

**Marijuana Law Enforcement in the United States:
Statistical estimates of an economic crime model**

May, 2005

Draft Copy: Comments Appreciated

**Presented at the Canadian Economics Association
Meetings, Hamilton, Ontario, May 2005**

**Edward M. Shepard
Paul Blackley
Economics Department
LeMoyne College
1419 Salt Springs Road
Syracuse, New York 13214-1399
Telephone: 315-445-4235
e-mail: Shepard@LeMoyne.edu**

Abstract

Research into the social costs associated with marijuana, marijuana laws, and associated enforcement activities provides important information for policy evaluations. Drug use, drug prohibition, and law enforcement activities have pervasive and uncertain effects on society. Marijuana is the most widely consumed illicit drug; the size of the U.S. market has been estimated to exceed 10 billion dollars annually. Marijuana arrests have increased dramatically in the United States; over 2 million arrests for marijuana law violations were reported during the past three years, with over 80 percent for possession, and less than 20 percent for sale or manufacture of marijuana. Enforcement of marijuana laws is estimated to consume close to 8 billion dollars a year in criminal justice system resources. Foregone tax revenues are estimated to be between 2.4 and 6.2 billion dollars annually. Formal cost benefit analyses of existing illicit drug policies would be highly speculative and have not been conducted. There is disagreement about the magnitude of social costs associated with marijuana and with other illicit drugs; some reports suggest that social costs may be substantial because of adverse effects on crime, health and mortality, and economic productivity, as well as the costs associated with criminal justice and law enforcement resources. There is disagreement about whether these social costs result from drug use per se, or are the result of the drug laws and associated enforcement activities.

From a public policy perspective, existing policies are supported only if greater net benefits are provided than leading alternatives, such as a legal, regulated market for marijuana. Statistical estimates of an economic crime model are presented in this paper to provide evidence about effects of marijuana enforcement on crime rates and on involvement with hard drugs in later periods. Specifically, crime rates are modeled as a function of economic and demographic conditions, enforcement effectiveness, and arrests for possession or sale of marijuana. A national pooled sample of over 1000 counties in the United States for 1994-2002 is used to estimate the model. Pooled county level data from a large state (New York) are also used to provide further evidence about effects of marijuana arrests on the public health. Alternative fixed-effects models are estimated, with controls or corrections for time effects, autocorrelation and heteroskedasticity. The empirical results indicate that marijuana arrests are associated with increases in non-drug crime, including homicides, burglaries, motor vehicle thefts and larcenies. In addition, marijuana arrests are also associated with increases in hard drug arrests in later periods, and with increases in drug-related emergency room visits. These results do not support the existing focus in the United States on criminal justice approaches for marijuana control and suggest that greater benefits might result with an alternative legal, regulated market.

1.0 Introduction

Federal and state policies regarding illegal drugs are numerous and have multidimensional objectives. In recent decades the United States has emphasized criminal justice approaches to enforcing drug prohibitions with substantial and increasing resources allocated to law enforcement and prisons. The Office of National Drug Control Policy (ONDCP) is responsible for coordinating the efforts of federal agencies with respect to control of illegal drugs and also for issuing an annual “National Drug Control Strategy” report. According to the most recent report, the goal of current efforts is to reduce drug use by 10 percent in 2 years, 25 percent in 5 years, and to achieve the first reduction in drug use by young people in nearly a decade (ONDCP, 2003). To accomplish this, the priorities are placed on “stopping drug use before it starts”, “healing America’s drug users”, and “disrupting the market”.¹ Specific policies aim to deter young people from starting, to force users into treatment, and to arrest and incarcerate participants in illegal drug markets. Thus federal resources have been targeted for enforcement and interdiction to disrupt or limit the flow of drugs into and within the country, to deter individuals from using or selling drugs through risk of arrest and application of severe penalties such as fines, property seizures and imprisonment, and arrest of those who use, sell, or manufacture drugs.

¹ The goal of federal anti-drug laws or programs in general is sometimes stated boldly to be a “drug free” society. A number of drug laws have been passed with resources devoted to drug enforcement, education, treatment, and research as means to achieve that goal. More realistic advocates of current prohibition policies argue that containment of or improvement in the “drug problem” –reduction in the economic and social costs associated with illegal drug use and illegal drug markets- justifies current prohibitions and emphasis on enforcement. Opponents cite increased social costs and significant spillover effects.

These drug policies have resulted in large and growing economic costs for the public sector, with substantial increases in resources used by federal and state drug control agencies, state and local police departments, federal and state attorneys, judges at all levels, state and federal prisons, drug education and treatment services, and research in related areas for drug control.² Constitutional protections for the accused have been relaxed in order to more vigorously prosecute the “war on drugs”: law enforcement agencies at the state and federal level use controversial practices such as asset seizures (without convictions for crimes), confidential informants, and conspiracy laws to obtain drug convictions (without hard evidence of drug possession or drug sales).³ At the federal level, spending for drug enforcement (including interdiction and intelligence) rose from about 1.5 billion dollars in 1981 to over 12 billion by the year 2002; state level spending for drug control activities has been estimated to be even higher.⁴ Arrests for drug law violations have shown a similar pattern, increasing from under 600,000 a year in 1980 to over 1.5 million today.⁵ Approximately 80 percent of all drug arrests are for possession, and a majority of drug arrests are for marijuana possession or sales.⁶ DEA officials have reported that marijuana investigations remain a top priority for the federal

² According to a recent National Research Council Report (2001), federal expenditures on enforcement increased more than ten-fold between 1981 and 1999.

³ For a discussion of the erosion of constitutional protections in drug cases, see “The Drug War and the Constitution”, by Steven Duke, in After Prohibition (2000), edited by Timothy Lynch, Chapter 4, pp. 41-59, or Why Our Drug Laws Have Failed, and What We Can Do About It, (2001), by Judge James P. Gray, Chapter 3, pp. 95-122.

⁴ Historical information on federal drug control expenditures are from an evaluation of government reports provided by Transactional Records Access Clearinghouse (TRAC, 1998) at Syracuse University, Syracuse, NY. Expenditures for recent years are provided in the National Drug Control Strategy Report of ONDCP, 2002. See Miron, 2003, pp. 12-15 for a discussion of methods for measuring state and local (and federal) expenditures for drug prohibition enforcement.

⁵ Federal Bureau of Investigation (FBI), Uniform Crime Reports, for the years 1981 and 2002. See The Sentencing Project report Drug Policy and the Criminal Justice System, (2001) for a discussion of these trends available at <http://www.sentencingproject.org/pdfs/5047.pdf>.

⁶ FBI Uniform Crime Reports, 1997-2002, indicates that possession offences have accounted for approximately 80 percent of all drug arrests for each of the past five years.

enforcement agency. In part because of strict drug laws and increased penalties, the prison population has grown to over 2 million.⁷

By any measure, the opportunity costs of enforcing marijuana laws in the United States are large. In 2003 there were over 750,000 arrests for marijuana, 88 percent of which were for possession only.⁸ Over 2 million marijuana arrests have been made during over the past 3 years, and over 6 million have been made over the last 10 years. A recent study estimates the size of the marijuana market to exceed 10 billion dollars a year (Miron, 2004). In addition, marijuana law enforcement is estimated to cost about 7.7 billion dollars a year in criminal justice resources; tax revenues that are foregone because of marijuana prohibition are estimated to range from about 2.8 to 6.4 billion dollars per year, depending on the form of taxation (Miron, 2004). Marijuana laws increasingly are being questioned for several reasons. First, there is growing evidence of medical utility for specific conditions, and lack of evidence of significant harms or adverse health effects comparable to alcohol, tobacco, other illicit substances, and even commonly prescribed prescription medications. Second, substantial law enforcement resources have been directed towards enforcing marijuana laws without any solid evidence of effectiveness. A recent report by the National Research Council indicated that, because of “a lack of investment in data and research”, the nation is in no better position to perform a comprehensive assessment than 20 years ago, and that “it is unconscionable for this country to continue to carry out a public policy of this magnitude and cost without

⁷ Bureau of Justice Statistics, Prison Statistics, Summary Findings as of Dec. 31, 2002, available at <http://www.ojp.usdoj.gov/bjs/prisons.htm#findings>. For a discussion of these numbers see the report of the Sentencing Project (2002): U.S. Prison Populations—Trends and Implications, available at <http://www.sentencingproject.org/pdfs/1044.pdf>.

