studies of the police-crime relationship, finding only 10 studies that supported the deterrence hypothesis. More recent studies, however, reported significant inverse relationships between the increased police levels and crime rates (Kim, 2007; Lilley & Boba, 2008; Zhao, Scheider, & Thurman, 2002). For instance, Kim (2007) examined 466 U.S. cities and 173 counties over an eight-year period using a dynamic panel data analysis. Kim's study found short-term impacts of both increases of the number of police and police activity-arrest on certain types of crimes such as auto theft, robbery and homicide, but not on all types of crime. The current article attempted to find explanations for the inconsistent results reported in the literature by reviewing relevant studies published over the last four decades on the police-crime relationship and focusing on their methodological and substantive differences.

THEORETICAL BACKGROUNDS

The contemporary argument supporting an inverse effect of police on crime rates is based upon utilitarian concepts (Marvell & Moody, 1996), which are the cornerstone of classical criminology. Classical criminology is, in essence, an economic theory of crime that asserts that people rationally calculate and balance costs and benefits of behavioral options (Einstadter & Henry, 1995; Phillips & Votey, 1972). Classical criminology assumes that all people have freewill to choose to violate or obey the laws by individual calculation of the risk of pain versus the

pleasure of the act (Akers & Sellers, 2000). These concepts go back to Beccaria and Bentham, the founders of classical criminology. Personal decisions to commit crime are usually based on rational choice which, Beccaria believed, reflected materialism and represented the offenders' attempt to improve the material conditions in their lives. Bentham believed criminals chose to violate the law because they desired money, sex, excitement, revenge, or any other such gain" (Meier, 1989, p. 92). According to Siegel (1989), the choice to violate the law is similar to deciding to undertake conventional actions. Classical criminologists take into consideration the possibility of arrest and the probability of legal punishment in contemplating the characteristic of crime (Akers & Sellers, 2000).

The original classical theory has been transformed into several perspectives such as Neoclassicism, justice models, economic theories of crime, rational choice models, situational choice models, and routine activity theories (Einstadter & Henry, 1995). The concept of deterrence has been generally coupled with the introduction of rational choice theory into criminology in the 1980s. The difference between deterrence theory and rational choice theory is that deterrence theory mainly focuses on the effect of punishment on criminal choices, while rational choice theory focuses on the effect of opportunity on criminal behavior. The similarity between rational choice in a free market and in crime is the one of the reasons why rational choice theories have been favored by many economists (Becker, 1968; Ehrlich, 1973; Heineke, 1978; Reynolds, 1980; Schmidt & Witte, 1984; Sullivan, 1973; Tullock, 1969).

Gibbs (1975) noted that "as sociologists became more interested in the deterrence issue, economists became interested in rational choice models of crime" and "shortly after the rival of interest in the deterrence question among sociologists, economists were drawn to the subject in large number" (p. 203). Becker (1968),who established the theoretical framework of the rational choice theory, hypothesized that the decisions of the criminals are based on the expected reward compared to the possibility of arrest and severity of punishment. Thus, when given the choice of legal economic gain against illegal avenues of economic gain, people are more likely to choose the former when the costs of crime increase (Marvell & Moody, 1996). Over the past twenty years, the rational choice theory has been frequently applied to crime control strategies and the logic that people commit crime because it pays has been used to justify "get-tough" policies. As a counter-plan, increases of punishment have been adopted so that the costs of crime surpass its benefits. Politicians use the lack of deterrence as proof that the cost of crime has not been raised enough and call for another round of get-tough policies (Clear, 1994; Currie, 1998). Reynolds (1996) maintained that "crimes are committed

by people who at least implicitly compare the expected benefits with the expected costs, including the costs of being caught and punished" (p. 9). The impact of law enforcement and punishment on the individual criminal decisions are expected to increase the costs of crimes. Marvell and Moody (1996) pointed out "additional police presence deters crime by making criminals believe arrests and subsequent sanctions are more likely" (p. 609).

Another version of the classical position of economic theory is routine activity theory (Cohen & Felson, 1979; Felson, 1987; Felson & Cohen, 1980). This theory is based on the ecological tradition and partly on control theory which, consistent with classical criminology, holds that human beings are rational. Cohen and Felson (1979) asserted that crimes require the convergence in time and place of a motivated offender, a suitable target, and the absence of a capable guardian. They argued that some changes in crime rates might be explained by the changes of the availability of suitable targets and in the absence of capable guardianships. The theory is not exactly deterrence or rational choice, but the concept of capable guardianship includes the formal police activity to prevent crimes. The basic assumption of routine activity theory is the motivated offenders commit crimes after assessing the presence of guardians, which is similar with the rational calculation in rational choice theory. For this reason, routine activity theory is often interpreted as another version of rational choice theory (Akers & Sellers, 2004).

Routine activity or situational choice theories, however, emphasize the strategies of crime prevention that do not involve the use of police, downplaying the importance of police under the premise that "crime is a private phenomenon largely impervious to state intervention" (Akers, 1999, p. 28). Episodic police patrols, one of the main crime prevention strategies of police departments, cannot displace the three factors suggested by Felson (1998). Consequently, theorists often adopt problem-oriented policing when studying police-crime relations and applying routine activity theories (Eck & Spelman, 1987; Goldstein, 1979; Sherman et al., 1997).

METHODS

The present article examines the findings of existing studies to identify the impact of the increased police levels on crime rates. Several selection criteria were established to retrieve relevant literature from the study population. First, the dependent variables are limited to crime rates. There are several patterns in dealing with crime rates in this field. Most studies used Index crime rates from the Federal Bureau of Investigation (FBI) although some excluded the rates of arson or both

arson and rape. Some studies reported the rates of individual index crimes separately while others reported the result of total index crime rates. Regardless of how they were measured, various methods of measuring crime rates were all included in this study. Second, the independent variable is police levels, which include the total number of police officers as well as expenditures on policing. Although the studies used either the number of total sworn officers or the number of police employees as a predictor variable, these two measures were all included in the current study because they are reasonable proxies of police manpower. Third, studies included in this analysis are limited to only quantitative studies written in English.

The following search terms were used to retrieve relevant studies from research databases: "police levels," "police employment," "police manpower," "police expenditure," "police outlay," "police budget," "police and deterrence," and "police and crime prevention." After relevant studies were found, the references of each study were reviewed to find additional relevant literature. The current study was able to identify and retrieve 58 pertinent studies that addressed the hypothesis that the increased police levels have an inverse effect on crime rates.

The 58 selected studies were systematically reviewed to find explanations for the inconsistent results in these studies by focusing on their methodological and substantial differences based on the following criteria: (1) total number years analyzed; (2) unit of analysis (jurisdiction, city, or county); (3) research design (cross-sectional design, multiple time-series design, panel design or time-series design); (4) sample size; (5) type of statistical analysis (bivariate, ordinary least squares, two stage least squares, three stage least squares, or other analyses); (6) simultaneity controlled (yes/no); (7) if so, how simultaneity was controlled (by Granger test, instrumental variable(s), lagged variable(s) or two stage least squares analysis); (8) arrest rates controlled (yes/no); (9) crime clearance rates controlled (yes/no); (10) patrol controlled (yes/no); (11) the total number of control variables; (12) types of independent variables (number of police officers or police expenditure); (13) types of dependent variables (offense types); and (14) direction of significant or non-significant findings. The following section discuses on the contemporary issues in police-crime studies based on the findings from the systematic analysis of those studies.

