

COLLATERAL DAMAGE & THE WAR ON DRUGS:

ESTIMATING THE EFFECT OF ZERO TOLERANCE POLICIES
ON DRUG ARREST RATES, 1975–2002

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For years, policy makers and researchers have investigated the relationship between drug use and crime. Beginning in the early 1980s, the United States adopted more punitive approaches in order to deter drug use and distribution. While much research has been done on the effects of zero tolerance and similar policies, this study attempts to estimate the impact of these policies on U.S. drug arrest rates over a 27-year period. We use state-level panel data to estimate the impact of habitual drug offender laws, repeat drug offender laws, and sentencing enhancements for drug offenses on U.S. drug arrest rates. We find that repeat and habitual drug offender laws have a non-significant relationship with drug arrest rates. However, sentencing enhancement laws have a significantly negative relationship with drug arrest rates. These results imply that, while all zero tolerance policies have the same deterrence objective, each policy can have drastically different impacts on drug crime. These results highlight the need for the United States to consider alternative policy solutions.

INTRODUCTION

Currently, the United States ranks among the top countries in the world for crime, incarceration, and drug consumption rates.¹ While several factors contribute to the nation's high crime and illicit drug use rates, some of the most studied and debated factors are ways in which U.S. drug policy has influenced crime rates and drug use patterns over time. However, we found that prior research did not explore how zero tolerance policies, e.g. repeat offender laws, habitual offender laws, and sentencing enhancements, influence drug arrest rates. Our study does examine this relationship. To test this relationship empirically, we use state-level

1 Francis Cullen and Cheryl Leo Jonson, "Rehabilitation and Treatment Programs," in *Crime and Public Policy*, edited by James Q. Wilson and Joan Petersilia, 293-344, New York, NY: Oxford University Press, 2011; Anne Morrison Piehl and Bert Useem, "Prisons," in *Crime and Public Policy*, edited by James Q. Wilson and Joan Petersilia, 532-558, New York, NY: Oxford University Press, 2011.

panel data on all fifty U.S. states, focusing on repeat drug offender laws, habitual drug offender laws, and state sentencing enhancements for drug crimes. Finally, we offer policy recommendations for current U.S. drug policy to reduce overall crime and drug use rates.

LITERATURE REVIEW

THE DRUG-CRIME RELATIONSHIP

It is well known that drugs have a strong relationship with crime and other forms of socially deviant behavior. While this report will only test the effects of zero tolerance policies on drug arrest rates, it is also important to note the possibility that high crime rates contribute to drug use, in other words, that causality is working in both directions. On this issue, research found that characteristics of socially disorganized communities, i.e. those communities with poverty, high arrest rates, and distrust among community members, are associated with a history of alcohol and drug use, as well as substance abuse. Thus, as drug markets become increasingly concentrated in poorer areas, a further breakdown of social cohesion and a simultaneous rise in both drug use and drug arrest rates may occur.² Illicit drug use is also viewed as a societal harm in that it increases health care costs through long-term intoxication damages and criminal justice costs of enforcing drug laws.³ Ultimately, all drug-related crime occurs under four main categories: psychopharmacological crime, economic compulsive crime, systemic crime, and drug law offenses.⁴

Psychopharmacological Crime

Psychopharmacological crimes are committed while an individual is under the influence of a psychoactive substance.⁵ Intoxication resulting from drug use reduces an individual's social controls, making him or her more likely to engage in criminal behavior by distorting one's perceptions of the costs and benefits of actions.⁶ Most crimes, especially violent crimes, are committed under the influence of some form of licit or illicit chemical substance. In fact, individuals under the influence of drugs or alcohol commit approximately 26 percent of all crimes, and only 5 percent of these are committed under the influence of drugs.⁷

2 Todd R. Clear, *Imprisoning Communities: How Mass Incarceration Makes Disadvantaged Neighborhoods Worse*, New York, NY: Oxford University Press, 2007.

3 David A. Boyum and others, "Drugs, Crime, and Public Policy," in *Crime and Public Policy*, edited by James Q. Wilson and Joan Petersilia, 368-410, New York, NY: Oxford University Press, 2011.

4 EMCDDA, *Drug-Related Crime*, 2010, <http://www.emcdda.europa.eu/themes/monitoring/crime>.

5 Ibid.

6 James Q. Wilson and Richard J. Herrnstein, *Crime and Human Nature*, (New York: Touchstone, 1985).

7 U.S. Department of Justice, Drug Use and Crime, Bureau of Justice Statistics, (Washington DC: U.S. Department of Justice, 2007).

Systemic Crime

Another major source of drug-related crime and violence is systemic crime, or crime resulting from illicit drug market activities in an area where statutory law is rarely enforced.⁸ Instead, violence or the threat of violence becomes a common way of settling disagreements regarding territory or market exchanges.⁹ As a result, local dealers, competitors, and residents of drug-involved neighborhoods are all incentivized to arm themselves for protection.¹⁰

Economic-Compulsive Crimes

Economic-compulsive crimes are crimes committed in order to obtain drugs or the financial means to support drug use.¹¹ Many heavy drug users do not have the resources to finance their drug consumption and, as a result, often turn to crime to acquire the necessary funds.¹² Resorting to crime to obtain drugs may be increasing among drug users, especially as strict drug laws and heavy enforcement increase the selling price of illicit drugs. Estimates indicate cocaine prices are between 5 and 15 percent higher today than in 1985 due to increases in drug punishment.¹³ A survey of prison inmates found that approximately two-thirds of all incarcerated property crime offenders meet the standards for drug dependence or abuse, and 30 percent of all property crime offenders in state prisons claim to have committed crimes in order to obtain money to purchase drugs.¹⁴

Drug Law Offenses

Drug law offenses—defined as “state and/or local offenses relating to the unlawful possession, sale, use, growing, manufacturing, and making of narcotic drugs” in the Uniform Crime Report—account for a significant portion of all drug-related offenses.¹⁵ Currently, approximately 1.8 million drug arrests occur annually in the United States; this trend appears to be increasing over time.¹⁶ By 2007, drug arrests constituted 13 percent of total arrests, compared to 7.4 percent

8 EMCDDA, Drug-Related Crime.

9 David A. Boyum and others, “Drugs, Crime, and Public Policy.”

10 Alfred Blumstein and Daniel Cork, “Linking Gun Availability to Youth Gun Violence,” *Law and Contemporary Problems* 59, no. 1 (1996): 5–24; David M. Kennedy, “Can We Keep Guns Away From Kids?” *The American Prospects*, no. 5 (1994): 74–80; Elijah Anderson, “The Code of the Streets,” *The Atlantic Monthly*, no. 274 (1994): 80–94.

