

PORTLAND'S ASSET FORFEITURE PROGRAM:
THE EFFECTIVENESS OF VEHICLE SEIZURE IN
REDUCING REARREST AMONG "PROBLEM"
DRUNK DRIVERS

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A JOINT PROJECT OF
THE REED COLLEGE PUBLIC POLICY WORKSHOP
AND
THE PORTLAND POLICE BUREAU

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*For Steve:
Mentor, Benefactor, Friend.*

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EXECUTIVE SUMMARY

Many drunk drivers are seemingly impervious to traditional sanctions and continue to drive when their licenses are suspended or revoked. Since 1989, Portland has used asset forfeiture to deprive these drivers of the instrumentality of their offenses: their vehicles. While Portland's asset forfeiture program is unique and innovative, it has arisen in the context of a burgeoning of policies nation-wide extending forfeiture to ever more areas of law enforcement. Yet even as forfeiture's targets have multiplied, serious study of its effectiveness has been neglected. In Portland, as in the rest of the nation, a question whose answer is crucial to the success of asset forfeiture has remained unanswered. **Does the seizure of instrumental assets actually disrupt criminal activity and incapacitate or deter criminals? In Portland, it now appears that it has.**

This study applies multivariate statistical analysis techniques to arrest data covering five years of forfeiture enforcement. With race, age, sex, prior arrest history and level of police enforcement held constant, **perpetrators whose vehicles were seized could reliably be expected to be rearrested on average half as often as those whose vehicles were not.** The most plausible explanations for this result point to a reduced threat to public safety from these problem motorists as a result of Portland's forfeiture program.

It is hoped that the information contained in this report will aid policy makers in informed decision making. **Portland should share its experience through contacts with local, state and national law enforcement agencies, and encourage research on the effectiveness of forfeiture in combating the other activities against which it has been deployed.**

BACKGROUND AND INTRODUCTION*FORFEITURE 'S IMPACT ON CRIME: PAST RESEARCH AND DEBATE***The Reed Forfeiture Project**

This study is a successor to another study of asset forfeiture initiated in the Fall of 1991 by Professor Stefan Kapsch, director of the Reed College Public Policy Workshop (PPW). The PPW is an organization dedicated to the empirical study of "ideas in good currency" — policy issues generating great public interest and debate. Forfeiture was then and remains now such an issue. After languishing in relative disuse since prohibition, the wars on drugs and organized crime promulgated new statutes and an explosion of interest which revived first criminal and ultimately civil forfeiture as common prosecutorial tools. Across the nation in the late 1980s, many state and local jurisdictions passed measures authorizing novel uses of forfeiture against crime. In 1989 one such measure, Portland's Forfeiture Ordinance, began targeting problem drunk drivers. For the PPW, the Portland forfeiture program promised to afford a unique opportunity for empirical investigation of forfeiture's effectiveness against a highly recidivistic group of lawbreakers. The forfeiture study consisted of two stages: a comprehensive review of the literature on forfeiture in general and a survey to study Portland's program.

PPW researchers discovered an abundant body of literature regarding the legal issues surrounding forfeiture, but they were surprised to find little material relating to forfeiture's effectiveness in deterring crime. This dearth of research was even more bewildering in light of the frequency with which they found the effectiveness of forfeiture cited in justification of its employment. The introduction to their report states: "Considering the appeals that the courts so often make to the effectiveness of

forfeiture as an apology for occasional abuses, it is astounding that so little empirical evidence of that effectiveness has been produced."¹ Since the 1991 report, forfeiture has continued to be a frequent topic of articles in academic and legal publications, as well as the subject of court decisions and public debate. Unfortunately, this attention has done little to provide any systematic evidence of forfeiture's widely touted effectiveness against any of the many types of crime against which it is now frequently used.