5

CONTEMPORARY ISSUES IN POLICE-CRIME RESEARCH

The current study examined the 58 empirical studies, assessing the impact of police levels on crime rates. A detailed description of each individual study is presented in Table 1, and all findings are summarized in Table 2. Among the 58 studies, eight studies adopted the total Index crime rates as the main dependent variable. Violent/property crime rates were measured in 25 studies, and individual Index crime rates were used as main outcome variables in 25 studies. A total of 256 findings were produced from the 58 studies: 11 on total Index crime rates, 24 on violent crime rates, 30 on property crime rates, and 191 on specified crime rates.1

As Table 2 shows, the entire set of findings consisted of 50 (20 percent) inverse and significant, 115 (45 percent) inverse and non-significant, 57 (22 percent) positive and non-significant, and 34 (13 percent) positive and significant relationships between police levels and crime rates. Contrary to the relevant

Table 1: Description of Individual Studies of the Effect of Police Levels on Crime Rates

Study	Data year/place	Design[a]	N	Type of Analysis[b]	Simultaneity[c]	Arrest[d]			#CV[g]	Police Level[h]	Crime Rates	Findings[i] (one-tailed) Contemporaneous /Lagged
Boba & Lilley (2009)	1996-2002/10,371 U.S. jurisdictions	P	55,917	OLS	No	No	No	No	6	$	Homicide	-*
											Rape	-*
											Robbery	-
											Assault	-*
											Burglary	+
											Larceny	+
											Auto theft	+
Lilley & Boba (2008)	1990-2001/11,559 U.S. jurisdictions	P	91,323	OLS	No	No	No	No	12	$	Homicide	-*
											Rape	-*
											Robbery	-*
											Assault	-*
											Burglary	-*
											Larceny	-*
											Auto theft	-*
Ren et al. (2008)	1991-2001/85 U.S. cities	P	935	OLS	No	No	No	No	11	$	Violent	-*
Evans & Owens (2007)	1991-2001/2,074 U.S. cities	P	23,335	2SLS	No	No	No	No	0	#	Homicide	-
											Rape	-
											Robbery	-
											Assault	-

Study	Period/Sample		N	Method							Crime		
											Burglary	-	
											Larceny	-	
											Auto theft	-	
										$	Homicide	-	
											Rape	-	
											Robbery	-	
											Assault	-	
											Burglary	-	
											Larceny	-	
											Auto theft	-	
Kim (2007)	1990-1997/58 U.S. cities	P	464	FD-GMM	Yes/Lag	Yes	No	No	14	#	Homicide	+	-
											Rape	-	+
											Robbery	-	-
											Assault	-	-
											Burglary	-	-
											Larceny	+	-
											Auto theft	-	-*
	1990-1997/408 U.S. cities	P	3,264	FD-GMM	Yes/Lag	Yes	No	No	14	#	Homicide	-	
											Rape	-	
											Robbery	-	
											Assault	-	
											Burglary	-	
											Larceny	-	
											Auto theft	-	
	1992-1999/173 counties	P	1,384	FD-GMM	Yes/Lag	Yes	No	No	14	#	Homicide	-	
											Rape	-	
											Robbery	+	
											Assault	-	
											Burglary	+	
											Larceny	+	
											Auto theft	+	
Worrall & Kovandzic (2007)	1990-2000/189 U.S. cities	P	2,079	2SLS	No	No	No	No	12	$	Homicide	-	
											Rape	-*	
											Robbery	-	
											Assault	+	
											Burglary	-	
											Larceny	-	
											Auto theft	-*	
Corman & Mocan (2005)	1974-1999/New York City	TS	300	OLS	Yes/Lag	Yes	No	No	5	#	Homicide	-	
											Rape	-	
											Robbery	-	
											Assault	-	
											Burglary	-	
											Larceny	-*	
											Auto theft	-*	
Gould et al. (2002)	1979-1997/371 U.S. counties	P	5,979	OLS	No	Yes	No	No	4	$	Homicide	+	
											Rape	+	
											Robbery	+*	

Study	Period/Sample	Type	N	Method	Endog.				n	#/$	Crime		
											Assault	+*	
											Burglary	+*	
											Larceny	+*	
											Auto theft	+*	
										#	Homicide	-	
											Rape	+*	
											Robbery	+	
											Assault	+	
											Burglary	-	
											Larceny	+	
											Auto theft	-	
Kovandzic & Sloan (2002)	1980-1998/57 FL counties	MTS	1,025	OLS	Yes/GT	No	No	No	3	#	Homicide		-
											Rape		+
											Robbery		-*
											Assault		+
											Burglary		-*
											Larceny		-
											Auto theft		-
Levitt (2002)	1975-1995/122 U.S. cities	P	2,005	2SLS	Yes/IV	No	No	No	7	#	Violent		-
											Property		-
MacDonald (2002)	1993-1994/164 U.S. cities	CX	164	OLS	No	No	No	No	11	#	Homicide	-	
											Robbery	+	
	1997-1998/164 U.S. cities	CX	164	OLS	No	No	No	No	13	#	Homicide	-	
											Robbery	+	
	1997-1998/164 U.S. cities	CX	164	OLS	No	No	No	No	15	#	Homicide	-	
											Robbery	-	
McCrary (2002)	1970-1992/59 U.S. cities	P	1,136	2SLS	Yes/IV	No	No	No	5	#	Homicide		-
											Rape		+
											Robbery		-
											Assault		-
											Burglary		-
											Larceny		+
											Auto theft		-
Zhao et al. (2002)	1995-1999/6,100 city police agencies	P	36,605	2SLS	No	No	No	No	7	$	Violent		-*
											Property		-*
Muhlhausen (2001)	1995-1998/752 U.S. counties	P	3,010	OLS	No	No	Yes	No	14	$	Violent		-*
Corman & Mocan (2000)	1970-1996/New York city	TS	324	2SLS	Yes/Lag	Yes	No	No	3	#	Homicide	-	-
											Robbery	-	-
											Assault	-*	-
											Burglary	-	-
											Auto theft	-	-
Benson et al. (1998)	1983-1987/67 FL counties	TS	335	OLS	No	Yes	No	No	13	#	Crime	-	-*
											$ Crime	+*	+*
Levitt (1997)	1970-1992/59 U.S. cities	P	1,136	2SLS	Yes/IV	No	No	No	7	#	Homicide	-	
											Rape	+	

8

											Robbery	-
											Assault	-
											Burglary	-
											Larceny	+
											Auto theft	-
Chamlin & Langworthy (1996)	1930-1987/Milwaukee	TS	58	BA	No	No	No	No	0	#	Violent	-
											Property	-
Marvell & Moody (1996)	1973-1993/49 states	MTS	980	OLS	Yes/GT	No	No	No	9	#	Homicide	-*
											Rape	-
											Robbery	-*
											Assault	-
											Burglary	-*
											Larceny	+
											Auto theft	-
	1973-1992/56 cities	MTS	1,029	OLS	Yes/GT	No	No	No	8	#	Homicide	-*
											Rape	-
											Robbery	-*
											Assault	+
											Burglary	-*
											Larceny	-*
											Auto theft	-*
Cornwell & Trumbull (1994)	Year Unknown/North Carolina	MTS	630	2SLS	Yes/IV	Yes	No	No	19	#	Crime	+
Niskanen (1994)	1991/50 States and the District of Columbia	CX	51	2SLS	Yes/2SLS	No	No	No	9	#	Violent	+
											Property	+
Sollars et al. (1994)	1987/296 FL jurisdictions	CX	296	OLS	No	Yes	No	No	19	#	Property	+
Tauchen et al. (1994)	1964-1970/Philadelphia	P	7	OLS	No	Yes	No	No	17	$	Crime	-*
van Tulder (1992)	1979-1980/805 Dutch municipals	CX	805	OLS	No	No	No	No	11	#	Violent	+*
											Property	+
	1979-1980/40 Dutch areas	CX	40	OLS	No	No	No	No	6	#	Violent	-
											Property	-
	1950-1981/32 Dutch areas	TS	1,024	OLS	No	No	No	No	7	#	Property	-*
Corman & Joyce (1990)	1970-1986/New York City	TS	189	VAR	Yes/GT	Yes	No	No	4	#	Homicide	+
											Rape	+
											Robbery	+*
											Assault	+*
Deutsch et al. (1990)	1970-1980/48 states	MTS	528	OLS	No	No	No	No	5	$	Property	-*
Mikesell &	1970-1984/50	MTS	750	OLS	No	No	No	No	5	#	Property	+*