⁸ Report of the NORML organization, available at Norml.org.

knowing whether and to what extent it is having the desired effect”.⁹ An organized drug policy reform movement has also emerged to advocate reforms at the Federal, State, and Local level.

The Bush administration, as with the prior Clinton administration, stresses criminal justice approaches and opposes state initiatives that de-emphasize the role of law enforcement or are inconsistent with Federal drug laws. Federal officials, as well as federal anti-drug advertising in the media, draw connections between drug use, illegal drug markets, crime, public health, economic productivity and even international terrorism. This has led to expanded powers for investigations, arrests, and relaxed constitutional protections for the accused to help fight the “drug war”. Recent evidence that enforcing drug laws remains a high priority at the federal level includes the following:

- Provisions of the Patriot Act have been used to obtain evidence and prosecute individuals for drug crimes,
- Medical marijuana clinics operating under state law and with approval of local officials under guidelines established by State Medical Marijuana Laws have been raided and shut down by federal DEA agents,
- Federal prosecutors have been directed to seek maximum mandatory sentences for federal drug crimes,
- Federal officials including the President’s top drug policy advisor have lobbied against state initiatives that reduce penalties, mandate

⁹ National Research Council, 2001, pp 3-11.

alternatives to incarceration for non-violent drug offenses, or provide medical marijuana to qualified patients.¹⁰

At the federal level, marijuana remains in the most prohibited category as a “Schedule 1” drug, which is reserved for highly addictive, dangerous drugs with no legitimate medical uses. Cocaine and many amphetamines, in contrast, are classified as “Schedule 2” drugs, legal under certain restrictive conditions, and tightly controlled. Unless this scheduling of marijuana changes, marijuana arrests and prosecutions are likely to remain a high priority for the United States, influencing the allocation of public sector resources within the United States, and relations with other nations at the borders and around the world.

The increasing costs of drug enforcement in general combined with growing budget deficits during recession lead to more difficult choices for policy makers when allocating scarce public funds, and it is not surprising that these policies are being scrutinized more carefully. Funds allocated to prisons and the criminal justice system will not be spent for education, health, welfare, roads, the environment, or other areas that contribute to the public welfare. Despite rapidly increasing expenditures associated with arrests and imprisonment, many states have begun to experiment with alternative approaches to drug issues that de-emphasize the role of policing.¹¹ As state policymakers face more difficult choices due to growing budget deficits, many have adopted policies that reduce penalties for drug offenses and have added “harm reduction” reforms such as needle exchange or sale of syringes, methadone maintenance, and medical marijuana,

¹⁰ See the Media Awareness Project for an archive of newspaper articles from around the country on each of these topics for the years 2001-2004, available at <http://mapinc.org>.

¹¹ Drug Policy Alliance (2003), *State of the States: Drug Policy Reforms, 1996-2002*, found many changes in state legislation on issues such as advancing alternatives to incarceration, protecting medical marijuana patients and providers, expanding sterile syringe availability, and restoring benefits and voting rights to former drug offenders.

among others. Thus, while Federal officials push for intensified drug enforcement, individual states appear to be moving in the opposite direction. It is clear that further research into the effectiveness of alternative approaches for drug control is needed.

An economic evaluation of drug policies requires information on policy objectives and outcomes as well as public and private sector resource costs, so that relevant economic costs and benefits can be assessed and compared to those of a leading alternative such as a legal regulated market.¹² To date, there has not been a comprehensive cost-benefit analysis of federal and state drug enforcement policies because the data required to estimate impacts in different areas of policy are of poor quality or non-existent.¹³ The pervasive nature of the effects of drug use and drug policies on many facets of society and the difficulty in obtaining reliable data on illegal drug markets have made it difficult to evaluate the effectiveness of drug policies.

To fill this gap in part, this paper develops and estimates an economic crime model so that potential outcomes associated with marijuana law enforcement and can be assessed. There are two important questions that are addressed using estimates from this model:

- Are marijuana arrests associated with increases or decreases in other crimes such as homicides, burglaries, and larcenies?
- Are marijuana arrests associated with increases or increases in participation with “hard drug” crimes in current or later periods?

The remaining sections of this paper present the theory, model, data, estimates, and discuss the findings. Section 2 presents the theory and model and reviews prior relevant

¹² For a discussion of applying cost benefit analysis to evaluate drug policies, see Miron (2003).

¹³ For a discussion of the serious lack of data needed for evaluating federal drug control policies, see the National Research Council, 2001.

research. Section 3 provides the empirical model and discusses and interprets the statistical estimates. Section 4 presents a summary and concluding remarks.

2. Theory and evidence from prior research

Microeconomic theory holds that resources should be allocated to law enforcement up to the level where the marginal benefit is equal to the marginal cost, and when enforcement is cost effective compared with alternative approaches. It is rational for society to tolerate some crime—the efficient level of crime for society is not 0. It is probably rational for society to tolerate some illicit drug use as well if the additional cost of achieving a “drug free” society exceeds the benefit. Since illicit drugs such as marijuana can be produced and sold in “underground markets” in any part of the world, reducing supply to 0 would be impossible or have monumental costs. Interdiction at the border usually leads to alternative supply routes or increases in domestic production.¹⁴ However, governments such as the United States continue to direct billions of dollars of scarce public sector resources each year into marijuana law enforcement, with significant effects on the criminal justice system and pervasive effects on society.

Miron and Zwiebel (1995) and Rasmussen and Benson (1994) are among those who have examined the economics of drug prohibition in the context of supply and demand models. The objective of current drug control policies is to reduce both supply and demand by achieving a higher risk of arrest and incarceration for buyers and sellers as well as disruptions in supply. This would reduce the quantity of illegal drugs sold, but have an indeterminate effect on their prices. When resources are directed more at the supply side than the demand side, prices should increase as well. If demand is inelastic in

¹⁴ See Nadelmann (1992) for a discussion of the reasons for the failure for international drug control.

the short run, then expenditures and revenues would actually increase, making participation for sellers more profitable. Proponents of current policies argue that benefits accrue to society from reductions in the economic or social costs associated with drug use and other activities of illegal drug markets—objectives commonly cited are improvements in health, safety and the quality of life, higher productivity in the workplace, and reductions in “drug related” crime. Special priority is often placed on children and young adults, since the related problems of dependence, addiction, unemployment, homelessness, crime, and incarceration would impose costs on society over a long period of time. The annual social costs associated with illicit drugs has been estimated to exceed 140 billion dollars, although the reliability of these estimates has recently been brought into question. (ONDCP 2001, Miron 2003).

Drug enforcement is commonly justified as being an effective tool for controlling or reducing crime. For example, the United States Drug Enforcement Agency (DEA) publication Speaking Out Against Drug Legalization reports that “most violent crime is committed not because people want to buy drugs, but because people are *on* drugs. Drug use changes behavior and exacerbates criminal activity, and there is ample scientific evidence that demonstrates the links between drugs, violence, and crime.”¹⁵ A substantial amount of research documents the positive statistical correlations between illicit drugs and other crimes.¹⁶ A high percentage (relative to the population) of persons arrested test positive for illicit drugs; and drugs have been found to be contributing

¹⁵ The publication is available at <http://www.usdoj.gov/dea/demand/speakout/07so.htm>. For another example, consider the following statement from the web site of the National Narcotics Officers Association: "It is clear that vigorous law enforcement strategies can greatly reduce the number of victims of drug related violence. New York City's experience with drug related crime control clearly proves that point. In 1994, the New York Police Department implemented a program that targeted those individuals and drug gangs that were believed to be responsible for much of the city's violent crime...The results were nothing short of phenomenal."