11 EMCDDA, *Drug-Related Crime*.

12 Bruce D. Johnson, Kevin Anderson, and Eric D. Wish, “A Day in the Life of 105 Drug Addicts and Abusers: Crimes Committed and How the Money Was Spent,” *Sociology and Social Research* 72, no. 3 1988: 185–191.

13 Ilyana Kuziemko and Steven D. Levitt, “An Empirical Analysis of Imprisoning Drug Offenders,” *Journal of Public Economics*, no. 88 (2004): 2043–2066.

14 Christopher J. Mumola and Jennifer C. Karberg, *Drug Use and Dependence, State and Federal Prisoners, 2004*, (Washington, DC: U.S. Department of Justice, 2006).

15 EMCDDA, *Drug-Related Crime*.

16 United States Department of Justice, *Crime in the United States, 2007*, (Washington, DC: U.S. Department of Justice, 2008a).

in 1987. Among these, about four-fifths of arrests result from possession of drugs, while the actual sale or distribution of illicit drugs accounts for the remaining one-fifth.¹⁷ Proponents of zero tolerance policy argue that strict drug law enforcement is necessary to combat violent crime, yet research indicates that the overall increase in drug prisoners resulting from drug-related offenses has merely allowed for reductions in the expected time served for other crimes; the overall impact of increased drug incarceration has only resulted in a 1–3 percent reduction in violent and property crime.¹⁸

OVERVIEW OF U.S. DRUG POLICY AND ZERO TOLERANCE

War on Drugs

Tough-on-crime policies emerged in the early 1970s as a result of rising crime rates and growing public support for tougher sanctions, including increased arrests and incarceration.¹⁹ By the 1980s, a wave of conservatism against drug use appeared as rampant drug use and other counterculture behavior of the 1960s began to fade, which foreshadowed the future direction of drug policy. Specifically, under the Reagan administration, U.S. drug policy emphasized heavier enforcement of drug-related crimes.²⁰ The George H.W. Bush administration continued this trend when it declared a war on drugs and began reducing funding for drug prevention and treatment programs, while increasing federal expenditures on anti-drug enforcement by 50 percent.²¹

However, public support for U.S. drug policy began to wane during this period. As the nation experienced an overall decrease in drug consumption (likely due to changes in culture), the number of drug-related incarcerations continued to expand dramatically. These trends made the need for strict drug law enforcement questionable. Public opposition and criticism of U.S. drug policy also increased when the United States began to intervene internationally to further expand the war on drugs.²² Domestically, drug policy hardly changed between the Clinton and Bush administrations and the federal government continued to spend more on strict drug law enforcement than medical research and treatment.²³

17 U.S. Department of Justice, *Drugs and Crime*, (Washington DC: U.S. Department of Justice, 2008b).

18 Ilyana Kuziemko and Steven D. Levitt, “An Empirical Analysis of Imprisoning Drug Offenders,” *Journal of Public Economics*, no. 88 (2004): 2043–2066.

19 Alex Piquero and Alfred Blumstein, “Does Incapacitation Reduce Crime?” *Journal of Quantitative Criminology*, no. 23 (2007): 267–286.

20 Kathleen Ferraiolo, “From Killer Weed to Popular Medicine: The Evolution of American Drug Control Policy, 1937–2000,” *Journal of Policy History* 19, no. 2 (2007): 147–179; E. Benoit, “Not Just a Matter of Criminal Justice: States, Institutions, and North American Drug Policy,” *Sociological Forum* 18, no. 2 (2003), 269–294.

21 P.R. Lee and others, “2010: U.S. Drug and Alcohol Policy, Looking Back and Moving Forward.”

22 D.B. Heath, “US Drug Control Policy: A Cultural Perspective,” *Daedalus* 121, no. 31 (1992): 269.

23 P.R. Lee and others, “2010: U.S. Drug and Alcohol Policy, Looking Back and Moving Forward,” *Journal of Psychoactive Drugs* 42, no. 2 (2010): 99–114.

The impact of the war on drugs has been enormous, particularly on the incarceration rate. Between 1980 and 2006, the number of people incarcerated for drug crimes in the United States increased 1,412 percent. No other major offense category has seen incarceration rates increase so highly.²⁴ Additionally, prison terms increased by roughly one year between 1987 and 1998 due to more severe sentencing policies, while arrest and conviction rates for felonies remained largely unchanged.^{25*}

Zero Tolerance Policy

Today, the logic of zero tolerance policies is comparable to a concept of punishment suggested by Cesare Beccaria in 1764: swiftness, severity, and certainty.²⁶ Such policies impose severe sanctions in the form of longer prison terms to reduce crime through deterrence and physical incapacitation of lawbreakers. The underlying assumption behind zero tolerance laws is that, all else being equal, a person is less likely to commit a crime as the cost of getting caught and convicted increases.²⁷ Another basis for zero tolerance laws is that many types of crimes are interrelated.²⁸ For example, a murder may result from a drug deal gone wrong, while a gas station robbery could be committed to obtain funds to purchase drugs. Policy makers assume that if the cost of selling, purchasing, or consuming drugs is too high, fewer crimes will occur.²⁹ Therefore, zero tolerance policies are designed to make the cost of criminal behavior so prohibitively high that the quantity of drugs consumed and crimes committed decreases. However, such findings assume that individuals are rational decision makers acting in their best self-interest, but this may not always be the case.

For instance, addicted drug users may perceive the benefits of drug use outweighing the costs; hence, their consumption patterns might not significantly change under zero tolerance policies. In fact, since users could receive the same sentence regardless of the quantity of drugs possessed or consumed, they might even try to consume an amount higher than normal.³⁰ In this regard, drug users

24 Justice Policy Institute, "Finding Direction: Expanding Criminal Justice Options by Considering Policies of Other Nations," (Washington, DC: The Justice Policy Institute, 2011).