9

Study	Time/Location	Type	N	Method						\$/#	Crime		
Pirog-Good (1990)	states												
Friedman et al. (1989)	1970-1980/45 states	MTS	517	OLS	No	No	No	No	1	\$	Property	-*	+
Corman et al. (1987)	1970-1984/New York City	MTS	174	VAR	Yes/GT	Yes	No	No	3	#	Property		+
Howsen & Jarrel (1987)	1981/120 Kentucky counties	CX	120	2SLS	Yes/2SLS	No	Yes	No	5	#	Robbery Burglary Larceny	-* -* -*	
Krahn & Kennedy (1985)	Oct 1978-Jan1979/ 23 Canada cities	CX	19	BA	No	No	No	No	0	#	Violent Property	- -	
Greenberg et al. (1983)	1960 & 1970/252 U.S. northern & northeastern suburbs	P	252	OLS	Yes/Lag	No	No	No	5	#	Violent Property	+ +	- +
	1960 & 1970/269 U.S. cities	P	269	OLS	Yes/Lag	No	No	No	3	#	Violent Property	+* +*	+* +*
Liu & Bee (1983)	1969-1980/Youngstown	TS	48	OLS	No	Yes	No	No	6	\$	Property	+	
Zedlewski (1983)	1977/168 Standard Metropolitan Statistical Areas	CX	168	OLS	No	No	No	No	7	\$	Burglary Larceny	-* -*	
Brown (1982)	1972-1973/Chicago Suburbs	CX	126	OLS	No	No	No	No	15	\$	Property	+*	
Greenberg & Kessler (1982)	1960 & 1962/130 U.S. cities	CX	130	OLS	Yes/Lag	No	No	No	9	\$	Violent	-	+
Loftin & McDowall (1982)	1926-1977/City of Detroit	TS	52	BA	Yes/GT	No	No	No	0	#	Crime	+	
Jacob & Rich (1981)	1948-1978/9 U.S. cities	TS	279	BA	No	No	No	No	0	\$	Robbery	+*	
Fujii & Mak (1980)	1961-1975/Hawaii	TS	15	OLS	No	No	Yes	No	4	#	Homicide Rape Robbery Assault Burglary Larceny Auto theft	- + - - - + -	
Hakim (1980)	1970/ 94 Suburbs of New Jersey	CX	94	OLS	No	No	No	No	3	\$	Property	+*	
Huff &	1970-1972/252	CX	252	2SLS	Yes/2SLS	No	No	No	5	#	Violent	+	

10

Study	Data	Design	N	Method	Simultaneity				No.	Stat	Crime	Effect
Stahura (1980)	U.S. northern & northeastern suburbs										Property	+
Humphries & Wallace (1980)	1950 & 1971/23 U.S. cities	CX	23	OLS	No	No	No	No	7	#	Auto theft	-
Cloninger & Sartorius (1979)	1960-1976/City of Houston	TS	17	3SLS	Yes/2SLS	Yes	No	No	12	#	Homicide	-
											Auto theft	-
										$	Homicide	-
											Auto theft	-
Hakim et al. (1979)	1970/94 Suburbs of south New Jersey	CX	94	2SLS	Yes/2SLS	No	No	No	3	$	Larceny	-*
											Auto theft	-*
Bahl et al. (1978)	1972/79 U.S. cities	CX	79	2SLS	Yes/2SLS	No	No	No	4	#	Crime	-*
Hakim et al. (1978)	1970/61 Philadelphia communities	CX	1970	OLS	No	No	Yes	No	4	$	Robbery	+*
											Burglary	+
											Larceny	+
											Auto theft	+
Mehay (1977)	1969/46 U.S. cities	CX	46	OLS	No	No	Yes	No	5	#	Violent	-
											Property	+*
Land & Felson (1976)	1947-1972/U.S.	TS	26	OLS	No	No	No	No	4	$	Violent	-*
											Property	-*
Cloninger (1975)	1969-1971/113 Southern cities	CX	339	OLS	No	No	No	No	9	#	Homicide	-*
											Rape	+
											Robbery	+
											Assault	+
											Burglary	+
											Larceny	+
											Auto theft	-
Pogue (1975)	1962 & 1967/163 Standard Metropolitan Statistical Areas	CX	326	2SLS	Yes/2SLS	No	No	No	13	$	Homicide	+
											Rape	+*
											Robbery	+*
											Assault	+*
											Burglary	+*
											Larceny	+*
											Auto theft	+*
	1968/66 Standard Metropolitan Statistical Areas	CX	66	2SLS	Yes/2SLS	No	No	No	13	$	Homicide	-
											Rape	-
											Robbery	+
											Assault	-
											Burglary	-
											Larceny	+
											Auto	+

11

											theft	
McPheters & Stronge (1974)	1970/ 43 U.S. central cities	CX	43	2SLS	Yes/2SLS	No	No	No	6	$	Crime	-*
Swimmer E. (1974)	1960/U.S. 118 cities	CX	118	2SLS	Yes/2SLS	No	No	No	8	$	Homicide	-*
											Rape	-*
											Robbery	-
											Assault	-
											Burglary	-
											Larceny	-
											Auto theft	-
Swimmer G. (1974)	1960/U.S. 119 cities	CX	119	2SLS	Yes/2SLS	No	No	No	10	$	Violent	-*
											Property	-
Wellford (1974)	1960 & 1970/21 U.S. cities	CX	42	OLS	No	No	Yes	No	14	#	Violent	-
											Property	-
											$	Violent	-
												Property	-
Carr-Hill & Stern (1973)	1961 & 1966/110 districts of England & Whales	CX	110	FIML	No	No	Yes	No	5	$	Crime	+*
Ehrlich (1973)	1960/47 states	CX	47	2SLS	Yes/2SLS	Yes	No	No	7	$	Crime	-
Greenwood & Wadycki (1973)	1960 & 1962/199 SMSAs	CX	199	2SLS	Yes/2SLS	No	No	No	7	$	Violent	+*
											Property	+*
											#	Violent	+*
												Property	+*
Morris & Tweeten (1971)	1968/754 U.S. cities	CX	754	OLS	Yes/Lag	No	No	No	8	#	Violent	+*
												Property	+*

a CX = Cross-sectional design, MTS = Multiple Time-Series design, P = Panel design, TS = Time-Series design

b BA = Bivariate analysis, FD-GMM = First Differenced Generalized Method of Moments, FIML = Full Information Maximum Likelihood estimates, OLS = Ordinary Least Squares, 2SLS = Two Stage Least Squares,
   3SLS = Three Stage Least Squares,
   VAR = Vector Auto Regression

c GT = Granger Test, IV = Instrumental Variable, Lag = Lagged test

d Arrest Rates controlled

e Crime Clearance Rates controlled

f Patrol controlled

g Number of control variables

h # = Number of police officers, $ = Police expenditure

i Contemporaneous = Year to year analysis, Lagged = Lagged test* p < .05.

Table 2: Summary of the Entire Findings

	Number of Studies	Number	(Percent) of Findings			
		All	- Sig[a]	- ns[b]	+ ns[c]	+ Sig[d]
Total	58	256	50 (20%)	115 (45%)	57 (22%)	34 (13%)
Crime/Violent/PropertyCombined	**33**	**65**	**14 (21%)**	**18 (28%)**	**15 (23%)**	**18 (28%)**
- Crime	8	11	4 (36%)	2 (18%)	2 (18%)	3 (28%)
- Violent Crime	17	24	5 (21%)	9 (38%)	4 (17%)	6 (24%)
- Property Crime	22	30	5 (17%)	7 (23%)	9 (30%)	9 (30%)
IndividualIndexICrime	**25**	**191**	**36 (19%)**	**97 (51%)**	**42 (22%)**	**16 (8%)**
- Homicide	19	30	6 (20%)	20 (67%)	4 (13%)	0 (0%)
- Rape	16	23	4 (17%)	9 (39%)	8 (35%)	2 (9%)
- Robbery	21	31	5 (16%)	15 (48%)	6 (20%)	5 (16%)
- Assault	17	25	3 (12%)	14 (56%)	5 (20%)	3 (12%)
- Burglary	19	27	6 (22%)	15 (56%)	4 (15%)	2 (7%)
- Larceny	19	26	6 (23%)	7 (27%)	11 (42%)	2 (8%)
- Auto Theft	20	29	6 (21%)	17 (58%)	4 (14%)	2 (7%)
Arrest/Crime Clearance Control						
Yes	**18**	**94**	**7 (8%)**	**53 (56%)**	**23 (24%)**	**11 (12%)**
- Arrest Rates Controlled	12	75	6 (8%)	43 (57%)	18 (24%)	8 (11%)
- Crime Clearance Rates Controlled	6	19	1 (5%)	10 (53%)	5 (26%)	3 (16%)
No	**40**	**162**	**43 (27%)**	**62 (38%)**	**34 (21%)**	**23 (14%)**
Time Order						
Contemporaneous	44	146	22 (15%)	59 (40%)	37 (25%)	28 (20%)
Lagged	21	110	28 (25%)	57 (52%)	20 (18%)	5 (5%)
Simultaneity						
Yes	**27**	**142**	**24 (17%)**	**70 (49%)**	**32 (23%)**	**16 (11%)**
- Instrumental Variables	4	17	0 (0%)	12 (71%)	5 (29%)	0 (0%)
- Granger/Lagged	11	84	14 (17%)	43 (51%)	19 (23%)	8 (9%)