The Federal "War on Drugs"

According to the U.S. Justice Department Executive Office for Asset Forfeiture (EOAF), "[t]he mission of the Department's Asset Forfeiture Program is to maximize the effectiveness of forfeiture as a deterrent to crime."² While, in the opinion of the EOAF, "revenue is an ancillary benefit,"³ and not the primary goal of the forfeiture program, the amount of revenue derived from seizures and deposited in the Asset Forfeiture Fund "serves as a barometer to measure the success of the program."⁴ This amount has grown from \$27 million deposited in FY 1985 to more than one half billion dollars in FY 1993, and totals over \$3.2 billion since the Fund's inception in 1985.⁵ Excluding special deposits related to the Drexel Burnham Lambert case in 1989 and the Michael Milken case in 1991, regular deposits have increased in each year of the Fund's existence.⁶

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1. Kapsch, et al., *Forfeiture: History, Precedents, and Current Debate* (1991) (unpublished report of the Reed College Public Policy Workshop Forfeiture Project, on file with the Secretary of the Division of History and Social Science, Reed College).
 2. Exec. Off. for Asset Forfeiture, U.S. Dep't of Justice, *Annual Report of the Dep't of Justice Asset Forfeiture Program at v* (1994) [hereinafter EOAF Annual Report].
 3. *Id.* at 15.
 4. *Id.* at 16.
 5. *Id.*
 6. *Id.* at 15.

If the fund truly is a barometer of the Asset Forfeiture Program's objective of deterring crime, we might expect to see an impact on the U.S. drug supply which roughly mirrors the growth in annual asset seizures. Yet in the case of cocaine, the flagship target of the national "war on drugs," prices have remained consistently low and purity has remained consistently high in recent years. The number of individuals reporting using cocaine at least once a week has remained relatively constant over the same period.⁷ While the number of people reporting infrequent use of the drug has dropped dramatically since the mid-1980s, it is not clear whether this drop is related in any way to the Asset Forfeiture Program, or if it is the result of increased drug education, cultural trends or a combination of factors.⁸ Absent a better measure of the impact of the Asset Forfeiture Program than the mere value of assets seized, it remains an open question whether, "[a]sset forfeiture has proven to be an effective tool in stripping criminals of the instrumentalities and proceeds of their *illicit* activities," as Attorney General Janet Reno asserts,⁹ or whether criminals have merely absorbed the costs imposed by the Program as an inevitable cost of doing business in the multi-billion dollar international drug trade.

State and Local Efforts

At the state and local level, a number of law enforcement jurisdictions have implemented enforcement programs which have included the use of forfeiture and other forms of administrative property seizure against a variety of criminal activities. Studies evaluating these programs, some of them quite sophisticated, nevertheless fail in a variety of ways to conclusively assess the effectiveness of forfeiture in any of the

7. Nat'l Narcotics Intelligence Consumers Comm. (NNICC), U.S. Drug Enforcement Admin., The NNICC Report 1993: The Supply of Illicit Drugs to the United States 1 (1994).

8. See *id.* at 1.

9. Att'y General Janet Reno, Foreward to EOAF Report, *supra* note 2.

capacities in which it has been employed. Some efforts studied have targeted the "supply side" of criminal activities.

- In Phoenix Arizona, the attorney general's office used forfeiture to seize the assets of "chop shops" which dismantle stolen cars and sell their parts. Even as judgements under the program topped five million dollars, auto theft continued to increase far more quickly in Phoenix than nationally. The report was unable to conclude whether the theft rate would have increased even more had the program not been in place, or whether the effort was simply ineffectual.¹⁰
- In New York City, civil forfeiture was used to evict drug dealers from privately owned buildings by threatening or actually effecting the seizure of the properties. The program has been successful in removing problem drug dealers from chronically afflicted properties. The report does not address to what extent or whether drug activities resumed in the targeted properties after the evictions, nor the degree and duration of the disruption of the activities of the individual dealers evicted.¹¹

Other efforts have attempted to control or hold accountable individuals who use drugs, or whose possession and use of legal but controlled items, such as weapons, poses a threat to society:

- In Maricopa County, Arizona, a "demand reduction" program was implemented which included the seizure of the vehicles of individuals caught purchasing any quantity of illegal drugs.¹² Although a follow up study was conducted, it did not assess any independent effects of asset forfeiture in achieving the program's objectives.¹³

10. Peter Finn & Maria O'Brien Hylton, Nat'l Inst. of Justice, U.S. Dep't of Justice, Using Civil Remedies for Criminal Behavior: Rationale, Case Studies, and Constitutional Issues 31-35 (1994) [hereinafter Using Civil Remedies].

11. Id. at 46-49.

12. Jan Chaiken, et al., Nat'l Inst. of Justice, U.S. Dep't of Justice, Multijurisdictional Drug Law Enforcement Strategies: Reducing Supply and Demand 7-9 (1990).