¹⁶ For example, see Drug Related Crime Fact Sheet, ONDCP, March 2000.

factors in the commission of many crimes.¹⁷ However, there are numerous potential links between drugs, drug enforcement, and crime, and positive statistical correlations between illicit drugs and crime may not reflect causality. Some individuals may be predisposed to commit crimes and take illegal drugs. Individual characteristics associated with increased drug use and increased propensities to commit crimes might include low self-esteem, risk-taking behavior, high discount rates, aggressive tendencies, general disrespect for authority, and unstable or impoverished households.¹⁸ Associations between drugs and crime could be due to drug use, drug sales, or result from other characteristics of illegal drug markets, including methods of drug enforcement. Most researchers agree that currently illegal drugs would be more widely available at lower prices with most forms of legalization, and that the violence characterizing urban drug markets would be reduced.¹⁹

Becker's (1968) economic crime model is based on the theory of the rational criminal and has resulted in over three decades of empirical research on crime. Crime rates are modeled as a function of economic and demographic conditions, enforcement effectiveness, crime opportunities and characteristics of local "crime markets". Within the Becker framework, the "rational criminal" makes the decision to commit a crime based on an objective assessment of the expected benefits (e.g. opportunities for loot,

¹⁷ For example, see Goldstein, P.J., Brownstein, H.H., Ryan, P.J. & Bellucci, P.A., "Crack and Homicide in New York City: A Case Study in the Epidemiology of Violence," in Reinerman, C. and Levine, H. (eds.), *Crack in America: Demon Drugs and Social Justice* (Berkeley, CA: University of California Press, 1997), pp. 113-130.

¹⁸ Rasmussen and Benson (1994) review empirical evidence about drugs and criminality and conclude that the set of people who are drug offenders only partially overlaps with the set of Part I crime offenders. Thus, while the percentage of non-drug criminals who use drugs is larger than the general population, a substantial majority of drug offenders do not commit violent or property crimes. See Chapter 3, pp. 39-66.

¹⁹ Miron (1998), Duke and Gross (1993), and Nadelmann (1992) and others make this argument. Alcohol, for example, is known to be associated with crime because of pharmacological effects, and yet the market, distribution, and sales networks, have not been particularly violent since prohibition was lifted.

payoffs, or stolen goods) as well as the economic costs (e.g. resources used to commit the crime, opportunity costs of foregone earnings, and risks of arrest, incarceration, and fines). Criminal justice policies and methods of enforcement will influence crime rates because they influence the severity and certainty of arrest and punishment as well as the availability of crime opportunities. A growing body of research based on the Becker model has produced considerable evidence on the roles of many different factors as determinants of crime rates.²⁰ Published research has generally produced empirical evidence consistent with the basic predictions of rational choice models.

In recent years the model has been adapted to assess the role of drug enforcement in explaining underlying rates of crime (e.g. Rasmussen and Benson (1994), Miron (1999), and Kuziemko and Levitt (2001)). It is reasonable to include drug law or arrest variables in the model because drug prohibitions and related enforcement activities have been found to be associated with the commission of crimes (Miron, 1999, Rasmussen and Benson, 1994). In addition, there are important differences between different drugs (e.g. marijuana versus heroin) and different activities (e.g. possession versus sale or manufacture) that should be accounted for with the model specification. Drug prohibitions create opportunities for “drug crime”—the use or sale of illegal drugs is, by definition, a crime.²¹ Drug prohibitions also create criminal opportunities because they

²⁰ For example, see Corman and Mocan (2000), Levitt 1998, Polinsky and Shavell 1984, Witte 1980, and Stigler 1970. In particular, Levitt (1998) estimates an economic model of crime to investigate the relationship between enforcement effectiveness (for different types of crime) and reported crime rates. He finds that increases in enforcement effectiveness (for one type of crime) decreased that crime due to both deterrent effects and incapacitation effects, but increased other types of crime that were considered substitutes (for example robberies and burglaries). Corman and Mocan (2000) find “robust evidence of deterrent effects of arrests and police on most categories of serious felony offences”(p. 584).

²¹ Many researchers have explored the relationship between drugs, drug prohibition, and crime, including Wilson 1990, Nadlemann 1992, Kleiman 1993, Duke and Gross 1993, Rasmussen and Benson 1994, Miron and Zwiebel 1995, Miron 1999, and Kuziemko and Levitt 2001. The channels explored here, in which drug enforcement potentially increases (or decreases) crime, have been identified in prior research.

result in elaborate “underground” distribution networks—illegal drug markets with no recourse to legal dispute resolution mechanisms. Violence frequently becomes the favored resolution mechanism (Miron, 1999). Drug prohibitions also create new forms of “economic crime” (e.g. drug sales) to obtain income within the underground economy, and one form of economic crime may become substitutable for other forms (Levitt 1998). For example, robbery or larceny may increase when opportunities for income from drug sales are diminished through effective law enforcement. Third, law enforcement resources directed to investigate and prosecute drug crimes cannot be used elsewhere, potentially reducing the risk of arrest or conviction for other non-drug crimes (Benson et.al 1992, Rasmussen and Benson 1994).

Prior research has identified three potential ways in which use or sale of illicit drugs such as marijuana potentially lead to other crimes:

- 1) Pharmacological effects: by increasing aggressive tendencies or reducing inhibitions, individuals become more likely to commit crimes;
- 2) Dependency or addiction effects: illegal drug users may commit economic crimes such as robbery, burglary, auto theft, larceny or assault to obtain income to purchase drugs; and
- 3) Systemic effects of illegal drug markets: an elaborate “underground economy” consisting of importers and manufacturers, transporters, retailers and wholesalers, and small seller networks where there is no recourse to legal mechanisms for dispute resolution. Violence often results as a way to settle disputes. In addition high prices and large profits associated with illegal drugs

provide incentives to enter or capture part of the market, leading to more violence (e.g. turf wars by drug gangs for control over drug sales).²²

Drug enforcement methods complicate evaluation of the relationship between drugs and crime. Enforcement approaches, if successful, should reduce supply and demand and result in less drug use and smaller illegal drug markets. In addition, the arrest and incarceration of participants in the illegal drug market will prevent these individuals from committing other crimes associated with drug use or participation in illegal drug markets. (Kuziemko and Levitt, 2001) However enforcement of drug laws can lead to increased crime because:

- 1) Distribution networks are disrupted, leading to disputes over market share and informal contractual arrangements within the illegal drug markets. This may lead to more violence, a favored dispute resolution mechanism in illegal markets (Miron 1999).
- 2) Greater risk of arrest or supply disruptions may lead drug sellers to switch to other forms of economic crime that are substitutes, such as robbery and burglary, to obtain income (Kuziemko and Levitt, 2001).
- 3) Individuals who use illegal drugs to treat (diagnosed or undiagnosed) medical conditions may resort to crime as a result of pharmacological effects from withdrawal or from behavioral changes after ending self-treatment.
- 4) Prices and profits for remaining suppliers may increase with enforcement, providing more incentive for potential suppliers to use violence to obtain a

²² Goldstein (1985) and Nadelmann (1992) both discuss these three basic ways in which drugs and crime are associated. Duke and Gross (1993) identify nine ways in which drug prohibition can lead to crime. (See Duke and Gross, 1993, Chapter 6, pp 103-121.

share of the market, or leading to economic crime by users to support a habit.²³

- 5) Resources used for drug enforcement cannot be used for investigating and making arrests for other types of crime, and so enforcement effectiveness for other crimes may be reduced (Rasmussen and Benson, 1994).
- 6) The incarceration of drug users and sellers takes up scarce prison cells. With prisons at full capacity, drug arrests can lead to less imprisonment for other crimes, early release of other criminals, prison overcrowding, or new prison construction. (Kuziemko and Levitt, 2001).