			a	b	c	d
- 2SLS/3SLS	12	41	10 (24%)	15 (37%)	8 (20%)	8 (20%)
No	**31**	**114**	**26 (23%)**	**45 (39%)**	**25 (22%)**	**18 (16%)**
Study Design						
Cross-sectional Design	26	79	13 (16%)	27 (34%)	21 (27%)	18 (23%)
Multiple Time Series Design	7	27	12 (44%)	7 (26%)	7 (26%)	1 (4%)
Time Series Design	12	44	7 (16%)	26 (59%)	6 (14%)	5 (11%)
Panel Design	14	106	18 (17%)	55 (52%)	23 (22%)	10 (9%)
Number of Control Variables						
0-4	17	79	9 (11%)	38 (48%)	17 (22%)	15 (19%)
5 or more	41	177	41 (23%)	77 (44%)	40 (23%)	19 (11%)
Police Level						
#	34	163	21 (13%)	87 (53%)	41 (25%)	14 (9%)
$	30	93	29 (31%)	28 (30%)	16 (17%)	20 (22%)

a   Negatively Significant
b   Negatively Non-significant
c   Positively Non-significant
d   Positively Significant

theories discussed above, the present results showed that the increased police manpower or police expenditure fails to consistently produce an inverse impact on crime rates. To address the causes of the inconsistent findings, the current article analyzed the 256 findings in accordance with relevant theoretical and methodological issues.

Theoretical Issues

As indicated earlier, police-crime relationships can be explained by deterrence, rational choice, and routine activity theories. The 58 studies, however, were found to focus on either deterrence or rational choice theories. None of the review studies tested routine activity theories.2 Moreover, it was difficult to identify their theoretical perspectives: (1) many studies did not clearly report which theory was tested, (2) no information was provided on whether they focused on the effect of

possibility of arrest and punishment on criminal choice or the effect of opportunities on criminal choice, and (3) even though the rational choice theory has been favored by economists, the rational choice theory itself is an extension of the deterrence theory. Thus, the current article concentrated on the mechanisms of the 58 studies about how deterrence or rational choice theories have explained the effects of the increased police levels on crime rates.

Causal Relationships between Police Levels and Crimes

Generally, the causal relationships between police levels and crime rates are conceptualized in this way: increased police levels increase police activities such as arrests and patrols, and the enhanced police activities affect the rationality of potential offenders and deter crimes. In other words, to get deterrent effects, increased police levels should result in more law enforcement activity. Thus, without measuring police actions, existing theoretical rationales to explain the relationships between police levels and crime rates might be ambiguous.

The theoretical relationships between police levels and crime rates in the 58 studies can be summarized in two ways. First, increased police levels directly affect the rationale of potential offenders and enhance the perceived costs of crimes which, in turn, should deter criminal activity. The studies, however, do not provide any information about how the increased police levels affect potential offenders' accounting of the costs and benefits of crimes. Perceptions of the costs of crime, such as the probability of arrest and punishment, are shaped by the perceptions of police activities such as arrest and patrol. Two conflicting effects of the police activities must, therefore, be considered (Car-Hill & Stern, 1973). One is a "deterring effect" on crimes where police activity diminishes criminal activity, and the other is a "detecting effect" where increased police activity has a positive effect on crimes reported by the police and public (Hakim, Ovadia, & Weinblatt, 1978). Without accounting for these effects in police activities the interpretation of the relevant studies will be confounded.

Second, additional police levels increase the arrest rates, which increases the certainty of arrest to some degree, and should lower future crime rates. Research has shown some deterrent impacts of police arrest rates or clearance rates on crimes (Carr-Hill & Stern, 1973; Phillips & Votey, 1972; Sjoquist, 1973); however, police activities can also increase apparent crime rates because of enhanced crime detecting effects. It is, therefore, crucial to distinguish crime prevention effects from crime detecting effects. While additional police can reduce crime rates by

15

enhancing the level of guardianship through patrol, none of the 58 studies dealt with the impact of police patrol on crime rates mainly because the independent variables of this review study are number of police officers and police expenditure. As indicated earlier, the Kansas City Preventive Patrol Experiment tested the impact of increased patrol on crimes, reporting no statistically significant result (Kelling, Pate, Dieckman, & Brown, 1974). This finding has been supported by Felson (1998), Gottfredson and Hirschi (1990), Klockars (1983), and Skolnick and Bayley (1986). Sherman and Weisburd (1995), however, reported inverse-effects of police patrol on crime rates in hot spots. As Greenwood and Wadycki (1973) noted, police activities increase the proportion of reported crimes, but additional police officers might actually reduce actual crime rates. Consequently, future research should examine the relationship between police staffing levels and levels of police patrol as well as the interaction between police patrol and crime rates.

Arrest Rate/Crime Clearance Rate/Patrol controlled

Among 256 findings, 91 were found to have positive relationships between police levels and crime rates. One might infer from this result that the increased police levels have no deterrent effects on crime rates rather than inferring that the increasing crime rates enhance police levels. The other interpretation is that the increases in police forces enhance the degree of reporting or detecting of crimes. Greenwood and Wadycki (1973) observed that "it is likely that additional police are more efficient in detecting crime than in deterring crime, and that a relatively small percentage of all crime are reported, with the consequence that a rise in the number of police per capita results in an increase rather than a decrease in crime" (p. 145).

All the studies approached the analysis of crime as an economic activity with rational participants. In terms of theoretical perspective, deterrence, rational choice, and routine activity theories emphasize the importance of rational calculation of potential offenders about the cost and benefits of crime. But, how does police activity increase the perception of arrest and punishment? The basic idea of deterrence, rational choice, and routine activity theory is based on the economic model of Becker (1968) and Ehrlich (1973). The decision to commit crime reflects the potential offender's rational assessment of the net benefits and costs of crime. Jeffery (1977) indicated that most police departments justify their existence by the logic that if they detect, arrest, and punish criminals, crime rates will drop. Thus, arrest is a powerful element for increasing the cost of crime. As Bayley (1994)

noted, police activities are composed of patrol, criminal investigation, traffic, administration, operational support, and so on. He also noted that 60 percent of police personnel patrol and respond to requests for service and 15 percent of police officers investigate crime. Despite the importance of police patrol and arrest, 40 studies did not include the effectiveness of police activities, which means the studies did not consider the two contradictory effects of the additional police on crime rates. Another criticism is that the deterrence, rational choice and routine activity theories have failed to explain the offender's motive and accessible choices (Kovandzic & Sloan, 2002).

In the current study, 12 (21 percent) studies controlled for arrest rates and six (10 percent) studies examined the crime clearance rates. The studies that controlled for arrest rates produced eight percent of inverse and significant findings. The studies with crime clearance rates controlled reported five percent of inverse and significant findings. The other 40 studies that did not control for arrest or crime clearance rates showed 27 percent inverse and significant findings. Of the total 50 inverse and significant findings, 43 came from the 40 studies that did not control for arrest or crime clearance rates with the remaining 7 coming from the 18 studies that controlled for arrest or crime clearance rates. These results suggest that arrest or crime clearance rates provide most of the explanatory power for crime rate reduction in comparison to other influences of police actions or presence. This finding is not a firm metric, however, and should be examined more rigorously in future studies.