13. See John R. Hepburn, et al., Nat'l Inst. Of Justice, Dep't of Justice, Do Drugs, Do Time: An Evaluation of the Maricopa County Demand Reduction Program (1994).

- In Los Angeles, authorities seized weapons from the mentally ill absent the commission of a crime and without search warrants under the Welfare and Institutions Code. While the report notes reasons why this strategy should have been effective, it offers no hard evidence that it actually reduced violence among the mentally ill or that the confiscated weapons were not simply replaced.¹⁴

Some programs have used forfeiture in combatting both supply and demand of illegal drugs:

- As part of "Operation 'Caine Break," a multi-pronged attack on the activities of drug dealers and users in Birmingham, Alabama, 32 vehicles were seized from 80 individuals charged with soliciting narcotics from undercover officers. During and after the operation, violent and property crimes in the targeted areas of the city stayed relatively constant, in contrast to sharp rises in other areas of the city. However, since forfeiture was only one part of a larger strategy, it is impossible to determine the extent to which it independently influenced this outcome. The report also fails to address the concern that the reported results are consistent with the possibility that rather than reducing crime in Birmingham, 'Caine Break merely caused criminals to relocate their activities to non-targeted areas of the city.¹⁵
- In San Diego, asset forfeiture was used vigorously against dealers and purchasers as part of a comprehensive strategy to combat drug sales and use. While sophisticated multivariate techniques were used to test the effectiveness of certain elements of the strategy in obtaining convictions of suspects, no such techniques were employed to assess the effectiveness of forfeiture. A survey of offenders assessed their opinions on the importance of asset seizure in reducing drug use and sales. Offenders were ambivalent: 41% claimed that asset seizure was very important in achieving these goals, 41% said it was not important at all, and the remaining 18% felt that it was only somewhat important. While the report draws interesting conclusions about offender

14. Using Civil Remedies, supra note 10, at 26-30.

15. Craig D. Uchida et al., National Institute of Justice, U.S. Dep't of Justice, Modern Policing and the Control of Illegal Drugs: Testing New Strategies in Two American Cities 33-51 (1992).

psychology from these results, it rightly does not attempt to draw any conclusions about the usefulness of forfeiture from them.¹⁶

While all of these studies provide interesting information on how forfeiture is being employed around the country to address a variety of law enforcement needs, none provides any conclusive evidence of forfeiture's effectiveness as a deterrent of crime.

Forfeiture and Policy Making: Need for Study

If any conclusive studies of forfeiture's effectiveness do indeed exist, certainly none have reached the attention of those who would have the greatest stake in citing their outcomes: the policy makers, public officials and academics who regularly square off in the forfeiture debate. Several papers delivered to a 1994 New York Law School Law Review symposium¹⁷ debating forfeiture assert that forfeiture is an effective crime deterrent. Yet none cites statistics which adequately substantiate this claim. At a 1993 congressional hearing in which civil forfeiture came under intense criticism sparked by well-publicized tales of abuse, a U.S. representative,¹⁸ a state representative,¹⁹ a high ranking Department of Justice official,²⁰ and a county sheriff²¹ all characterized forfeiture as a "powerful weapon" against crime. Yet none cited studies to substantiate this characterization, nor do any documents entered into the record of the hearing contain references to any such studies. A 1992 report by the

16. Susan Pennell and Christine Curtis, Nat'l Inst. of Justice, U.S. Dep't of Justice, Drug Control Strategies in San Diego: Impact on the Offender 152 (1994).

17. Symposium, What Price Civil Forfeiture? Constitutional Implications and Reform Initiatives, 39 N.Y.L. Sch. L. Rev. 1 (1994).

18. Review of Federal Asset Forfeiture Program: Hearing Before the Subcomm. on Legislation and Nat'l Security of the Comm. on Gov't Operations, 103d Cong., 1st Sess. 11 (1993) (statement of Rep. McCandless).