25 Todd R. Clear, *Imprisoning Communities: How Mass Incarceration Makes Disadvantaged Neighborhoods Worse*; Jeremy Travis, *But They All Come Back: Facing the Challenger of Prisoner Reentry* (Washington, D.C: Urban Institute Press, 2005); Alfred Blumstein and Allen Beck, "Reentry as a Transient State between Liberty and Recommitment," in *Prisoner Reentry and Crime in America*, edited by Jeremy Travis and Christy Visser, 50–79, New York, NY: Cambridge University Press, 2005.

* Offenses measured include murder, sexual assault, robbery, aggravated assault, and burglary.

26 George Vold and others, *Theoretical Criminology*, New York, NY: Oxford University Press, 2002.

27 T.B. Marvell and C.E. Moody, "Determinate Sentencing and Abolishing Parole: The Long Term Impacts on Prisons and Crime," *Criminology*, no. 34 (1996): 107–128; Jonathan P. Caulkins, "Zero-Tolerance Policies: Do They Inhibit or Stimulate Illicit Drug Consumption," *Management Science*, (1993): 458–476.

28 T.B. Marvell and C.E. Moody, "The Lethal Effects of Three-Strikes Laws," *The Journal of Legal Studies*, (2001): 89–106.

29 Jonathan P. Caulkins, "Zero-Tolerance Policies: Do They Inhibit or Stimulate Illicit Drug Consumption."

30 Jonathan P. Caulkins, "Zero-Tolerance Policies: Do They Inhibit or Stimulate Illicit Drug Consumption"; Beau Kilmer et al, "The US Drug Policy Landscape," (2012).

function much like a company in which profit is maximized when marginal revenue equals marginal cost.³¹ For drug users, an individual's utility may be maximized when his or her individual marginal benefit of consumption equals his or her marginal cost of purchasing drugs. Thus, if the cost of purchasing drugs is constant, the optimum rate of drug consumption may be unaffected by any level of punishment.³² Therefore, in formulating drug policy, addictive gains to drug users such as "euphoria, escape, and acceptance in some social groups" should not be dismissed as irrelevant or unimportant, even if they are difficult to measure.³³

Past Research

Previous research on zero tolerance or similar policies does not directly study the impact of these policies on drug arrests. Generally, unlike this study, other studies either used methods that did not involve tests for statistical significance, focused on the impacts of zero tolerance on all forms of crime and not just drug-related crimes, or did both. Caulkins et al (1997) found mandatory minimum drug sentences to be ineffective and inefficient in reducing drug crime, though they do suggest exploring more effective programs such as increased law enforcement.³⁴ In a separate study, Caulkins (1993) used a mathematical model that describes users' purchasing habits and found that zero tolerance policies may actually encourage drug consumption.³⁵ Marvell and Moody (1996) found mixed results on determinate sentencing laws (DSLs): increases in prison population in only one state, decreases in only two states, and no significant evidence of impacts on prison population and crime elsewhere.³⁶ Stenmen et al (2005), who used the same dataset as in the current study, found that states using a combination of determinate sentencing and presumptive sentencing laws experienced lower incarceration rates.³⁷ Conversely, states with more mandatory sentencing laws had higher incarceration rates and no relationship was found between repeat offender laws and incarceration rates. In their recent paper on the overall drug policy landscape, Kilmer et al (2012) noted that the mere incarceration of drug distributors may be tactically ineffective; not only are distribution systems often scattered and decentralized—making it difficult to apprehend leaders—but distributors and their assets are easily replaceable.³⁸ Thus, prison populations may unceasingly increase without significant impacts on drug use, distribution, or violence.

31 Michael C. Jensen and William H. Meckling, "Theory of the Firm: Managerial Behaviour, Agency Costs, and Ownership Structure," *Journal of Financial Economics*, (1976): 305–360.

32 Jonathan P. Caulkins, "Zero-Tolerance Policies: Do They Inhibit or Stimulate Illicit Drug Consumption?"

33 John Kaplan, *The Hardest Drug: Heroin and Public Policy*. (Chicago, IL: The University of Chicago Press, 1983).

34 Jonathan P. Caulkins et al, *Mandatory Minimum Drug Sentences*. RAND Corporation, 1997.

35 Jonathan P. Caulkins, "Zero-Tolerance Policies."

36 Thomas B. Marvell and Carlisle E. Moody, "Determinate Sentencing and Abolishing Parole: The Long-Term Impacts on Prisons and Crime," *Criminology* 34, no. 1 (1996): 107–28.

37 Don Stemen, Andres Rengifo, and James Wilson, "Of Fragmentation and Ferment: The Impact of State Sentencing Policies on Incarceration Rates, 1975–2002," *Vera Institute of Justice* (2005).

38 Beau Kilmer et al, "The US Drug Policy Landscape," 33.

DATA ANALYSIS

HYPOTHESES

This analysis will test whether drug arrest rates increase under zero tolerance drug policies. According to deterrence theory, each of these zero tolerance policies should raise the costs and reduce the benefits of violating drug laws, which will negatively impact drug arrest rates. Specifically, this paper will test the following three hypotheses:

H1: The presence of habitual offender laws for drug crimes reduces the drug arrest rate.

H2: The presence of sentencing enhancements for drug crimes reduces the drug arrest rate.

H3: The presence of repeat drug offender laws reduces the drug arrest rate.

DATA

To test the hypotheses described above, this analysis uses the dataset *Impact of State Sentencing Policies on Incarceration Rates in the United States 1975 to 2002* (ICPSR_04456), which contains state-level panel data on U.S. sentencing and corrections policies between 1975 and 2002. Below is a description of the dependent variable, independent variables of interests, and control variables used.