Methodological Issues

There are several methodological issues which should be considered when examining the relationship between police and crime such as simultaneity, endogeneity, measurements of dependent and independent variables, research design, and statistical or analytic issues. The following addresses these issues in detail based on the results of the 58 studies.

Types of Dependent Variables

Crime/violent/property combined

Three different types of dependent variables were adopted in the 58 studies: rates

of total Index crime, rates of violent/property crime, and rates of individual crimes. The aggregated rates of the FBI Index crimes were adopted as the main outcome variable in eight studies.3 The eight studies produced a total of 11 findings: four (36 percent) inverse and significant, two (18 percent) inverse and non-significant, two (18 percent) positive and non-significant, and three (28 percent) positive and significant findings. Violent crime rates and/or property crime rates were used in 25 studies. These studies produced 24 findings about the impact of police levels on violent crime rates and 30 findings about property crime rates. The results about violent crime rates consist of five (21 percent) inverse and significant, nine (38 percent) inverse and non-significant, four (17 percent) positive and non-significant, and six (24 percent) positive and significant findings. Regarding property crime rates, the 30 findings are made up of five (17 percent) inverse and significant, seven (23 percent) inverse and non-significant, nine (30 percent) positive and non-significant, and nine (30 percent) positive and significant findings.

Individual crime rates

Each individual crime rate of Index crimes (homicide, rape, robbery, assault, burglary, larceny, and auto theft) was adopted as a main dependent variable in 25 studies, where 191 findings were generated. It is noteworthy, however, that it was possible to arbitrarily add or drop certain individual crimes in some studies. Among the 25 studies where individual crime rates were assessed, the seven individual Index crimes were addressed in 15 studies.4

In ten studies, individual crime rates were selectively adopted as dependent variables. Corman and Mocan (2000), examining crime rates between 1970 and 1996, dropped rape and larceny because the reporting frequencies of rape and the definition of larceny have changed over time. Meanwhile, three other studies (Kovandzic & Sloan, 2002; Levitt, 1997; Marvell & Moody, 1996) analyzed changes in rape and larceny within the same time period. Corman and Joyce (1990) reported four individual violent crimes: homicide, robbery, rape, and assault. Hakim, Ovadia, Sagi, and Weinblatt (1979) used only larceny and auto theft without providing any reasons.5 In case of Cloninger and Sartorius (1979), they reported only homicide and auto theft, mentioning these crimes showed no appreciable reporting errors in national surveys.

For this reason, it is hard to compare the findings of police levels on total crime or violent/property crime with the findings of each crime rate. In terms of significance levels and signs, findings on homicide, burglary, larceny, and auto theft are more likely to show that the increased police levels have a deterrent impact

compared to rape, robbery, and assault (see Table 2). The studies on homicide, especially, produced six (20 percent) inverse and significant and 20 (67 percent) inverse and non-significant findings while they generated only four (13 percent) positive and non-significant and no positive and significant findings.6

Contemporaneous vs. Lagged Effects

   Lagged relationships between police levels and crime rates were examined in 21 studies. Four out of the 21 lagged studies employed the Granger test as a simultaneity test, while the other 17 studies used the lagged test for their longitudinal datasets. Both the Granger test and the lagged test were used to examine the relationship between police levels of prior year or month and present crime rates in these studies. When it comes to contemporaneous relationships, 44 studies examined the instantaneous relationships between police levels and crime rates. Seven out of 13 lagged studies examined a short-term relationship between the two variables as well. The contemporaneous studies produced 146 findings: 22 inversely significant (15 percent), 59 inversely non-significant (40 percent), 37 positively non-significant (25 percent), and 28 positively significant (20 percent) findings. The lagged studies produced 110 findings: 28 (25 percent) inversely significant, 57 (52 percent) inversely non-significant, 20 (18 percent) positively non-significant, and five (5 percent) positively significant findings.
   Studies with time-lagged variables identified more inversely significant relationships between police action and crime than did the contemporaneous studies. In addition, more positively significant relationships were found in the contemporaneous studies than in the lagged studies. A goodness of fit test revealed a significant and inverse difference between the two models (Chi-Square = 20.496, $p < .000$) in their distributions of findings. The discrepancy between the contemporaneous and lagged models underscores the need for strong connections between theory and method. Without theoretical support for the choice of a model the findings become little more than statistical artifacts. The overall results show that increased police levels were more effective in reducing crime in a long-term period than in a short-term. These results, however, should be interpreted with caution since there are reciprocal relationships between police levels and crime rates related to simultaneity issues.

Simultaneity

   Contrary to common sense that the additional police force can reduce crime rates,

19

police departments are often affected by crime rates because the levels of police forces are repeatedly increased in response to growing crime rates (Marvell & Moody, 1996). If governments enlarge police forces mainly because of increasing crime rates, deterrence and rational choice theory can be severely attacked for its poor justification. However, the reciprocal relationship problems between police levels and crime rates are seldom adequately dealt with (Cornwell & Trumbell, 1994; Loftin & McDowall, 1982; Marvell & Moody, 1996). Cloninger and Sartorius (1979) also noted that increasing crime rates cause a "system strain" effect on police departments. Such strains could result in loss of efficiency and the true level of crime in the community could appear to be less due to underreporting. Simultaneous effects, therefore, can produce artifacts that can confound analysis. The lack of simultaneity tests is one of the reasons why prior research has been criticized for methodological problems (Kovandzic & Sloan, 2002; Levitt, 1997; Marvell & Moody, 1996).

For the simultaneity test of police-crime relation, criminologists have used ordinary least squares (OLS), two-stage least squares (2SLS), three-stage least squares (3SLS), instrumental variables with 2SLS, the Granger test, and the lagged test. OLS regression analysis cannot avoid the criticism of being biased and inconsistent because the causal order is arbitrary (Pedhazer, 1982). Marvell and Moody (1996) argued "simultaneity in OLS models is clearly possible for the simple reason that governments are likely to respond to crime problems by enlarging police forces" (p. 611). As shown in Table 2, the present article examined the simultaneity issue with four categories: instrumental variable, Granger or Lagged test, 2SLS or 3SLS, and no simultaneity test including OLS.

Four studies adopted instrumental variables, 11 studies employed Granger test or lagged time test, 12 studies used 2SLS or 3SLS, but 31 studies made no efforts to test reciprocal relationships. The most common test of simultaneity is the use of instrumental variables with 2SLS regression (Marvell & Moody, 1996). All the studies, however, failed to adopt good instrumental variables reinforcing the assertion by Nagin (1978) and Fisher and Nagin (1978) that the police-crime relationship lacks realistic instrumental variables. Levitt (1997, 2002) and McCrary (2002) used election cycles, and Cornwell and Trumbull (1994) used total tax revenues as instrumental variables. The election cycle may affect the police levels as an incumbent attempt to avoid criticisms or gain a political edge by reducing crime rates. Total tax revenues also can influence the police funding, however, increased crime rates may create an impetus to enhance total revenues to overcome the "system strain."

In terms of inverse and significant findings, the test of simultaneity with

20

instrumental variables produced zero percent, Granger or lagged time test studies showed 17 percent, 2SLS studies produced 24 percent, and the studies without reciprocal relation tests reported 23 percent. This result should not be taken to mean that studies with simultaneity tests are less likely to support the deterrent effect of increased police levels on crime rates. The simultaneity tests adopted in the reviewed studies are not satisfactory or appropriate because in case of 2SLS, there should be a good instrumental variable (which was not present). In the case of the Granger and lagged tests, there is an explicit assumption that lagging addresses simultaneity. Consequently, any result that showed increased police levels having inverse effects on crime rates cannot be fully trusted because the findings that 2SLS analysis produced without good instrumental variables are meaningless; however, OLS results are even less trustworthy because the analysis does not correct for simultaneity.

Study Design

Of the 58 studies, 26 studies used cross-sectional designs, seven studies employed multiple time-series designs (MTS), 12 studies used time-series designs, and 14 studies adopted panel designs. While multiple time-series design studies showed 44 percent inverse and significant findings, cross-sectional design studies showed 16 percent, time series design studies produced 16 percent, and panel design studies presented 17 percent of inverse and significant findings. Studies with cross-sectional or panel designs showed 28 positive and significant findings out of 34 across all the findings; however, multiple time-series designs showed only one positive and significant finding.