Recent evidence suggests that drug enforcement may reduce drug use, but other methods, such as drug treatment, have been found to be more cost-effective for accomplishing that objective.²⁴ Further, recent studies find drug prohibitions and drug arrests to be associated with increases, not decreases, in non-drug crime. Miron (1999) provides evidence that enforcement of drug prohibitions has led to increased violence; homicides in the United States over the past century were found to be associated with increased drug enforcement expenditures. Miron (2001) also finds the degree of enforcement of drug prohibitions across countries to be positively associated with increased violence. Other research has also found positive associations between drug

²³ Silverman and Spruill (1977) found that higher heroin prices were associated with increased property crime. Some recent studies find higher cocaine prices are associated with less crime. (See Kuziemko and Levitt 2001, or Markowitz, 2000.)

²⁴ The Rand Corporation conducted a study on the cost-effectiveness of enforcement, interdiction, and treatment, and found treatment to be substantially more cost-effective than domestic enforcement or interdiction in bringing about reduction in cocaine use. A simulation study by Caulkins et al. (1997) estimated the cost-effectiveness of enforcement versus treatment in reducing drug use and also found treatment to be more cost-effective. A study by Saffer and Chaloupka (1999) found drug control spending to be associated with reduced illicit drug participation. A study by Shepard and Blackley (2004) found increased drug enforcement to be associated with higher drug mortality rates, whereas increases in education and treatment were associated with reduced drug mortality rates.

enforcement and homicides (Brumm and Cloninger 1995, Friedman 1991, Benson et al. 1992). Benson et al. (1992) finds increases in drug enforcement to be associated with increases in property crime using data from Florida counties. Kuziemko and Levitt (2001) report that increases in drug prisoners has resulted in reductions in expected time served for other offences, increasing other crimes as a result.²⁵ Shepard and Blackley (2005) estimate a set of economic crime models for New York State to evaluate effects of hard drug possession and sales arrests and marijuana sales arrests on crime rates for robbery, burglary, assault, and larceny. With each model there were significant and positive (or adverse) estimated effects of drug arrests on crime rates: in no cases were drug arrests found to have significant negative (or favorable) effects on other crime rates.

3. Empirical models, data, and results.

The impacts of arrests for the sale and possession of marijuana upon other criminal activity and the public health are assessed below. National data are used to estimate the impacts upon arrests for the mainly economic crimes of burglary, larceny, and motor vehicle theft. Similar data are used to estimate more preliminary models for a violent crime, homicide, and a drug-related crime, possession of non-marijuana drugs (“hard drug” possession). New York State data are used to assess public health impacts as measured by drug related hospitalizations.

Table 1 provides the units of measurement, means, and standard deviations of the variables used in the national analysis. The sample selection methodology, data sources,

²⁵ Kuziemko and Levitt (2001) also estimate a model to measure the effect of incarcerating drug offenders on violent or property crime rates. Increases in drug share of prisoners are associated with reduced rates of violent and property crime; however, the estimated coefficients are not found to be statistically significant.

and official definitions for each type of crime are contained in an appendix at the end of the paper. The estimated national equations can be summarized as:

$$Crime_{it} = \alpha + \beta_1 DrugArrests_{it} + \beta_2 DrugArrests_{i,t-1} + \beta_3 Enforcement_{it} + \beta_4 UnemploymentRate_{it} + \beta_5 AnnualWage_{it} + \mu_{it} \quad (1)$$

where Crime represents reported arrests per 1000 residents for the five criminal activities: burglary, larceny, motor vehicle theft, homicide, and hard drug possession. Drug Arrests are specified as either arrests for marijuana possession or sales. This equation is based on an economic model of crime specified by Levitt (1998) and is similar to specifications used in prior studies (Resignato, 2000; Benson et al. 1998, 2001). The main sample includes observations for 1337 counties for the years 1994-2001. The sample for homicide has 960 counties for the same years as described in the appendix.

The data indicate that there is considerable variation in average crime rates and their dispersions over the sample. The crimes of larceny and burglary have the highest reported rates of 19.11 and 6.79 per 1000 residents, respectively. While motor vehicle thefts average 1.86 per 1000, the relative infrequency of homicides is illustrated by an average of only 0.05 per 1000. Four types of Part II drug abuse crimes or violations as classified by the U.S. Department of Justice (1984) are used: Hard Drug Sales, the manufacture and/or sale of non-marijuana drugs; Hard Drug Possession, the possession of non-marijuana drugs; Marijuana Sales, the manufacture and/or sale of marijuana; and Marijuana Possession, the possession of marijuana.²⁶ The average rate of possession

²⁶ It is not possible to construct a variable measuring the ratio of drug arrests to drug crimes since most drug crimes are not reported. Other studies have used drug arrests, changes in drug arrests, drug enforcement budgets, or incarcerations for drug crimes to construct measures of drug enforcement. Benson et al. (1998) argued that “drug arrests reflect the consequences of the allocation decisions” and are an appropriate variable for measuring the intensity of drug enforcement.

arrests for non-marijuana drugs (1.13 per 1000) is more than twice that of sales arrests for such drugs. The highest arrest rate is for marijuana possession (2.43 per 1000), while arrest rates for marijuana sales is the lowest at just 0.36 per 1000. The traditional law enforcement view maintains that drug-related arrests should reduce the crime rates for all types of offenses, especially those related to the drug culture such as burglaries and larcenies by users. However, the previous section reviewed a number of factors that may lead to higher rates of several Part I crimes when increases in drug arrests occur, calling into question the traditional view. A one period lag for drug-related arrests is also included to allow arrests and subsequent prosecutions to have a delayed impact upon other types of crime.

The variable Enforcement measures the ratio of Part I arrests to reported Part I crimes (see the appendix for the specific crimes included in this variable). With a mean of only 0.27, many counties have an enforcement magnitude in terms of arrest rates per reported crime of less than one-half. Following Levitt (1998), a negative relation between Enforcement and Crime implies both incapacitation and deterrent effects for law enforcement efforts that result in a reduction in all types of criminal activity. When Enforcement is disaggregated by type of crime, Levitt showed that a positive relationship between some enforcement ratios and specific crime rates is expected. In this case, because of deterrent effects, criminals substitute away from crimes with stronger enforcement efforts and towards those receiving relatively less attention from the police. As documented by Levitt, reviews of studies using aggregate variables similar to

Enforcement have concluded that the incapacitation and deterrent effects result in a negative relation between arrests and rates of specific crimes.

Specification and Estimation Results

Fixed-effects models are used to estimate the parameters of equation (1) for each of the five crime rates specified as dependent variables above. The Unemployment Rate and average Annual Wage are included to control for economic conditions in each regression.²⁷ Lags were not included for Enforcement, the Unemployment Rate, and the Annual Wage because their effects are more immediate and preliminary estimates indicated that their coefficients were not significant in any of the specifications. For the fixed-effects models, county dummy variables capture the variation in each crime rate due to county-specific factors that are invariant over time. Time effects are also included by means of yearly dummies that control for national changes affecting crime rates from 1995 to 2001. Failure to include significant cross-section and time-series effects would yield biased coefficient estimates. F-statistics used to test for the inclusion of the dummy variables are significant at the 0.01 level for all of the fixed effects models presented.

Table 2 shows the coefficients estimated for the impact of arrests for marijuana possession upon the incidence of each of the three property crimes. On the basis of a significant estimate of a first-order autocorrelation coefficient, the estimates for each equation incorporate a correction for autocorrelation. In all cases throughout this section,

²⁷ The unemployment rate is expected to be positively related to each crime rate. Raphael and Winter-Ebmer (2001) found a significant positive impact for the unemployment rate upon property and violent crime rates in U.S. states from 1971 to 1997. Counties with a higher average annual wage are likely to have fewer low income residents and therefore are hypothesized to be associated with fewer economic crimes per capita. Similarly, negative relationships between the annual wage and both homicides and hard drug possession are expected.

the standard errors for coefficient significance levels are based on White covariances robust to heteroscedasticity in the error terms.