Dependent Variable – Drug Arrest Rate (state-level)

The dependent variable in this analysis is the drug arrest rate per state, defined as the number of drug arrests per 100,000 state residents.³⁹ This variable lags by one year to assure the drug policies and other factors were in full effect at the measurement of the drug arrest rate.⁴⁰ Next, the variable was recoded into log-linear form, since the number of arrests is expected to increase initially with high rates of drug use and then decline at some point as the deterrence aspect of zero tolerance takes effect. This should occur because many offenders will have already been arrested and therefore rendered incapable of committing future crimes, while others will be deterred for fear of arrest.⁴¹

³⁹ *Ibid.*

⁴⁰ Thomas B Marvell and Carlisle E Moody, "Determinate Sentencing and Abolishing Parole."

⁴¹ Alfred Blumstein, Jacqueline Cohen, and Daniel S. Nagin, eds., *Deterrence and incapacitation: Estimating the effects of criminal sanctions on crime rates*, Washington, DC: National Academy of Sciences, 1978.

Independent Variables

The three independent variables of interest used in this study represent prominent zero tolerance policies as defined by Stenmen et al (2005): habitual drug offender laws, repeat drug offender laws, and sentencing enhancements for drug offenders. Habitual offender laws are punishment enhancements for an individual who violates the same law at least twice. These laws differ from repeat offender laws in that they are generally broader in scope, targeting offenders with prior convictions for any felony offense. Repeat offender laws, which may be directed at offenders with prior convictions for the same or similar offenses, trigger mandatory sentences or sentence enhancements for an individual who violates a drug law.^{42**} Sentencing enhancement laws explicitly mandate increased sentences for the sale and/or possession of drugs. Specifically, mandatory sentencing enhancements alter the duration of the sentence for the underlying offense and require the judge to mandate both incarceration and a different length of sentence than would otherwise be required or available by law.⁴³

Each independent variable is coded as a binary variable: 1 indicates that a state has the law and a 0 indicates that a state does not have the law. However, it can be argued that each policy is not truly binary, as each of these zero tolerance policies can see varying degrees of severity. This is especially true within the U.S. criminal justice system, which operates heavily on the discretion of judges during criminal sentencing. Still, due to data limitations that specify the difference in severity levels in such drug policies, this analysis will treat each zero tolerance policy as a binary variable.

Control Variables

This analysis adds control variables to account for other factors that may influence the arrest rate, including state-level variables on race, age, religion, ideology, police presence, socioeconomic status, and the percentage of individuals living in a metropolitan area. Prior research indicates each of these variables as key correlates of crime. For instance, age is relevant in most societies; criminal activity tends to increase in the teenage years, peak in the early to mid-twenties, then subsequently decline.⁴⁴ Regarding the relationship between poverty and arrests, research has found that living in a low-income, urban area increases the likelihood of experiencing interactions with police and various forms of police misconduct.⁴⁵ Unemployment may also be highly correlated to crime rates, as the unemployed may be more motivated or willing to commit crimes to fulfill their

42 Don Stemen, Andres Rengifo, and James Wilson, "Of Fragmentation and Ferment."

** The number of law violations necessary to trigger a repeat offender law varies by state.

43 Ibid.

44 Travis Hirschi and Michael Gottfredson, "Age and the Explanation of Crime," *American Journal of Sociology* 89, no.3 (1983): 552–584.

45 Rod K. Brunson and Jody Miller, "Young Black Men and Urban Policing in the United States," *British Journal of Criminology*, no. 46 (2006): 613–640.

financial needs. Additionally, the employed are also more likely to engage in crime during economic recessions due to underemployment and lower job security.⁴⁶

TABLE I: DESCRIPTIVE STATISTICS

<i>Variables</i>	<i>Mean/Freq.</i>	<i>S.D.</i>
Drug Arrest Rate	2,276.00	3,849.01
Percentage of People Living in a Metropolitan Area	63.20	23.10
Violent Crime Rate	436.50	235.90
Property Crime Rate	4,153.50	1,299.90
Percentage of People in a Fundamentalist Religion	11.00	10.20
State Revenue per 100,000 Residents	351,742.90	208,957.90
Percentage of Population Aged 18–24	11.60	1.70
Percentage of Population Aged 25–34	15.50	2.20
Police Per 100,000 Residents	265.10	63.00
Prison Admissions per 100,000 Residents	272.00	352.70
Citizen Ideology	47.4	15.5
Government Ideology	49.5	23.1
Welfare Expenditures per 100,000 People	51,990.80	28,846.30
Poverty Rate	13.00	4.30
Unemployment Rate	6.10	2.10
Severity Levels for Cocaine Possession	1.9	2.6
Severity Levels for Cocaine Distribution	2.2	2.5
Severity Levels for Marijuana Possession	3.1	2.6
Severity Levels for Marijuana Distribution	2.8	2.6
Severity Levels for Heroin Possession	2.1	2.7
Severity Levels for Heroin Distribution	2.4	2.6
Habitual Offender Laws 0= State Does Not Have a Law 1= State Has a Law	526 24	
Sentence Enhancements 0= State Does Not Have a Law 1= State Has a Law	13 537	

46 David Cantor and Kenneth C. Land, “Unemployment and Crime Rates in the Post World War II United States: A Theoretical and Empirical Analysis,” *American Sociological Review*, no. 50 (1985): 317–322; David Cantor and Kenneth C. Land, “Exploring Possible Temporal Relationships of Unemployment and Crime: A Comment of Hale and Sabbagh,” *Journal of Research in Crime and Delinquency*, no. 28 (1991): 418–425.

<i>Variables</i>	<i>Mean/Freq.</i>	<i>S.D.</i>
Repeat Offender Laws 0= State Does Not Have a Law 1= State Has a Law	246 304	
Republican Governor 0= Governor is not a Republican 1= Governor is a Republican	315 235	

Interaction Terms

Appendix 1 provides descriptive statistics based on variables in the model that interact with three critical years: 1978, just before the Reagan administration; 1987, in which zero tolerance anti-drug policies had been expanded during the Regan Administration; and 1999, in which the anti-drug policies of the Reagan and Bush I Administrations had largely continued during the Clinton Administration. It is worth noting a number of key trends. First, although average drug-related arrests slightly decrease between 1978 and 1987, the number of drug-related arrests per 100,000 individuals noticeably increases. While states experienced different rates, the average number increased approximately 329 percent between 1987 and 1999. Meanwhile, violent and property crime remain relatively stable over the same period, with average violent crime slightly increasing and property crime slightly decreasing. Third, average state revenue and police per 100,000 residents also increases in the same period, approximately 41 percent and 10 percent, respectively. Fourth, severity levels and sentence enhancements for drug possession and distribution increase during this time. Without controlling for other exogenous factors, the data appear to show a positive association between strict law enforcement and drug-related arrests.