19. Id. at 56 (statement of Florida State Rep. Elvin Martinez).

20. Id. at 71 (statement of Cary H. Copeland, Director and Chief Counsel, Executive Office for Asset Forfeiture).

21. Id. at 307 (statement submitted for record of Robert L. Vogel₃ Sheriff, Volusia County, Fla.).

Bureau of Justice Statistics on drug crime characterizes forfeiture in an almost identical manner, again without citation of evidence.²²

In academic and legal journals, in government reports, and ultimately before the political bodies where policy is shaped, forfeiture continues to be portrayed as a potent weapon against crime without the benefit of any systematic knowledge of its effectiveness. This does not seem to be the result of disingenuousness, but rather of a pervasive conflation of the power of forfeiture to seize assets, which neither proponents nor critics doubt, with the power of forfeiture to deter crime, which is untested. The two are not synonymous. The words of Cary H. Copeland, Director and Chief Counsel of the EOAF, suggest a martial analogy which illustrates why this distinction is crucial to the forfeiture debate. Copeland states: "Asset forfeiture can be to modern law enforcement what airpower is to modern warfare: it attacks and destroys the infrastructure of criminal enterprises."²³

No matter how tactically successful airpower may be in destroying targets, if it fails to materially effect the ability of the enemy to wage war, then strategically it is little more than a waste of ordinance. The value of assets seized has little relevance to the effectiveness of forfeiture in achieving its stated goals if the deprivation of those assets neither deters criminals nor incapacitates them from engaging in further crime. Forfeiture is also of little practical use if its benefits are outweighed by the "collateral damage" — the unfortunate but inevitable civilian casualties, in current military euphemism — it inflicts. The need for proof that the benefits of forfeiture are

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22. Bureau of Justice Statistics, U.S. Dep't of Justice, Drugs, Crime, and the Justice System 186 (1992) [hereinafter 1992 Drug Crime Report] (calling forfeiture a "powerful sanction against illegal drugs").
 23. Department of Justice Asset Forfeiture Program: Hearing Before the Subcomm. on Legislation and Nat'l Security of the Comm. on Gov't Operations, 102d Cong., 2d Sess. 85 (1992)

tangible and significant increases with every *cause celebre* whose tale of alleged injustice is trumpeted in the newspaper headlines and paraded before congressional committees. Without knowing whether forfeiture achieves its ends, it is impossible to state whether the costs of its occasional abuse are justified. Rational public policy making requires well-defined, quantifiable assessments of what forfeiture has and has not achieved. Such assessments are sadly lacking from current policy debate.

PORTLAND'S FORFEITURE PROGRAM

User Accountability

The most well known, debated and publicized aspect of forfeiture in the U.S. in the last decade has been the cooperative efforts of federal, state and local law enforcement authorities to wage the war on drugs against the various parts of the organizations which supply narcotics, from the giant international cartels to the dealers on the street. However, asset forfeiture programs aimed at "[ensuring] user accountability"²⁴ have been employed in various jurisdictions at least since 1986.²⁵ Typically, these efforts have targeted the demand-side of the drug equation, seizing the property — typically vehicles — of users who attempt to purchase drugs. Portland has taken this approach to new areas by using forfeiture to target other crimes in the commission of which a motor vehicle is instrumental. Under Portland's Forfeiture Ordinance, in effect since December of 1989, vehicles may be seized and forfeited from offenders arrested for driving while their licenses are suspended or revoked (DWS) if the suspension resulted from driving under the influence of

24. 1992 Drug Crime Report, *supra* note 22.

25. Todd S. Purdum, *New York Police Now Seizing Cars in Arrests for Possession of Crack*, N.Y. Times, Aug. 5, 1986, at A1-1. (describing cooperative effort between U.S. DEA and New York Police Department to seize vehicles of persons attempting to purchase small amounts of "crack")

intoxicants (DUII), and from offenders who are arrested as habitual traffic offenders (HO) — people who have committed three or more serious traffic offenses, at least one of which must be a **DUII** to meet the criteria for forfeiture.²⁶

Questions and Concerns

Portland's program raises a number of questions and issues. Drinking and driving is a devastatingly serious problem, a problem which is made more troublesome by the fact that many perpetrators are hard-core recidivists whose behavior seems to be all but impervious to modification by means of conventional sanctions. The Forfeiture Ordinance targets these individuals specifically, since one must be a repeat offender to be subject to its provisions. Does seizing these people's vehicles succeed where other measures often fail, or, as some suspect, do they simply replace the seized vehicles with unregistered "junkers" and continue to drive?