Increases in current period arrests for marijuana possession are associated with increases in reported rates of larceny and motor vehicle theft. These results support the view that arrests for possession may significantly harm the employment or educational status of those involved, leading to a greater likelihood of stealing to get by. Also, because of the illegality of participating in marijuana transactions, prices are also higher when sellers perceive a greater risk of being caught due to the information provided by detained buyers. This implies that users may also turn to stealing in order to finance their purchases of marijuana at higher prices.

Estimated effects of increases in marijuana arrests on other crime rates are calculated for a typical county in the sample. For example, a one-standard deviation increase in the rate of marijuana possession arrests per 1000 would be associated with 52 additional larcenies and 5 additional motor vehicles thefts in a county of 100,000 persons.²⁸ For more populous jurisdictions, the effect can be calculated by substituting the appropriate population for the 100,000 value.

The significant coefficients for the Enforcement and economic variables have the expected signs. Increases in arrests per reported crime and a county's average wage lead to fewer arrests for burglary, larceny, and motor vehicle theft. In each case, the largest absolute effect is upon larcenies and the smallest is upon motor vehicle thefts. A one-

²⁸ The effects are point estimates of the increase in the number of other crimes reported. They are calculated by multiplying the significant possession coefficients from the regression equations by the standard deviation of arrests for marijuana possession and a county population of 100,000, which is slightly above the sample average of 87,000. The estimated effects for marijuana sales arrests (and for the Enforcement, Unemployment Rate, and Average Wage variables) are also derived using this approach. In each case, appropriate adjustments are made to the reported parameter and variables values in order to convert the estimates to the change in reported crimes per county.

standard deviation increase in the average wage reduces larcenies by 105, burglaries by 49, and motor vehicle thefts by 28. Comparable values for Enforcement are 36, 15, and 6. Higher unemployment rates are associated with more burglaries, with a one-standard deviation increase in unemployment raising burglaries by 20 for a typical county.

Results for the impact of arrests for marijuana sales upon economic crime rates are contained in the first three columns of Table 3, with estimates obtained after correcting for autocorrelation. In this case, only the rate of burglaries is adversely affected by an increase in marijuana sales arrests. Again, two effects may be at work. First, arrests for sales can be expected to disrupt supply and lead to price increases. Users or other sellers may therefore rely upon burglary to cope with these increases. Second, if the risks of selling become too great for some, they may switch to burglary as an alternative criminal activity that has the potential to be more economically rewarding and to have less risk than is typical of larceny and motor vehicle theft. The impact of a standard deviation increase in sales arrests is small, with the typical county experiencing an increase of only 7 reported burglaries per year. As can be seen by the very similar coefficient magnitudes and significance levels in the marijuana possession and sales models, the estimated quantitative impacts of Enforcement, Unemployment Rate, and Annual Wage upon Burglary, Larceny, and Motor Vehicle Theft are nearly identical in both tables.

There are models in the literature designed to explain variation in homicide rates that do not depend on the interactions between law enforcement and illegal drug activities. However, to begin an analysis in the context of the work presented above, Table 4 shows estimates from two models relating arrests for illegal drug activity and

reported homicide rates. The first model assumes that only arrests for marijuana sales, and not possession, may be related to the number of homicides committed. As discussed earlier, the arrest of sellers may disrupt established supply channels in the illegal market and lead to violent confrontations between rival groups seeking to replace those recently arrested. While this process is underway, homicides may increase, and not decline to previous levels until stable geographical supply relationships are reestablished.

The results for Model I in Table 4 are consistent with the supply disruption hypothesis. When counties increase their arrests for selling marijuana, they experience an increase in homicides during that time period. There is a decrease in the following period, but it is not large enough to completely offset the prior increase. Since profits for selling hard drugs are often greater and involve supply chains that are expensive to establish and maintain, a second model (II) is estimated for the impact of arrests for hard drug sales. Again, an increase in sales arrests lead to an increase in current period homicides, but in this case there is no significant reduction in the subsequent period. These results suggest that it may be helpful to include information about the enforcement of laws against selling drugs in models formulated to explain cross-section or time series variation in homicides. However, it is also apparent that the general model for explaining economically oriented crime rates is less applicable to the case of homicide. Not only are the R^2 values much lower than in Tables 2 and 3, but the impacts of Enforcement, Unemployment Rate and Annual Wage are either insignificant or of much smaller magnitudes.

The final column in Table 3 presents estimates for the impact of arrests for marijuana sales on arrests for possession of hard drugs. Although significant

contemporaneous effects are not present, lagged arrests for marijuana sales are found to have significant effects on hard drug possession. Two possible explanations involve the effects that marijuana supply disruptions may have on use or sale of hard drugs. First, some users may substitute hard drugs for marijuana when supplies are cut off leading to greater participation with hard drug markets and additional hard drug possession arrests. Second, it is possible that some former sellers of marijuana may decide to possess hard drugs, with the latter being a substitute for marijuana as a way to produce income, and later are arrested for hard drug possession. Regardless of the reason, these results provide little support for the gateway theory because marijuana supply disruptions are found to be associated with increases, not decreases, in participation with hard drug markets in later periods. In addition, the empirical results show significant effects on hard drug possession from changes in the unemployment rate or annual wage. Specifically, hard drug possession crimes are found to increase when the unemployment rate increases or when the annual wage declines.

A final model involves initial estimates for the impact of arrests for the sale of marijuana on drug-related hospitalizations (DRH) in New York State. The sample covers the years 1995-2000 for the 62 counties located in the state. The average county had a DRH value of 14.5 per 10,000 residents and sales arrests of 0.28 per 1000, a rate less than the national value shown in Table 1. While additional variables will need to be added to the model, estimates from a fixed effects model with an autocorrelation correction are provided in equation (2):

$$\begin{aligned}
 DRH_{it} &= 2.28 \text{ MarijuanaSales}_{it} + 3.32 \text{ MarijuanaSales}_{i,t-1} \\
 &\quad (1.55) \qquad\qquad\qquad (2.07) \qquad\qquad\qquad (2) \\
 R^2 &= 0.98
 \end{aligned}$$

While both coefficients are significant at the 0.10 level for a one-tailed test, most of the explanatory power stems from the cross-section fixed effects terms. Even so, increases in arrests for marijuana sales lead to increases in drug-related hospitalizations in both the current and subsequent period. This is consistent with the hypothesis that if arrests for selling marijuana lead to reductions in supply and increases in price, users may respond by switching to alternative drugs for which there are far more serious health consequences from abuse.

Although most of the coefficients of interest are statistically significant and the empirical results are consistent with those obtained from prior economic studies, some caution is in order when interpreting these estimates. Economic theory suggests that there may be a simultaneous relationship between reported crimes and drug arrests because resources are allocated to crime control activities in response to underlying crime rates (Benson et al., 1992; Mocan and Corman, 1998). To overcome the potential endogeneity, two-stage least squares would require that suitable instruments be found. Levitt (1998) evaluated potential instruments for estimating economic crime models and concluded that none of the potential variables are satisfactory. However, he demonstrated that measurement error and the potential endogeneity of independent variables are not significant problems with the estimation of this type of economic model of crime. Other researchers have evaluated potential endogeneity concerns when estimating these types of models and reached similar conclusions.²⁹ A reasonable

²⁹Benson et al. (1998) provided theoretical arguments for why arrest variables should be treated as exogenous, and found empirical support for this specification using econometric tests for exogeneity. They also maintained that fixed-effects models reduce the potential of endogeneity problems for independent variables included in the regression equation. Miron (1999) reached a similar exogeneity conclusion because the level of police resources will be related to lagged, not current, crime rates due to the political processes associated with changing the allocation of police resources.

alternative is to control for measurement error and omitted variables using fixed-effects models (Levitt, 1998, and Benson et al. 1998, 2001). Furthermore, during the time period of this study, crime rates were falling and drug arrests were increasing, suggesting that the recent intensification in drug enforcement was not in response to greater crime.