METHODOLOGY – ORDINARY LEAST SQUARES (OLS), FIXED EFFECTS (FE), AND RANDOM EFFECTS (RE)

First, we examined the data through an Ordinary Least Squares (OLS) regression. OLS is the simplest econometric estimation technique and provided a strong baseline model. A major limitation with OLS, however, is that it assumes partial effects are constant and linear. In reality, changes in the drug arrest rates—post-implementation of zero tolerance policies—are unlikely to be linear due to deterrence. Specifically, according to the theoretical application of deterrence theory, we expect drug arrest rates to initially increase rapidly but then increase at a decreasing rate in the long run. To capture this effect, we used the log of drug arrest rates.

An additional concern is that unobserved heterogeneity, which is time invariant, is correlated with the explanatory variables. If true, then the entire composite error term is correlated with x_{it} , making OLS biased and inconsistent. To correct for this, we also estimated a fixed effects model (FE) and random effects (RE) model:

- FE will drop all time-invariant characteristics from the model and use fully time-demeaned data. Additionally, FE is more efficient than OLS with RE when the error term is serially uncorrelated.
- RE will use the time-invariant, unobserved heterogeneity to provide estimators that are more efficient than OLS—assuming the unobserved heterogeneity is significant. Also, since RE uses quasi time-demeaned data, it will provide a weighted average between the OLS and FE models.

If OLS, FE, and RE are unbiased, then RE will provide the least biased partial effect estimates. To decide which estimator is least biased, we ran two formal tests: 1) Breusch–Pagan, and 2) Hausman test via the Mundlak device.

Breusch–Pagan Test

A Breusch–Pagan test was implemented following random effects estimation. The test was used to detect the significance of the unobserved heterogeneity in the model. According to the Gauss Markov Theorem, if there is no unobserved effect—that is, the errors are equal to zero—then OLS is the best linear unbiased estimator. The results of the test display a χ^2 of 5.87, indicating that the unobserved effect is significant, and therefore, RE is appropriate.

Hausman Test

Having established a reason to use the OLS with RE estimation technique, we wanted to know whether fixed effects would give the least-biased estimate. We formally tested this by using the Hausman test via Mundlak device. The principle behind the test is that if RE assumptions hold, then RE and FE are both unbiased, and so, Hausman argues that we can compare RE to FE results. If they are significantly different, however, RE is biased and FE is preferred. After implementing the test, we found a χ^2 of 74.31, which is a significant difference between the two estimates and made FE the preferred estimate.

Clustering

The drug arrest rates for states over the time period in the panel data is likely to be serially correlated due to the unlikelihood that drug arrest rates will differ significantly from year to year. Further, states' crime policies do not change greatly, mainly due to political resistance to change. Finally, other environmental causes for crime and drug abuse, as well as subsequent law enforcement environments, are unlikely to change significantly. This leads to the assumption that drug arrest rates within states are likely serially correlated over the period of the panel. To adjust for this, we clustered at the state level, which made the resulting standard errors and t-tests robust to both serial correlation and heteroskedasticity.

METHODOLOGICAL ISSUES

Several methodological issues may limit the conclusions drawn from this study. Studies on drug use and crime often vary not just in the size and scope of the study, e.g. sampling size and state vs. city-level data, but also in the definition and measures of drug crime. For instance, drug crime can include murder, rape, or theft while under the influence; homicide and other acts of violence to obtain money for drugs; drug use and drug dealing; or trivial acts such as taking money from a parent's wallet. Some crimes are not even counted. Examples of this, which is called the "dark figure of crime," or crime that goes unreported, include robberies during which money is stolen and later spent on drugs or domestic violence against a wife because she used her husband's supply of drugs.⁴⁷ As this report only looks to drug arrests as a measurement of criminal behavior, the data missing are crimes that have not resulted in arrest.

Another major methodological issue necessary to understand when evaluating the deterrence aspect of a policy is the existence of simultaneity, or a situation in which two variables mutually influence one another. This issue makes untangling the influence of each variable difficult. With regard to this study, simultaneity can occur when imprisonment resulting from stricter drug laws prevents further crime through both deterrence and incapacitation of criminals. In this situation, the crime rate simultaneously affects the imprisonment rate, making it difficult to derive the deterrent effects of the policies in question. Thus, the statistical model used must properly account for the effect of crime on punishment in order to isolate the deterrence effect of zero tolerance.⁴⁸

A number of sampling issues could also affect measuring arrests and other trends related to drug use. Data gathered through research surveys may be subject to bias due to reliance on self-reports from long-term users who conceal or exaggerate their responses, misinterpret survey questions, or cannot remember past events. Data from the Drug Use Forecasting system, for instance, reports that only one-half to two-thirds of respondents who tested positive in urinalysis actually acknowledged recent drug use in self-reports.⁴⁹ Captive samples from prisons or treatment programs may overestimate the degree of drug-related behaviors, since heavy users are more likely to be arrested; incarcerated offenders can be the most indigent and least skilled and thus at higher risk for imprisonment.

Conversely, samples from the general population may also include a limited number of people who use or used drugs or currently engage in crime. Many youth surveys, for instance, omit dropouts—who are known to have higher rates of drug use and delinquency. As well, the National Household Survey on Drug Abuse (NHSDA) omits institutionalized members of the population, e.g., those

47 Helene R White and Dennis M. Gorman, "Dynamics of the drug-crime relationship," *Criminal Justice* 1, no. 15 (2000): 1–218.

48 Robert Apel and Daniel S. Nagin, "General Deterrence: A Review of Recent Evidence," In *Crime and Public Policy*, edited by James Q. Wilson and Joan Petersilia, 411–436, (New York, NY: Oxford University Press, 2011).