Fox (1979) already noted that cross-sectional designs are not appropriate for the study of police-crime relationship as it does not address the effect of crime on the levels of police. As noted in the previous section, Marvell and Moody (1996) argued that cross-sectional designs cannot evaluate the impact of the trends in crime rates on police manpower and expenditure even though governments are likely to respond to current crime rates by increasing police levels. As a solution to the crucial problem of cross-sectional design studies, Land and Felson (1976) adopted a time-series design and found inverse and significant effects of the increased police expenditure on crime rates. The time-series design studies in this literature review, however, did not produce significant effects of police on crime as Fox (1979) and Land and Felson (1976) expected. More recently, Kovandzic and Sloan (2002) emphasized the importance of multiple time-series (MTS) designs for police-crime studies. They insisted that MTS has powerful advantage over

longitudinal or cross-sectional designs because MTS provides a large sample size. Marvell and Moody (1996) also noted "MTS permits the researchers to enter numerous control variables" (p. 620). MTS design allowing large sample can include the inverse relationship that increased crime rates cause governments to increase police forces.

The current analysis also indicates that disparity in results comes from the sample size. Six out of eight multiple time-series design studies used relatively large sample sizes of more than 500 while only 15 out of 50 other studies employed sample size larger than 500. Thus, the result of this review regarding study designs corresponds to the quality of study design and the specific character of this study. In terms of methodological power, multiple time-series design provides large percentage of findings supportive of deterrence or rational choice theory and it is more appropriate than cross-sectional or time-series design for the study of police-crime relationship.

Number of Control Variables

The total number of control variables adopted in each review study varies from zero to 19. Forty-one studies that controlled for five or more variables showed 23 percent of inverse and significant findings while 17 studies that controlled for four or less control variables produced 11 percent of inverse and significant findings. In addition, the studies that controlled for five or more control variables showed 11 percent of positive and significant findings while the studies controlled for four or less control variables produced 19 percent of positively significant findings. There is a slight difference between two groups but it is not a significant difference. So, it can be said that the number of control variables does not affect the impact of police on crime rates rather what variables are controlled is more important.

Type of Police Levels

Most studies that examine the relationship between police levels and crime rates use police manpower or police expenditure as a main independent variable. The selection between those two measures, however, probably makes little difference because the bulk of police expenditures is for personnel and highly correlated with the number of police officers (Greenberg, Kessler, & Loftin, 1983). Thirty-four studies used the total number of police officers per capita while 29 studies employed police expenditure per capita as a measure of police levels; six studies used both of them.

The studies that used the total number of police officers as independent variables produced 13 percent of the inverse and significant and 9 percent of the positive and significant findings. The studies that used police expenditure as independent variables showed 31 percent of the inverse and significant and 22 percent of the positive and significant findings. While police expenditure studies produced more positive and significant findings than police manpower studies, the proportional differences are trivial.

DISCUSSION AND CONCLUSION

The relationship between police levels and crime rates has been explained by deterrence, rational choice and routine activity theories. According to deterrence and rational choice theories, the additional police manpower and expenditure make criminals perceive higher possibility of arrest and punishment. Routine activity theory also asserts that increased police levels make motivated offenders rationally calculate the benefit and cost of crime by enhanced guardianships. In terms of the impact of police activities on crime rates, police arrest and patrol are the most important elements in these theories. Arrest rate, crime clearance rate and amount of police patrol might explain the deterrent effects of the additional police. All the studies reviewed in this article, however, mainly focused on deterrence theory because the independent and dependent variables are confined to police levels and crime rates. None of the 58 studies examined the changes in police patrol, and 40 studies failed to control for arrest or crime clearance rates.

The overall results of this analysis do not clearly support the hypothesis of the deterrence theory. A total of 256 findings produced 50 inversely significant findings versus 34 positively significant findings, and showed 165 (65 percent) inverse signs versus 91 (35 percent) positive signs. Nevertheless, this review of police levels and crime rates found a few patterns related to theoretical and methodological issues. The studies that controlled for arrest rates or crime clearance rates are less likely to support the hypothesis suggesting that enforcement activities are inversely related to crime rates. Increasing police levels have more inverse and significant effects on homicide, robbery, burglary, larceny, and auto theft than on rape, assault, and total Index crime rates. This suggests that policing activity may have a deterrent impact on different offending patterns or types of offenses. Increased police levels are more strongly related to deterrent effects on crime rates in the long term than in the short term. Multiple time series are more likely than other study designs to produce findings that do not support the hypothesis that police levels are associated

with crime reduction.

The different types of simultaneity tests did not produce any pattern because all the studies that used 2SLS failed to adopt good instrumental variables. It is therefore meaningless to compare the results of the studies. The impact of police expenditure is slightly greater than police manpower in the percentage of the inverse and significant findings but the police expenditure studies produced more positive and significant findings than the police manpower studies.

Not taking into account the possible misperception of criminals in regards to the increased police levels, these theories have failed to explain the impacts of extra police on the crime rates. Although the additional police increase the levels of arrest and patrol that reduce crime, the increased police force might simultaneously increase the total amount of reported crimes, which results in the increase in the total crime rates. Even though 18 studies examined the effects of arrest and crime clearance rates on crime rates, they did not try to explain the two possible mechanisms of police activities and crime rates, crime deterring effect and crime detecting effect.

Causal order is another crucial issue in this field of study of the relationship between police levels and crime rates. Even though the police are not the only source of the crime deterrent effects, police definitely have crime prevention effects at least in theory. Police levels, however, also can be affected by the crime rates. Policy makers, city mayors, and citizens are all aware of the present crime rates. When crime rates rise, governments often react by increasing the police levels. The 27 studies in this review tested the two possible causal orders but they failed to define the exact causal order because they did not adopt any suitable instrumental variables.

Finally, the dependent variables adopted in this field are not good measurements of crime. All the studies used the UCR Index Crime Report that has only seven individual crimes after excluding arson. These crimes are only a part of crimes people experience and police deal with. Due to the characteristic of official data, the Index Crime Report has low reliability as it consists only of the crimes reported to police.

The results of this study indicate that the tests of deterrence, rational choice and routine activity theories do not support an explanation of the mechanism of the calculation of the expected costs and the benefits of the criminal acts as much as those theories predict. If additional police levels make potential offenders perceive higher possibility of arrest and punishment, the crime rates should be reduced. But this assumption is not clearly supported by the results of the 58 relevant studies. Short of dismissing these theories, the present study has identified a number of

issues that undermine the validity of the models applied to explain the relationship between police levels and crime rates.

The limitations of the official data must also be overcome; victimization studies and original data collection would help overcome some of the shortcomings demonstrated by prior research. In addition, future studies should seek to explain the crime preventing and the crime detecting effect of police activities, as well as more clearly define and operationalize the causal relationship between police levels and crime rates.

NOTES

1. Total Index crime rates, violent crime rates, and property crime rates could not be separated into each crime type because no information about their crime-specific results was provided. As a result, 65 findings about crime rates, violent crime rates, and property crime rates might have limitations to being applied to every individual crime type. It is because total crime rates or violent/property crime rates can be affected by some individual crimes which are hard to decrease even though enough police levels are added to decrease other types of crime rates. Due to the complexity of dependent variables, the current article reported all findings regardless of crime measures.

2. While the Kansas City Experiment (Kelling, Pate, Dieckman, & Brown, 1974) and the study of Sherman and Weisburd (1995) tested routine activity theories, these studies could not be included in the current analysis because their independent and dependent variables are different from those of this literature review.

3. One study (Loftin & McDowall, 1982) did not count rape since it was not reported in the early study years.

4. The 15 studies include: Boba and Lilley (2009), Cloninger (1975), Corman & Mocan (2005), Evans and Owens (2007), Fujii and Mak (1980), Gould, Weinberg, and Mustard (2002), Kim (2007), Kovandzic and Sloan (2002), Levitt (1997), Lilley and Boba (2008), Marvell and Moody (1996), McCrary (2002), Pogue (1975), Swimmer (1974), and Worrall and Kovandzic (2007).