Another reason for caution is that it was not possible to include a measure of drug use in the model. However, a growing literature suggests that drug use and major non-drug crimes are not closely linked.³⁰ One recent study that included proxy variables for drug use found them to be insignificant determinants of violent crime (Resignato, 2000), while another found a small positive association between drug use proxies and property crime, but no association with violent crime (Corman and Mocan, 2000).

4. Summary and Conclusions

A growing body of research uses the economic model of crime to evaluate the role of enforcement, economic conditions, and other characteristics of local crime markets. This analysis of the determinants of county-level crime in the United States has assessed the impacts of marijuana arrests, conditions in local labor markets, and arrest rates for all reported Part I crimes in the context of fixed-effects models. The results identify factors

³⁰ There is inconclusive evidence about the relationship between drug use and crime, and although significant correlations are clearly present, strong support is lacking for the hypothesis that drug use, separate from its illegal component, causes crime. Rasmussen and Benson (1994) provided a comprehensive review of the evidence and concluded that, except for a small subset of drug users, drug use and crime appear to be unrelated. Miron (2003, p.16) argued that “the evidence... demonstrates a correlation between a tendency to commit crime and the tendency to use drugs, without indicating whether there is a causal connection,” and that “reviews of the literature on drug use and crime have consistently concluded there is little evidence that drug use per se causes crime”. Mast et al. (2000, p.292) also found that “substantial research literature suggests that there is no reliable association between drug use and major non-drug crimes”.

that have been significant in reducing crime. Improvements in enforcement ratios for total Part I crimes contributed to lower rates in United States counties for all types of crimes assessed from 1994 to 2002. These findings suggest that the recent focus on marijuana law enforcement has been counterproductive for addressing non-drug crime.

The results suggest that when other determinants of crime are accounted for, drug arrests for marijuana possession and sales are significantly associated with higher rates of economic crime and of violent crime. By removing the legal restrictions against possessing marijuana and ending its sale in the underground economy, the results indicate that fewer burglaries, larcenies, and motor vehicle thefts are likely to be committed. A similar result also holds for marijuana sales with respect to the incidence of arrests for homicide, hard drug possession, and drug related hospitalizations. If it is the illegality and arrests for these drug market activities, rather than the usage of marijuana per se, that is the root cause of other crimes, then there is considerable evidence that criminal activity, and perhaps some types of drug-related hospitalizations, will not be adversely affected by a relaxation of laws against marijuana.

The consistency of results with the empirical estimates is striking—in only one of many models tested were marijuana arrests found to have negative and significant effects, barely passing the significance test by a small margin. Increases in per capita arrests for the manufacture and sale of marijuana are accompanied by higher reported rates of several types of violent and property crime assessed, including homicides. Arrests for possession or sales are also positively related to the primarily economic crimes of burglary, larceny, and motor vehicle theft. These results are consistent with the view that non-drug crime rates may rise because limited police resources are diverted from Part I

crimes when marijuana arrests are given a higher priority. These results are also consistent with users financing higher-priced purchases as supplies decline and prices increase, or sellers pursuing alternative crime opportunities when the risk of arrest for sale of marijuana increases.

The findings reported here suggest that resources allocated to marijuana law enforcement will not benefit society by reducing non-drug crime or by reducing participation with other illicit drug markets. In addition, adverse effects on the public health are found to be associated with increases in marijuana arrests. Additional studies at the national or local level and similar analyses using data from other countries are needed to provide more evidence on this important question. At a minimum, the empirical findings should raise serious questions about the effectiveness of drug enforcement as a crime control measure, and they suggest that significant social costs may arise from legal prohibitions and enforcement activities for control of marijuana use, sales, and associated outcomes.

References

- Becker, Gary. 1968. "Crime and Punishment: An Economic Approach." *Journal of Political Economy* 76(2):169–217.
- Becker, Gary S. and Kevin M. Murphy (1988), "A Theory of Rational Addiction," *Journal of Political Economy*, 96 (4, Aug.), 675-700.
- Bennett, William (1990), "Should Drugs Be Legalized", Reprinted in Schaler, J. (Ed.) *Drugs*, 63-67. Amherst, NY: *Prometheus Books*.
- Benson, Bruce L. and David W. Rasmussen (1991), "The Relationship Between Illicit Drug Enforcement Policy and Property Crimes," *Contemporary Policy Issues*, IX (Oct.), 106-115.
- Benson, Bruce L., Iljoong Kim, David W. Rasmussen, and Thomas W. Zuehlke (1992), "Is Property Crime Caused by Drug Use or by Drug Enforcement Policy," *Applied Economics*, 24, 679-692.
- Benson, Bruce L., Iljoong Kim, and David W. Rasmussen (1998), "Deterrence and Public Policy: Tradeoffs in the Allocation of Police Resources," *International Review of Law and Economics*, March, 77-100.
- Benson, Bruce L., Ian S. Leburn, and David W. Rasmussen (2001), "The Impact of Drug Enforcement on Crime: An Investigation of the Opportunity Cost of Police Resources," *Journal of Drug Issues*, 31, 989-1006.
- Brooks, R (2003) "The Effectiveness of Drug Enforcement," National Narcotics Officers Association Coalition, West Covina, California, available at <http://www.natlnarc.org/papers/effectiveness.pdf>
- Brown, George F., Jr. and Lester P. Silverman (1974), "The Retail Price of Heroin: Estimation and Applications," *Journal of the American Statistical Association*, 69 (347), 595-606.
- Brown, George F., Jr. and Lester P. Silverman (1980), "The Retail Price of Heroin: Estimation and Applications," in *Quantitative Explorations in Drug Abuse Policy*, Irving Leveson, ed., New York: SP Medical and Scientific Books, 25-53.
- Brumm, Harold J. and Dale O. Cloninger (1995), "The Drug War and the Homicide Rate: A Direct Correlation?," *Cato Journal*, 14 (3, Winter), 509-517.
- Caulkins, J.P., Rydell, C.P., Schwabe, W. and Chiesa, J.R. (1997). *Mandatory minimum drug sentences*. Santa Monica, CA: Rand Corporation.

- Corman, Hope and H. Naci Mocan, (2000) "A Time-Series Analysis of Crime, Deterrence, and Drug Abuse in New York City" *The American Economic Review*, 90, (3), June, 584-604.
- Drug Policy Alliance (2003), *State of the States: Drug Policy Reforms, 1996-2002* available at <http://www.drugpolicy.org/statebystate/sosreport>.
- Duke, Steven B. and Albert C. Gross (1993), *America's Longest War: Rethinking our Tragic Crusade Against Drugs*, New York: G.P. Putnam's Sons.
- Duke, Steven B (2000) "The Drug War and the Constitution", *After Prohibition* edited by Timothy Lynch, Washington D.C., *Cato Institute*, pp. 41-59.
- Friedman, Milton (1991), "The War We Are Losing," in *Searching for Alternatives: Drug-Control Policy in the United States*, Melvyn B. Krauss and Edward P. Lazear, eds., Stanford, California: *Hoover Institution Press*, 53-67.
- Goldstein, 1985 "The Drugs/Violence Nexus: A Tripartite Conceptual Framework", *Journal of Drug Issues*, v. 39, pp 143-174
- Goldstein, Paul J., Henry H. Brownstein, Patrick J. Ryan, and Patricia A. Bellucci (1989), "Crack and Homicide in New York City, 1988: A Conceptually Based Event Analysis," *Contemporary Drug Problems*, Winter, 651-687.
- Goldstein, Paul J., Henry H. Brownstein, Patrick J. Ryan, and Patricia A. Bellucci (1997), "Crack and Homicide in New York City: A Case Study in the Epidemiology of Violence," in Craig Reinerman and Harry G. Levine, eds., *Crack in America: Demon Drugs and Social Justice*, Berkeley: *University of California Press*.
- Gray, James P. (2001), *Why Our Drug Laws Have Failed and What we Can Do About It*, Philadelphia: *Temple University Press*.
- Kleiman, M.A.R. (1992). *Against Excess*. New York, NY: Harper Collins Basic Books.
- Kuziemko, Ilyana and Steven D. Levitt (2001), "An Empirical Analysis of Imprisoning Drug Offenders," Working Paper 8489, Cambridge, MA, *National Bureau of Economic Research*.
- Levitt, Steven D. (1998), "Why Do Increased Arrest Rates Appear to Reduce Crime: Deterrence, Incapacitation, or Measurement Error?" *Economic Inquiry*, 36, July, 353-372.
- MacCoun, Robert J. and Peter Reuter (2001), *Drug War Heresies: Learning from Other Vices, Times, and Places*, Cambridge: *Cambridge University Press*.