49 Helene R. White and Dennis M. Gorman, "Dynamics of the Drug-crime Relationship."

hospitalized or incarcerated, including individuals on military bases.⁵⁰ Additionally, samples used for studies of ethnic and racial groups are frequently not random, since differences in patterns of drug use and crime within specific ethnic groups, such as between Mexican-Americans and Puerto Ricans, are often ignored but can be as great as the differences between large ethnic and racial groups, such as those between whites and Latinos. Finally, since trends in drug consumption often change, samples from fixed points in time can fail to capture long-term trends.

A sound empirical model measuring the relationship between drug use and crime would therefore either avoid or appropriately account for these potential measuring errors in order to produce unbiased estimates. For this study, we used FE to control for unique differences between states. Our use of panel data and RE also allowed us to measure trends in arrests over time while controlling for unique events within these time periods that may have shocked or severely impacted data during the collection process. Finally, rather than restrict drug-related crime to specific categories—property crime, violent crime, drug use, drug possession, and others—we used arrest rates as a proxy to capture all crimes that could be influenced by drug-related activity.

RESULTS

TABLE 2: REGRESSION RESULTS

<i>Variables</i>	<i>OLS</i>	<i>FE</i>	<i>RE</i>
Habitual Offender Laws	0.047 (0.043)	0.007 (0.019)	0.008 (0.020)
Sentence Enhancements	-0.481 (0.333)	-0.448 **(0.211)	-0.442 *** (0.111)
Repeat Offender Laws	0.173 (0.108)	0.030 (0.149)	0.026 (0.100)
Percentage of People Living in Metropolitan Area	0.007 ** (0.003)	-0.003 (0.005)	0.002 (0.002)
Violent Crime Rate	0.001 ** (0.000)	0.001 ** (0.000)	0.001 *** (0.000)
Property Crime Rate	-0.000 (0.000)	0.000 (0.000)	0.000 * (0.000)
Percentage of People in a Fundamentalist Religion	0.026 *** (0.007)	-0.076 *** (0.027)	0.009 (0.005)
Republican Governor	0.015 (0.129)	-0.079 (0.103)	-0.098 (0.104)
State Revenue per 100,000 Residents	0.000 (0.000)	0.000 (0.000)	-0.000 ** (0.000)
Percentage of Population Aged 18–24	-0.367 *** (0.048)	0.049 (0.049)	-0.006 (0.036)

50 Ibid.

<i>Variables</i>	<i>OLS</i>	<i>FE</i>	<i>RE</i>
Percentage of Population Aged 25–34	-0.199 *** <i>(0.028)</i>	0.010 <i>(0.023)</i>	0.009 <i>(0.022)</i>
Police Per 100,000 Residents	0.000 <i>(0.001)</i>	0.001 <i>(0.001)</i>	0.001 <i>(0.001)</i>
Citizen Ideology	0.005 <i>(0.005)</i>	-0.001 <i>(0.005)</i>	-0.001 <i>(0.004)</i>
Government Ideology	-0.006 * <i>(0.004)</i>	-0.004 <i>(0.003)</i>	-0.004 <i>(0.003)</i>
Welfare Expenditures Per 100,000 People	0.000 ** <i>(0.000)</i>	-0.000 <i>(0.000)</i>	-0.000 <i>(0.000)</i>
Poverty Rate	-0.041 *** <i>(0.015)</i>	-0.018 <i>(0.012)</i>	-0.011 <i>(0.010)</i>
Unemployment Rate	-0.120 *** <i>(0.020)</i>	-0.001 <i>(0.022)</i>	-0.015 <i>(0.022)</i>
Severity Levels for Cocaine Possession	0.125 ** <i>(0.059)</i>	0.055 * <i>(0.028)</i>	0.010 * <i>(0.028)</i>
Severity Levels for Cocaine Distribution	-0.145 ** <i>(0.058)</i>	-0.059 * <i>(0.031)</i>	-0.023 <i>(0.028)</i>
Severity Levels for Marijuana Possession	0.023 <i>(0.027)</i>	-0.055 * <i>(0.032)</i>	-0.007 <i>(0.024)</i>
Severity Levels for Marijuana Distribution	-0.034 <i>(0.037)</i>	-0.028 <i>(0.024)</i>	-0.041 <i>(0.029)</i>
Severity Levels for Heroin Possession	-0.096 <i>(0.066)</i>	-0.008 <i>(0.030)</i>	-0.011 <i>(0.035)</i>
Severity Levels for Heroin Distribution	0.169 ** <i>(0.071)</i>	0.061 <i>(0.036)</i>	0.043 <i>(0.047)</i>
Year Dummy 1972		0.000 <i>(0.000)</i>	0.000 <i>(0.000)</i>
Year Dummy 1975		-0.519 * <i>(0.291)</i>	-0.473 <i>(0.299)</i>
Year Dummy 1978		-4.232 *** <i>(0.320)</i>	-4.148 *** <i>(0.335)</i>
Year Dummy 1981		-4.362 *** <i>(0.298)</i>	-4.286 *** <i>(0.312)</i>
Year Dummy 1984		-4.205 *** <i>(0.333)</i>	-4.122 *** <i>(0.337)</i>
Year Dummy 1987		-4.216 *** <i>(0.294)</i>	-4.283 *** <i>(0.276)</i>
Year Dummy 1990		-3.796 *** <i>(0.279)</i>	-3.907 *** <i>(0.241)</i>
Year Dummy 1993		-3.934 *** <i>(0.305)</i>	-4.117 *** <i>(0.230)</i>

<i>Variables</i>	<i>OLS</i>	<i>FE</i>	<i>RE</i>
Year Dummy 1996		-3.250 *** <i>(0.329)</i>	-3.455 *** <i>(0.227)</i>
Year Dummy 1999		-3.686 *** <i>(0.429)</i>	-3.780 *** <i>(0.349)</i>
Year Dummy 2002		-3.776 *** <i>(0.488)</i>	-3.840 *** <i>(0.395)</i>
West	0.482 *** <i>(0.171)</i>		0.011 <i>(0.141)</i>
East	-0.218 <i>(0.206)</i>		0.331 ** <i>(0.162)</i>
Midwest	-0.277 * <i>(0.143)</i>		0.030 <i>(0.128)</i>
Constant	353.014 *** <i>(26.505)</i>	258.490 *** <i>(32.334)</i>	261.992 *** <i>(26.208)</i>
Observations	550	550	550
R-squared	0.657	0.893	

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

As shown in Table 2, the presence of sentence enhancement laws is associated with a significant decrease in drug arrest rates by 45 percent, holding constant the other independent variables in the model. This is consistent with our stated hypothesis regarding sentence enhancement laws. Conversely, habitual offender laws and repeat offender laws are positively associated with drug arrests, but the relationships are not statistically significant. Our research findings are summarized with our hypotheses below:

H1: The presence of habitual offender laws for drug crimes reduces the drug arrest rate.