In addition to the impact of the Ordinance on offenders, its impact on taxpayers and law-abiding citizens must be considered. Contrary to popular (and often cynical) beliefs about the financial benefits of asset forfeiture to law enforcement, the Portland forfeiture program costs more to administer than it takes in from sales of seized property. Most vehicles seized are never auctioned, but are instead released to third parties, such as spouses and lenders. Of those that are forfeited and auctioned, most tend to be older vehicles of relatively little value. Another concern with the widened use of forfeiture by law enforcement is its perceived potential for abuse. Although the Portland Ordinance contains important

cocaine); Kirk Johnson, Seized, N.Y. Times, Oct 14, 1986, at B1-1 (reporting results of first month of New York seizure effort).

26. The Ordinance also authorizes the seizure of vehicles which are used in connection with the solicitation of prostitutes. The effectiveness of this aspect of the forfeiture program is not a subject of this study.

safeguards and is administered by men and women of the highest integrity, the entrustment of such a powerful tool to the hands of law enforcement should be accompanied by clear benefits to public safety. Only if the program is effective in protecting lives on the highways by depriving drunks of their weapon of choice will the real cost in tax dollars and potential cost in liberty seem worth paying.

The 1992 Survey of Offenders

In the Spring of 1992, the PPW conducted its planned survey to examine the effectiveness of the Portland program in deterring alcohol-related driving activity. The study was designed as a phone survey of a target group consisting of households of offenders, as well as of a control sample of households selected at random from the Portland metropolitan area. It was decided to request to speak with the individual in each household with the birthday nearest to the survey date rather than ask to speak to the offenders directly. It was felt that asking for offenders by name and posing questions relating to their criminal histories might result in a large number of refusals, hang-ups or untruthful responses. The survey was conducted in cooperation with the Portland Police Bureau (PPB) using the facilities of the PPW and funded through a grant from the Rose E. Tucker Charitable Trust.

Analysis of the data from the survey unfortunately revealed problems with the target group data. Of the 194 households surveyed in the target group, only 78 reported that any member had been stopped for DUII. Of those, only 12 reported having had a vehicle seized or forfeited. This was especially puzzling given the care with which the survey instrument had been adapted from instruments which had already been tested and found to be relatively reliable. It must be concluded either that the perpetrators were no longer or never had been at the phone numbers provided

from the PPB computer files, or that the respondents did not answer accurately or truthfully on a wide scale. While there are no doubt important methodological lessons to be learned from the 1992 survey results, they cannot be used to answer the question of whether Portland's forfeiture program has been an effective crime deterrent.

The Current Study

The current research effort seeks to answer this question using offender data acquired internally from PPB, rather than from a survey. For the purposes of this investigation, the broad notion of deterrence is addressed operationally along the lines of the familiar dichotomy between general deterrence and specific deterrence. General deterrence is the reduction in criminal activity caused by the threat of a sanction in those potentially subject to its imposition. Specific deterrence is the reduction in criminal activity caused by the imposition of a sanction in those to whom it has actually been applied. Despite exploration of a variety of techniques to circumvent the inherent shortcomings of arrest data, the lack of crucial information regarding individual knowledge and perceptions of forfeiture as a sanction prevented a methodologically sound assessment of the general deterrent effect of the forfeiture program. This study therefore focuses on the impact of forfeiture as a specific deterrent in reducing rearrest rates among those whose vehicles have been subjected to it. The body of the report is organized in three sections. *Data* describes the sources from which the data for the study were collected and the organization of the data file used in the analysis. *Methods* gives an account of the rationale behind the choice of the statistical model employed, as well as a discussion of the basic concepts involved in regression and event-history analysis. It is written for the interested layman with

little knowledge of statistics and may be glossed over by those either familiar with the subject matter or wholly uninterested by it. *Results* reports and discusses the interpretation of the outcome of multivariate analysis which tests the effect of the forfeiture sanction on rearrest rates among a sample of offenders. The study as a whole should be of interest to policy makers and law enforcement officials in Portland, as well as to those from other jurisdictions who wish to implement similar programs or evaluate the effectiveness their own forfeiture efforts.