5. Hakim et al. (1979) examined breaking and entering, however, it was excluded in the current analysis.

6. Homicide is generally considered a crime of passion and not subject to rational choice. This could be one explanation that why most studies found non-significant relationships between policing levels and homicide rates.

REFERENCES

Akers, R. L. (1999). *Criminological theories: Introduction and evaluation* (2nd ed.). Chicago, IL: Roxbury.

Akers, R. L., & Sellers, C. S. (2000). *Criminological theories: Introduction, evaluation, and application.* Los Angeles, CA: Roxbury.

Bahl, R. W., Gustely, R. D., & Wasylenko, M. J. (1978). The determinants of local government police expenditure: A public employment approach. *National Tax Journal, 31,* 67-79.

Bayley, D. H. (1994). *Police for the future.* New York: Oxford University Press.

Becker, G. S. (1968). Crime and punishment: An economic approach. *Journal of Political Economy*, 76, 169-217.

Benson, B. L., Rasmussen D. W., & Kim, I. (1998). Deterrence and public policy: Trade-offs in the allocation of police resources. *International Review of Law and Economics, 18,* 77-100.

Boba, R., & Lilley, D. (2009). Violence Against Women Act (VAWA) funding: A nationwide assessment of effects on rape and assault. *Violence Against Women*, 15, 168-185.

Brown, M. A. (1982). Modeling the spatial distribution of suburban crime. Economic Geography, 58, 247-261.

Cameron, S. (1988). The economics of crime deterrence: A survey of theory and evidence. *Kyklos*, 41, 301-323.

Carr-Hill, R. A., & Stern, N. H. (1973). An econometric model of the supply and control of recorded offences in England and Wales. *Journal of Public Economics, 2,* 289-318.

Chamlin, M. B., & Langworthy, R. H. (1996). The police, crime, and economic theory: A replication and extension. *American Journal of Criminal Justice, 20*, 165-182.

Clear, T. R. (1994). *Harm in American penology: Offenders, victims, and their communities*. Albany, NY: State University of New York Press.

Cloninger, D. O. (1975). The deterrence effect of law enforcement: An evaluation of recent findings and some new evidence. *American Journal of Economics and Sociology, 34*, 323-336.

Cloninger, D. O., & Sartorius, L. C. (1979). Crime rates, clearance rates and enforcement effort: The case of Houston, Texas. *American Journal of Economics and Sociology, 38*, 389-402.

Cohen, L. E., & Felson, M. (1979). Social change and crime rate trends: A routine activity approach. *American Sociological Review, 44*, 588-608.

Corman, H., & Joyce, T. (1990). Urban crime control: Violent crimes in New York. *Social Science Quarterly, 71*, 567-584.

Corman, H., Joyce, T., & Lovitch, L. (1987). Crime, deterrence and the business cycle in New York: AVAR approach. *Review of Economics and Statistics, 69*, 695-700.

Corman, H., & Mocan, H. N. (2000). A time-series analysis of crime, deterrence, and drug abuse in New York City. *American Economic Review, 90,* 584-604.

Corman, H., & Mocan, H. N. (2005). Carrots, sticks, and broken windows. *Journal of Law and Economics, 48*, 235-266.

Cornwell, C., & Trumbull, W. N. (1994). Estimating the economic model of crime with panel data. *Review of Economics and Statistics, 76*, 360-366.

Currie, E. (1998). *Crime and punishment in America*. New York: Metropolitan Books.

Deutsch, J., Hakim, S., & Spiegel, U. (1990). The effects of criminal experience on the incidence of crime. *American Journal of Economics and Sociology, 49,* 1-6.

Eck, J. E., & Spelman, W. (1987). Who ya gonna call? The police as problem-busters. *Crime & Delinquency, 33,* 31-52.

Ehrlich, I. (1972). The deterrent effect of criminal law enforcement. *Journal of Legal Studies, 1*, 259-276.

Ehrlich, I. (1973). Participation in illegitimate activities: A theoretical and empirical investigation. *Journal of Political Economy, 81*, 521-565.

Einstadter, W. J., & Henry, S. (1995). *Criminological theory: An analysis of its underlying assumptions.* Fort Worth, TX: Harcourt Brace.

Evans, W. N., & Owens, E. G. (2007). COPS and crime. *Journal of Public Economics, 91,* 181-201.

Felson, M. (1987). Routine activities and crime prevention in the developing metropolis. *Criminology, 25*, 911-932.

Felson, M. (1998). *Crime and everyday life* (2nd ed.). Thousand Oaks, CA: Pine Forge.

Felson, M., & Cohen, L. E. (1980). Human ecology and crime: A routine activities approach. *Human Ecology, 8*, 389-406.

Fisher, F. M., & Nagin D. (1978). On the feasibility of identifying the crime function in a simultaneous model of crime rates and sanction levels. In A. Blumstein, J. Cohen, & D. Nagin (Eds.), *Deterrence and incapacitation: Estimating the effects of criminal sanctions and crime rates*(pp. 361-399). Washington, DC: National Academy Press.

Fox, J. A. (1979). Crime trends and police expenditure: An investigation of the lag

27

structure. *Evaluation Quarterly, 3*, 41-58.

Friedman, J., Hakim, S., & Spiegel U. (1989). The difference between short and long run effects of police outlays on crime: Policing deters criminals initially, but later they may 'learn by doing.' *American Journal of Economics and Sociology, 48*, 177-191.

Fujii, E. T., & Mak, J. (1980). The impact of alternative regional development strategies on crime rates: Tourism vs. agriculture in Hawaii. *Regional Studies, 13,* 27-36.

Gibbs, J. P. (1975). *Crime, punishment, and deterrence*. New York: Elsevier.

Goldstein, H. (1979). Improving policing: A problem-oriented approach. *Crime & Delinquency, 25,* 236-258.

Gottfredson, M. R., & Hirschi, T. (1990). *A general theory of crime*. Stanford, CA: Stanford University Press.

Gould, E. D., Weinberg, B. A., & Mustard, D. B. (2002). Crime rates and local labor market opportunities in the United States: 1979-1997. *Review of Economics and Statistics, 84,* 45-61.

Greenberg, D. F., & Kessler, R. C. (1982). Model specification in dynamic analyses of crime deterrence. In J. Hagan (Ed.), *Deterrence reconsidered: Methodological innovations* (pp. 15-32). Beverly Hills, CA: Sage.

Greenberg, D. F., Kessler, R. C., & Loftin C. (1983). The effect of police employment on crime. *Criminology, 21,* 375-394.

Greenwood, M. J., & Wadycki, W. J. (1973). Crime rates and public expenditure for police protection: Their interaction. *Review of Social Economy, 31*, 138-152.

Hakim, S. (1980). The attraction of property crimes to suburban localities: A revised economic model. *Urban Studies, 17,* 265-276.

Hakim, S., Ovadia, A., & Weinblatt, A. (1978). Crime attraction and deterrence in small communities: Theory and results. *International Regional Science Review, 3,* 153-163.

Hakim, S., Ovadia, A., Sagi, E., & Weinblatt, J. (1979). Interjurisdictional spillover of crime and police expenditure. *Land Economics, 55,* 200-212.

Heineke, J. M. (1978). *Economic model of criminal behavior*. New York: North-Holland.

Howsen, R. M., & Jarrell, S. B. (1987). Some determinants of property crime: Economic factors influence criminal behavior but cannot completely explain the syndrome. *American Journal of Economics and Sociology, 46*, 445-457.

Huff, C. R., & Stahura, J. M. (1980). Police employment and suburban crime. *Criminology, 17,* 461-470.

Humphries, D., & Wallace, D. (1980). Capitalist accumulation and urban crime,

1950-1971. *Social Problems, 28,* 179-193.

Jacob, H., & Rich, M. J. (1981). The effects of the police on crime: A second look. *Law and Society Review, 15*, 109-122.

Jeffery, C. R. (1977). *Crime prevention through environmental design* (2nd ed.). Beverly Hills, CA: Sage.

Kelling, G., Pate, A. M., Dieckman, D., & Brown, C. (1974). *The Kansas City preventive patrol experiment: Technical report*. Washington, DC: Police Foundation.

Kim, M. (2007). *Reassessing the effects of police manpower changes on crime rates: Evidence from a dynamic panel model.* Unpublished doctoral dissertation, University at Albany, State University of New York.