- The relationship between habitual offender laws and drug arrest rates is not statistically significant. Therefore, the hypothesis mentioned above is not supported.

H2: The presence of sentencing enhancements for drug crimes reduces the drug arrest rate.

- States with sentencing enhancements are predicted to have a decrease in drug arrest rates of 45 percent, compared to states without sentencing enhancements, holding all else constant.

H3: The presence of repeat drug offender laws reduces the drug arrest rate.

- The relationship between repeat offender laws and drug arrest rates is not statistically significant. Therefore, the hypothesis mentioned above is not supported.

Using OLS, FE, and RE regression to examine the relationship between zero tolerance drug policies and drug arrest rates, we found mixed results in our analysis, which suggests that the drug-crime relationship is either weak or unclear.

CONCLUSION AND RECOMMENDATIONS

In spite of the mixed results in our data analysis, we can draw key policy implications from our overall research. First, while tough on crime policies were enacted to diminish drug use and distribution, it is questionable whether these laws actually achieve their deterrent effect. For example, between 1980 and 2000, after tough on crime policies went into effect, the total number of U.S. residents incarcerated for drug offenses rose 15-fold. Between 1980 and 1996, the number of arrests for drug crimes per 100,000 adults more than doubled from 300 to 700, which contributed to rampant increases in prison admissions for drug offenses, from 9 percent to 30 percent, during the same period.⁵¹ In the last thirty years, no other type of crime has contributed as much of an increase in prison populations as drug offenses. Yet between 1983 and 1994, the three-year reconviction rate for drug offenders increased by 33 percent.⁵² Second, the findings in this study suggest that different drug enforcement laws can have vastly different impacts on drug arrests. Given the issues highlighted by our research and data analysis, a broader set of policy alternatives should be considered than what is currently employed in U.S. drug policy.

For instance, removing criminal penalties for non-violent drug crimes can dramatically reduce the prison population. In 2001, Portugal made use of treatment programs and removed criminal sanctions for the use and possession of drugs such as marijuana, cocaine, and heroin. Though critics argued this policy would exacerbate Portugal's drug problems, illegal drug use among teens declined, as did rates of HIV infections, while the number of people seeking treatment doubled.⁵³ Such proposed policy would face an enormous political opposition in the United States and it is difficult to predict how well it would work, but decriminalization would theoretically reduce the number of prison admissions and, thus, the total prison population.

51 Jeremy Travis, *But They All Come Back*; James Austin and John Irwin, *It's About Time: America's Imprisonment Binge*, 3rd ed. Belmont, CA: Wadsworth, 2001.

52 Timothy Hughes and Doris J. Wilson, *Reentry Trends in the United States: Inmates Returning to the Community after Serving Time in Prison* (Washington, DC: U.S. Department of Justice, Bureau of Justice Statistics, 2004), <http://www.ojp.usdoj.gov/bjs/reentry/reentry.htm>; (Kuziekmo& Levitt, 2004)

53 Maia Szalvitz, "Drugs in Portugal: Did Decriminalization Work?" *Time Magazine*, April 26, 2009, <http://www.time.com/time/health/article/0,8599,1893946,00.html>.

Similarly, the United States should consider increasing the use of drug courts and treatment programs to deter drug use. Drug use and crime are highly correlated behaviors, with evidence suggesting that offenders are more likely to use drugs than the general population.⁵⁴ Instead of incarceration, many scholars and practitioners advocate for drug rehabilitation programs. Many evaluations find these programs to be sufficiently more effective at reducing recidivism than incarceration, surveillance, and random testing.⁵⁵ ***

In order to help assess alternative policies, future research should continue to examine the relationship between current U.S. drug policy and drug arrest rates. While our analysis showed varied and non-significant findings, future research can verify the relationship between zero tolerance drug policies and drug arrest rates using different datasets and, if available, other suitable estimation techniques. For instance, the synthetic control method—a relatively recent development in econometrics—can help compare the impact of a policy by creating an artificial unit, implementing the treatment, and examining the impacts for statistically significant findings. Further, we propose examining how alternative policies such as marijuana decriminalization impact drug arrest rates. Additional research in these areas can improve our understanding of the drug-crime relationship and help ensure drug policy is enforced in a way that reduces drug consumption, minimizes crime, and makes criminal justice more effective.

54 Arthur J. Lurigio, “Drug Treatment Availability and Effectiveness: Studies of the General and Criminal Justice Populations,” *Criminal Justice and Behavior*, no. 27 (2000): 496–528; Christopher J. Mumola and Jennifer C. Karberg, *Drug Use and Dependence, State and Federal Prisoners*, 2004.

55 Francis Cullen and Cheryl Leo Jonson, “Rehabilitation and Treatment Programs”; Michael L. Prendergast and others, “Treatment for Drug Abusing Offenders under Community Supervision,” *Federal Probation* 59, no.4 (1995): 66–75; Ojmarrh Mitchell, David B. Wilson, and Doris L. MacKenzie, “Does Incarceration-Based Drug Treatment Reduce Recidivism? A Meta-Analytic Synthesis,” *Journal of Experimental Criminology*, no. 3 (2007): 353–375.

*** This includes therapeutic communities (TC), residential substance abuse treatment, group counseling, boot camps for drug offenders, and narcotic maintenance groups.