- MacCoun, R., Reuter, P. and Schelling, T. (1996). Assessing alternative drug control regimes. *Journal of Policy Analysis and Management* 15 (3): 330-352
- Markowitz, Sara (2000) “An Economic Analysis of Alcohol, Drugs, and Violent Crime in the National Crime Victimization Survey,” Working Paper 7982, *National Bureau of Economic Research*.
- Mast, Brent D., Bruce L. Benson, and David W. Rasmussen. 2000. “Entrepreneurial Police and Drug Enforcement Policy,” *Public Choice* 104(3): 285-308.
- Miron, Jeffrey A. and Jeffrey Zwiebel (1995), “The Economic Case Against Drug Prohibition,” *Journal of Economic Perspectives*, 9(4, Fall), 175-192.
- Miron, Jeffrey A. (2001), “Violence, Guns, and Drugs: A Cross-Country Analysis,” *Journal of Law and Economics*, XLIV(2, pt 2), 615-634.
- Miron, Jeffrey A. (1999), “Violence and the U.S. Prohibitions of Drugs and Alcohol,” *American Law and Economics Review*, 1-2, Fall, 78-114.
- Miron, Jeffrey A. (2003), “A Critique of Estimates of the Economic Cost of Drug Abuse,” Manuscript. Boston, MA: Department of Economics, Boston University.
- Miron, Jeffrey A. (2004), “The Budgetary Implications of Marijuana Prohibition,” Manuscript. Boston, MA: Department of Economics, Boston University.
- Mocan, H. N., and Hope Corman. 1998. “An Economic Analysis of Drug Use and Crime.” *Journal of Drug Issues* 28:613–30.
- Nadelmann, E. (1988). The case for legalization. *Public Interest* 92: 3-17.
- Nadelmann, Ethan, "Commonsense Drug Policy." *Foreign Affairs*. Jan-Feb 1998; 77(1): pp. 111-126
- National Research Council (2001) *Informing America's policy on illegal drugs*. Washington, DC: National Academy Press.
- New York State District Attorney's Association (2001), *A Balanced Approach (Drug Laws, March 2001)*, available at <http://www.nysdaa.org/detail.cfm?page=163>.
- Office of National Drug Control Policy (1993), *State and Local Spending on Drug Control Activities*, Washington: ONDCP
- Office of National Drug Control Policy (2000), Drug Policy Information Clearinghouse Fact Sheet, “Drug Related Crime,” Washington, ONDCP: 1-6.

- Office of National Drug Control Policy (2001), "The Economic Costs of Drug Abuse in the United States, 1992-1998" Washington, D.C.: ONDCP, Executive Office of the President.
- Office of National Drug Control Policy (2002), *The Nation Drug Control Strategy*, Washington, D.C.: ONDCP.
- Polinsky, Mitchel and Shavell, Steven (1984), "The Optimal Use of Fines and Imprisonment," *Journal of Political Economy*, June: 89-99.
- Raphael, Steven and Rudolph Winter-Ebmer (2001), "Identifying the Effect of Unemployment on Crime," *Journal of Law and Economics* 44, April, 259-283.
- Rasmussen, David W. and Bruce L. Benson (1994), *The Economic Anatomy of a Drug War*. Maryland: Rowman and Littlefield.
- Resignato, Andrew J. (2000), "Violent Crime: A Function of Drug Use of Drug Enforcement," *Applied Economics*, 32, 681-688.
- Rydell, C.P. and Everingham, S.S. (1994). *Controlling cocaine*. Santa Monica, CA: Rand Corporation, 1994.
- Saffer, H. and Chaloupka, F. (1999). "State drug control spending and illicit drug participation," Working Paper 7114. Cambridge, MA: *National Bureau of Economic Research*.
- Sentencing Project (2001) *Drug Policy and the Criminal Justice System*, (2001) available at <http://www.sentencingproject.org/pdfs/5047.pdf>
- Sentencing Project (2002): *U.S. Prison Populations—Trends and Implications*, available at <http://www.sentencingproject.org/pdfs/1044.pdf>.
- Shepard and Blackley (2004), "U.S. Drug Control Policies: Federal Spending on Law Enforcement versus Treatment in Public Health Outcomes" *Journal of Drug Issues*, 34: 4, Fall: 771-786.
- Shepard and Blackley (2005), "Drug Enforcement and Crime: Recent Evidence from New York", *SOCIAL SCIENCE QUARTERLY*, 86: 2, June:323-342.
- Silverman, Lester P. and Nancy L. Spruill (1977), "Urban Crime and the Price of Heroin," *Journal of Urban Economics*, 4, 80-103.
- Sollars, David L., Bruce L. Benson, and David W. Rasmussen (1994), "Drug Enforcement and the Deterrence of Property Crime Among Local Jurisdictions," *Public Finance Quarterly*, 22(1, Jan.), 22-45.

- Stigler, George (1970), "The Optimum Enforcement of Laws," *Journal of Political Economy*, May-June: 526-36.
- U.S. Department of Justice (2002). Office of Justice Programs, Bureau of Justice Statistics, Prison Statistics. Available at www.ojp.usdoj.gov/bjs/prisons.htm.
- U.S. Department of Justice (2002). Drug Enforcement Agency *Speaking Out Against Drug Legalization* available at <http://www.usdoj.gov/dea/demand/speakout/07so.htm>.)
- U.S. Department of Justice (2002) Office of Justice Programs, Bureau of Justice Statistics, "Drug Use and Crime", available at <http://www.ojp.usdoj.gov/bjs/dcf/duc.htm>
- U.S. Department of Justice, Federal Bureau of Investigation (2002). *Uniform Crime Report 1981, and 1992-2002*. Washington, DC: FBI National Press Office. Available at www.fbi.gov/ucr/ucr.htm.
- U.S. Department of Justice, Federal Bureau of Investigation (1984), *Uniform Crime Reporting Handbook*, Washington, DC.
- Wilson, J.Q. (1990). Against the Legalization of Drugs. Reprinted in Schaler, J. (Ed.) *Drugs*, 49-62. Amherst, NY: *Prometheus Books*.
- Witte, Ann (1980), "Estimating the Economic Model of Crime with Individual Data," *Quarterly Journal of Economics*, February: 57-84.

Table 1: Data Summary			
Variable	Unit of Measure	Sample Mean	Standard Deviation
Burglary	Burglary arrests per thousand	6.79	4.01
Larceny	Larceny arrests per thousand	19.11	11.71
Motor Vehicle Theft	Motor Vehicle Theft arrests per thousand	1.86	1.94
Homicide	Homicide arrests per thousand	0.05	0.08
Hard Drug Sales	Non-marijuana drug sales arrests per thousand	0.51	0.76
Hard Drug Possession	Non-marijuana drug possession arrests per thousand	1.13	1.72
Marijuana Sales	Marijuana sales arrests per thousand	0.36	0.58
Marijuana Possession	Marijuana possession arrests per thousand	2.43	3.58
Enforcement	Part I arrests per reported crime	0.27	0.39
Unemployment Rate	Unemployment rate in %	5.60	3.13
Annual Wage	Annual wage in thousands of \$	23.28	5.32
N=9359: 1337 counties, 1995-2001. See the Appendix for sample selection methods and the data sources used. For homicides, N=6720: 960 counties, 1995-2001.			