Klockars, C. (1983). *Thinking about police*. New York: McGraw-Hill.

Kovandzic, T. V., & Sloan, J. J. (2002). Police levels and crime rates revisited: A county-level analysis from Florida (1980-1998). *Journal of Criminal Justice, 30*, 65-76.

Krahn, H., & Kennedy, L. W. (1985). Producing personal safety: The effects of crime rates, police force size, and fear of crime. *Criminology, 2*, 697-710.

Land, K. C., & Felson, M. (1976). A general framework for building dynamic macro social indicator models: Including an analysis of changes in crime rates and police expenditure. American Journal of Sociology, 82, 565-604.

Levitt, S. D. (1997). Using electoral cycles in police hiring to estimate the effect of police on crime. *American Economic Review, 87*, 270-290.

Levitt, S. D. (2002). Using electoral cycles in police hiring to estimate the effects of police on crime: Reply. *American Economic Review, 92*, 1244-1250.

Lilley, D., & Boba, R. (2008). A comparison of outcomes associated with two key law-enforcement grant programs. *Criminal Justice Policy Review, 19*, 438-465.

Liu, Y-W., & Bee, R. H. (1983). Modeling criminal activity in an area in economic decline. *American Journal of Economics and Sociology, 42*, 385-392.

Loftin, C., & McDowall, D. (1982). The police, crime, and economic theory: An assessment. *American Sociological Review, 47*, 393-401.

Marvell, T. B., & Moody, C. E. (1996). Specification problems, police levels, and crime rates. *Criminology, 34*, 609-646.

MacDonald, J. M. (2002). The effectiveness of community policing in reducing urban violence. *Crime & Delinquency, 48,* 592-618.

McCrary, J. (2002). Using electoral cycles in police hiring to estimate the effect of police on crime: Comment. *American Economic Review, 92*, 1236-1243.

McPheters, L. R., & Stronge, W. B. (1974). Law enforcement and expenditures and urban crime. *National Tax Journal, 27,* 633-644.

29

Mehay, S. L. (1977). Interjurisdictional spillovers of urban police services. Southern *Economic Journal, 43,* 1352-1359.

Meier, R. F. (1989). Crime and society. Boston, MA: Allyn & Bacon.

Mikesell, J., & Pirog-Good, M. A. (1990). State lotteries and crime: The regressive revenue producer is linked with a crime rate higher than by 3 percent. *American Journal of Economics and Sociology, 4*, 7-19.

Morris, D., & Tweeten L. (1971). The cost of controlling crime: A study in economics of city life. *Annals of Regional Science, 5*, 33-49.

Muhlhausen, D. B. (2001). *Do community oriented police services grants affect violent crime rates?* Washington, DC: The Heritage Foundation.

Nagin, D. (1978). General deterrence: A review of the empirical evidence. In A. Blumstein, J. Cohen, & D. Nagin (Eds.), *Deterrence and Incapacitation: Estimating the effects of criminal sanctions and crime rates* (pp. 95-139). Washington, DC: National Academy Press.

Niskanen, W. A. (1994). *Crime, police, and root causes*. March 17, 2010, from http://www.cato.org/pubs/pas/pa-218.

Pedhazer, E. J. (1982). *Multiple regression in behavioral sciences* (2nd ed.). New York: Holt, Rinehart & Winston.

Phillips, L., & Votey, H. L. (1972). An economic analysis of the deterrent effect of law enforcement on criminal activity. *Journal of Criminal Law, Criminology, and Police Science, 63,* 330-342.

Pogue, T. F. (1975). Effect of public expenditure on crime rates: Some evidence. *Public Finance Quarterly, 3,* 14-44.

Ren, L., Zhao, J., & Lovrich, N. P. (2008). Liberal versus conservative public policies on crime: What was the comparative track record during the 1990s? *Journal of Criminal Justice, 36*, 316-325.

Reynolds, M. O. (1980). The economics of criminal activity. In R. Andreano & J. Siegfried (Eds.), *The economics of crime* (pp. 27-69). Cambridge: Schenkman.

Reynolds, M. O. (1996). *Crime and punishment in Texas: An update*. Dallas. TX: National Center for Policy Analysis.

Samaha, J. (2003). *Criminal justice* (6th ed.). Belmont, CA: Wadsworth.

Schmidt, P., & Witte, A. D. (1984). *An economic analysis of crime and justice: Theory, methods, and applications*. Orlando, FL: Academic Press.

Sherman, L. W. (1992). Attacking crime: Police and crime control. In M. Tonry & N. Morris (Eds.), *Modern policing: Crime and justice, Vol. 15* (pp. 159-230). Chicago, IL: University of Chicago Press.

Sherman, L. W. (1995). The police. In J. Q. Wilson & J. Petersilia (Eds.), *Crime* (pp. 327-348). San Francisco, CA: Institute for Contemporary Studies.

Sherman, L. W., & Weisburd, D. (1995). General deterrent effects of police patrol in crime "hot spots": A randomized, controlled trial. *Justice Quarterly, 12*, 625-648.

Sherman, L. W., Gottfredson, D., MacKenzie, D., Eck, J., Reuter, P., & Bushway, S. (1997). *Preventing crime: What works, what doesn't, what's promising: Report to the United States Congress.* Washington, DC: U.S. Government Printing Office.

Siegel, L. J. (1989). *Criminology* (3rd ed.). St. Paul, MN: West

Sjoquist, D. L. (1973). Property crime and economic behavior: Some empirical results. *American Economic Review, 63,* 439-446.

Skolnick, J., & Bayley, D. H. (1986). *The new blue line.* New York: Free Press.

Sollars, D. L., Benson, B. L., & Rasmussen, D. W. (1994). Drug enforcement and the deterrence of property crime among local jurisdictions. *Public Finance Quarterly, 22*, 22-45.

Sullivan, R. F. (1973). The economics of crime: An introduction to the literature. *Crime & Delinquency, 19*, 138-149.

Swimmer, E. (1974). Measurement of the effectiveness of urban law enforcement?A simultaneous approach. *Southern Economic Journal, 40*, 618-630.

Swimmer, G. (1974). The relationship of police and crime: Some methodological and empirical results. *Criminology, 12*, 293-314.

Tauchen, H., Witte, A. D., & Griesinger, H. (1994). Criminal deterrence: Revisiting the issue with a birth cohort. *Review of Economics and Statistics, 76,* 399-412.

Tullock, G. (1969). An economic approach to crime. *Social Science Quarterly, 50*, 59-71.

van Tulder, F. (1992). Crime, detection rate, and the police: A macro approach. *Journal of Quantitative Criminology, 8,* 113-131.

Wellford, C. R. (1974). Crime and the police: A multivariate analysis. *Criminology, 12,* 195-213.

Worrall, J. L., & Kovandzic, T. V. (2007). COPS grants and crime revisited. *Criminology, 45,* 159-190.

Zedlewski, E. W. (1983). Deterrence findings and data sources: A comparison of the uniform crime reports and the national crime surveys. *Journal of Research in Crime and Delinquency, 20,* 262-276.

Zhao, J., Scheider, M, C., & Thurman, Q. (2002). Funding community policing to reduce crime: Have COPS grants made a difference? *Criminology & Public Policy, 2,* 7-32.

Hyeyoung Lim is anticipated to serve as an assistant professor of the School of Law Enforcement and Justice Administration at Western Illinois University, by fall 2010. She holds a Ph.D. in Criminal Justice from Sam Houston State University. Her research interests include program evaluation, policy analysis, crime and imprisonment trends, police decision-making, situational awareness, and data mining.

Hoon Lee is a graduate student at the College of Criminal Justice, Sam Houston State University, and earned his Master's degree in Criminology and Criminal Justice from Florida State University. His research interests are primarily related to management and legal issues in criminal justice. Currently, he is working for Police Research Center and Institute for Legal Studies in Criminal Justice.

Steven J. Cuvelier is a professor of the College of Criminal Justice at Sam Houston State University and a proud member of AAPS. ?He received is M.A. in sociology from the University of Northern Iowa and Ph.D. in sociology from the Ohio State University. His scholarly interests include comparative criminal justice systems, social deviance and applied information technology.