APPENDICES

APPENDIX I: YEARLY INTERACTION TERMS

<i>Variable Name</i>	<i>Year</i>	<i>Mean</i>	<i>S.D.</i>	<i>Min</i>	<i>Max</i>
Drug Arrest Rate	1978	267.110	99.822	75.193	564.018
	1987	262.328	147.974	70.138	679.791
	1999	1123.167	2287.037	55.728	9999.000
Percentage of People Living in a Metropolitan Area	1978	58.620	24.822	0.000	93.000
	1987	63.560	22.142	19.000	100.000
	1999	67.820	20.790	28.000	100.000
Violent Crime Rate	1978	372.155	180.858	67.080	831.770
	1987	458.514	242.032	51.250	1036.510
	1999	465.947	227.372	89.340	961.430
Property Crime Rate	1978	4340.298	1211.065	2102.400	7253.000
	1987	4496.224	1210.304	2152.200	7191.900
	1999	3979.430	943.073	2298.600	5997.000
Percentage of People in a Fundamentalist Religion	1978	11.024	10.019	1	33
	1987	11.284	10.656	1	37
	1999	10.364	10.036	1	35
State Revenue per 100,000 Residents	1978	254665.800	97191.960	166646	825301
	1987	326971.100	221084.100	193108	1770844
	1999	462308.800	200548.600	315281	1731752
Percentage of Population Aged 18–24	1978	13.376	0.892	11.630	15.880
	1987	11.677	0.527	10.340	12.710
	1999	9.648	1.035	7.880	13.800
Percentage of Population Aged 25–34	1978	15.469	1.066	13.500	19.600
	1987	17.969	1.229	15.690	22.380
	1999	13.830	1.182	10.910	15.950
Police Per 100,000 Residents	1978	245.983	47.111	169.045	365.929
	1987	258.006	48.127	168.753	393.561
	1999	284.612	46.824	199.559	444.204
Prison Admissions Per 100,000 Residents	1978	63.996	28.406	22.380	133.927
	1987	109.918	53.726	41.680	236.054
	1999	999.000	0.000	999.000	999.000
Citizen Ideology	1978	43.871	16.439	11.788	79.140
	1987	47.735	16.247	20.712	88.162
	1999	49.271	14.788	22.841	86.478
Government Ideology	1978	51.276	19.503	10.000	83.500
	1987	53.908	20.214	4.400	88.546
	1999	44.218	26.485	2.500	97.917
Welfare Expenditures Per 100,000 People	1978	32931.920	13713.960	12080.000	66402
	1987	42917.660	16603.630	21999.000	90847
	1999	80110.100	23748.470	45614.000	173080
Poverty Rate	1978	12.620	3.512	7.870	23.860
	1987	13.844	4.532	3.700	26.600
	1999	12.200	3.140	7.200	20.400

COLLATERAL DAMAGE & THE WAR ON DRUGS

<i>Variable Name</i>	<i>Year</i>	<i>Mean</i>	<i>S.D.</i>	<i>Min</i>	<i>Max</i>
Unemployment Rate	1978	6.598	1.569	3.300	9.400
	1987	6.906	2.289	2.800	13.100
	1999	4.330	1.013	2.500	6.600
Severity Levels for Cocaine Possession	1978	0.820	1.190	0	4
	1987	1.360	1.804	0	6
	1999	2.120	2.115	0	6
Severity Levels for Cocaine Distribution	1978	0.720	1.070	0	4
	1987	1.560	1.786	0	6
	1999	2.560	1.897	0	6
Severity Levels for Marijuana Possession	1978	1.680	1.449	0	6
	1987	2.680	1.953	0	7
	1999	2.940	2.024	0	7
Severity Levels for Marijuana Distribution	1978	0.960	1.261	0	5
	1987	2.220	1.799	0	7
	1999	2.920	1.736	0	7
Severity Levels for Heroin Possession	1978	0.760	1.098	0	4
	1987	1.320	1.708	0	5
	1999	1.980	2.025	0	6
Severity Levels for Heroin Distribution	1978	0.680	1.019	0	4
	1987	1.560	1.668	0	5
	1999	2.540	1.865	0	6
Habitual Offender Laws	1978	0	0	0	0
	1987	0.06	0.2398979	0	1
	1999	0.08	0.2740475	0	1
Repeat Offender Laws	1978	0.52	0.5046720	0	1
	1987	0.56	0.5014265	0	1
	1999	0.68	0.6833292	0	1
Republican Governor 0= Governor is not a Republican 1= Governor is a Republican	1978		0.443		
	1987	0.260	0.471	0	1
	1999	0.320	0.501	0	1
Number of Sentence Enhancements for Marijuana	1978	2.8	1.665986	0	8
	1987	4.3	2.689739	0	12
	1999	7.48	4.077014	1	18
Number of Sentence Enhancements for Cocaine	1978	2.64	1.574802	0	7
	1987	4.1	2.620562	0	12
	1999	7.38	3.885557	0	18

APPENDIX 2: BREUSCH AND PAGAN (BP) TEST OUTPUT

Breusch and Pagan Lagrangian multiplier test for random effects

lDRUG_ARR[STATE_ID,t] = Xb + u[STATE_ID] + e[STATE_ID,t]

Estimated results:

| Varsd = sqrt(Var)

-----+-----

lDRUG_ARR | 2.208934 1.486248

e| .2619038 .5117654

u| .0328188 .1811597

Test: Var(u) = 0

chibar2(01) = 5.87

Prob> chibar2 = 0.0077

APPENDIX 3: HAUSMAN TEST THRU MUNDLAK DEVICE OUTPUT

Joint significance test of time demeaned variables

```
( 1) m_HOL_DRUG = 0
( 2) m_sentenhance = 0
( 3) m_rpt = 0
( 4) m_METRO_L1 = 0
( 5) m_VIO_L1 = 0
( 6) m_PRO_CRIM = 0
( 7) m_GOVERN = 0
( 8) m_REV_L2_1 = 0
( 9) m_P_1824_L = 0
(10) m_P_25_34_ = 0
(11) m_POL_100K = 0
(12) m_ADM_100K = 0
(13) m_WEL_L1_1 = 0
(14) m_POVERTY_ = 0
(15) m_UNEMP_L1 = 0
(16) m_DR_OA = 0
(17) m_DR_OB = 0
(18) m_MAR_SPOS = 0
(19) m_MAR_SSAL = 0
(20) m_HER_SPOS = 0
(21) m_HER_SSAL = 0
chi2( 21) = 74.31 Prob> chi2 = 0.0000
```

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