Table 2: Marijuana Possession Regressions			
Crime Equation:	Burglary	Larceny	Motor Vehicle Theft
Explanatory Variables			
Marijuana Possession	0.030 (0.025)	0.145** (0.054)	0.015** (0.005)
Lag(Marijuana Possession)	0.011 (0.020)	0.016 (0.046)	-0.002 (0.005)
Enforcement	-0.372* (0.178)	-0.916* (0.485)	-0.151+ (0.095)
Unemployment Rate	0.064** (0.022)	-0.001 (0.044)	-0.002 (0.007)
Annual Wage	-0.093** (0.023)	-0.197** (0.052)	-0.052** (0.010)
R ²	0.878	0.936	0.930
Notes: Coefficient standard errors are in parentheses. ** (*) (+) indicates coefficient is significantly greater than 0 at the 0.01 (0.05) (0.10) level. The F-test for inclusion of the fixed effect dummy variables is significant at the 0.01 level for all models.			

Table 3: Marijuana Sales Regressions				
Crime Equation:	Burglary	Larceny	Motor Vehicle Theft	Hard Drug Possession
Explanatory Variables				
Marijuana Sales	0.124* (0.059)	-0.146 (0.132)	-0.017 (0.013)	-0.029 (0.050)
Lag(Marijuana Sales)	0.050 (0.041)	-0.025 (0.090)	0.003 (0.019)	0.114** (0.045)
Enforcement	-0.372* (0.179)	-0.903* (0.481)	-0.150+ (0.095)	-0.017 (0.027)
Unemployment Rate	0.062** (0.022)	-0.004 (0.045)	-0.002 (0.007)	0.034** (0.014)
Annual Wage	-0.093** (0.015)	-0.201** (0.053)	-0.053** (0.010)	-0.021+ (0.016)
R ²	0.879	0.936	0.930	0.674
Notes: Coefficient standard errors are in parentheses. ** (*) (+) indicates coefficient is significantly greater than 0 at the 0.01 (0.05) (0.10) level. The F-test for inclusion of the fixed effect dummy variables is significant at the 0.01 level for all models.				

Table 4: Homicide Regressions		
Explanatory Variables	I	II
Marijuana Sales	0.007* (0.004)	
Lag(Marijuana Sales)	-0.004* (0.002)	
Hard Drug Sales		0.010+ (0.007)
Lag(Hard Drug Sales)		-0.002 (0.002)
Enforcement	-0.003 (0.003)	-0.003 (0.003)
Unemployment Rate	-1.42x10 ⁻⁴ (9.32x10 ⁻⁴)	-4.46x10 ⁻⁵ (9.41x10 ⁻⁴)
Annual Wage	-.002+ (0.001)	-0.001+ (0.001)
R ²	0.370	0.370

Notes: Coefficient standard errors are in parentheses. ** (*) (+) indicates coefficient is significantly greater than 0 at the 0.01 (0.05) (0.10) level. The F-test for inclusion of the fixed effect dummy variables is significant at the 0.01 level for all models.

APPENDIX

SAMPLE SELECTION METHODOLOGY

Three samples are used to estimate the models presented above: (1) a national sample for the models in which the dependent variables are Burglary, Larceny, Motor Vehicle Theft, and Hard Drug Possession; (2) a national sample for the models in which Homicide is the dependent variable; and (3) a New York State sample in which the dependent variable is Drug Related Hospitalizations.

Sample (1)

Although there are over 3000 counties in the U.S., the final sample contains 1337 counties. Those omitted satisfy one of the criteria from (a) – (f) below.

- a. Counties in states with no or incomplete data for arrests or reported crimes: Florida, Illinois, Kentucky, Mississippi, Montana, South Dakota, Wisconsin.
- b. Counties in states for which State Police data were not reported or not allocated by county: Alaska, Connecticut, Vermont.
- c. Counties with changing boundary definitions during the 1994-2001 period.
- d. Counties in reporting jurisdictions that cover multiple counties because (1) the data were allocated only to the county with the largest population; or (2) the data were allocated in proportion to each county's population share.
- e. Counties for which either total Part I arrests or reported crimes are equal to zero.
- f. Counties for which the Coverage Indicator is less than 50 percent during any year. The Coverage Indicator represents the proportion of county-level data not imputed. For example, in the simplest case, if a county provided 8 months of data for variable z, an annual value would be computed as $12z/8$. If the number of months is fewer than 6 in any year, the data for that county was omitted. This is similar, but not identical, to the algorithm used prior to 1994.

SOURCE: U.S. Department of Justice, Federal Bureau of Investigation. UNIFORM CRIME REPORTING PROGRAM DATA [UNITED STATES]: COUNTY-LEVEL DETAILED ARREST AND OFFENSE DATA, 2001. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [producer and distributor], 2003.

Sample (2)

Sample (2) is the same as Sample (1) with two changes:

- a. The cutoff for the Coverage Indicator was raised to 75 percent because of the much lower number of homicides compared to other crimes.
- b. Any county with no homicides during the entire time series was omitted.

The homicide sample has 960 counties.

Sample(3)

This sample is described in detail in Shepard and Blackley (2005) and includes 62 counties in New York State for 1996-2000.

CRIMINAL OFFENSE DEFINITIONS

Part I Offenses: criminal homicide, forcible rape, robbery, aggravated assault, burglary, larceny-theft, motor vehicle theft, arson.

Definitions of Components of CRIME:

1. ASSAULT (aggravated assault): an unlawful attack by one person upon another for the purpose of inflicting severe or aggravated bodily harm. This type of assault usually is accompanied by the use of a weapon or by means likely to produce death or great bodily harm.
2. MURDER (criminal homicide): the willful (non-negligent) killing of one human being by another.
3. ROBBERY: the taking or attempting to take anything of value from the care, custody, or control of a person or persons by force or threat of force or violence and/or by putting the victim in fear.
4. BURGLARY: the unlawful entry of a structure to commit a felony or a theft
5. LARCENY (theft): the unlawful taking, carrying, leading, or riding away of property from the possession or constructive possession of another.

Part II, Drug Abuse Categories:

1. HARDSALE, HARDPOSS
 - a. opium or cocaine and their derivatives (morphine, heroin, codeine)
 - b. synthetic narcotics-manufactured narcotics which can cause true drug addiction (Demerol, methadone)
 - c. dangerous non-narcotic drugs (barbiturates, Benzedrine)
2. MARISALE:
 - a. marijuana

SOURCE: U.S. Department of Justice, Federal Bureau of Investigation, *Uniform Crime Reporting Handbook* (Washington, DC: 1984).

SOURCES OF VARIABLES USED: NATIONAL SAMPLE

1. Average wage: Bureau of Economic Analysis, U.S. Department of Commerce.
2. County unemployment rates are from the Local Area Unemployment Statistics (LAUS), Bureau of Labor Statistics (BLS).
3. County Crime and Drug Arrest Data from the FBI Uniform crime reports, available at the University of Michigan, National Archive of Criminal Justice Data (NACJD).

SOURCES OF VARIABLES USED: NEW YORK STATE SAMPLE

1. FBI Uniform Crime Reports County Data for New York State from the Geostat Center Collections of the University of Virginia (<http://fisher.lib.virginia.edu/collections/stats/crime>).
2. New York State Department of Health, County Health Indicator Profiles (1996-2000) (<http://www.health.state.ny.us/nysdoh/cfch/main.htm>).