DATA*SOURCES*

The data for this study were acquired from PPB's Portland Police Data System (PPDS), from the PPB Asset Forfeiture Unit's vehicle seizure records, and from the monthly reports of the PPB Traffic Division. The PPDS data consists of all citations issued from January 1, 1989, to December 31, 1994, for DUII, felony DWS, and HO (N = 22,525). Data prior to 1989 were unavailable due to regular purging of old citation records by the Data Processing Division. Multiple citations may be issued for a single custody, and of course many perpetrators have multiple citations. Each record of a citation contains variables for unique PPB perpetrator and custody identification numbers, allowing grouping and relational linking of records by perpetrator or custody. There are 21,220 unique custodies and 16,801 unique perpetrators represented in the PPDS data set.

The vehicle seizure data consist of records for all seizures of vehicles for felony DWS or HO subsequent to the institution of the forfeiture ordinance in mid-December, 1989 (N = 746). Traffic Division data consist of a record of hours patrolled by Traffic Division officers by shift (morning or evening) and the total number of DUII citations they issued for each month from January, 1986, to December, 1993. There are gaps of missing values in these data due to transitions in record-keeping staff. The data sets for all analyses were created via manipulation of these three sources.

*ORGANIZATION***Unobserved Sources of Heterogeneity**

Any individual charged with HO, or with felony DWS during a license suspension for DUII, is potentially subject to vehicle seizure and subsequent forfeiture. In answering the question of whether having a vehicle seized specifically deters, we wish to examine whether rearrest rates differ between individuals arrested for HO or felony DWS based on whether or not their vehicles were seized at the time of initial arrest. Ideally, there should not be any unobserved sources of heterogeneity — unmeasured differences between groups — which make people in one group more or less likely to be arrested than those in another. For example, if seizure were only applied to offenders with particularly egregious driving histories, and data about those driving histories were unavailable for inclusion as controls in analysis, we would be unable to sort out the effects of forfeiture on recidivism from the effects of having such a driving history. Fortunately, this is not the case. However, there is one difference which we must consider between the group of individuals whose vehicles were seized and the group whose vehicles were not.

We know that all individuals whose vehicles were seized for felony DWS were operating under a suspension for an alcohol related offense, since such a suspension is a criterion for seizure. However, due to the way that offenses are coded in the PPDS data and the purge by PPB Data Processing of all data prior to 1989, it is impossible to know whether the license of an individual charged with felony DWS whose vehicle was not seized was suspended for an alcohol related offense or for some other reason. However, the non-alcohol related license suspensions during which a felony (as opposed to misdemeanor) DWS citation may be issued are generally related to severe

and relatively rare offenses, such as suspensions for negligent vehicular homicide or hit-and-run.²⁷ Consequently, only a very small proportion of felony DWS citations are given to individuals whose licenses were suspended for non-alcohol related reasons. This fact, the fact that we may introduce controls for recent alcohol related driving convictions from the available data, and the large sample size all make it unlikely that the inevitable inclusion of non-alcohol related felony DWS custodies in the group whose vehicles were not seized introduces significant bias.

It should also be noted that even if any bias were introduced by the inclusion of such custodies, such a bias would be conservative with respect to the effect of vehicle seizure on rearrest, if one assumes, plausibly, that offenders charged with felony DWS for driving during non-alcohol related suspensions are less likely to be subsequently commit alcohol-related offenses. All individuals charged with felony DWS whose vehicles were seized are known to have been operating during an alcohol related suspension. Some individuals charged with felony DWS whose vehicles were not seized presumably were operating under non-alcohol related suspensions. If the non-seizure group as a whole were somewhat less likely to offend, then any reduction of the risk of rearrest attributable to having one's vehicle seized would be *underestimated*, since the group of individuals whose vehicles had been seized would be in general more likely to offend. Since the null hypothesis we wish to reject is that seizure has no effect in reducing recidivism, if seizure exhibits such an effect in analysis, we can be certain that this effect is not due to an unobserved source of heterogeneity related to the inclusion of non-alcohol related felony DWS custodies, and that if the estimation of this effect is at all in error, then such an error is on the side of conservatism.

27. OR. Rev. Stat. § 811.182(3) (1993-94).

Structure of the Data Set

With this in mind, the data set was chosen to consist of all custodies between January 1, 1990, and December 31, 1994, for which a citation for felony DWS or HO was issued (N = 5,493). Only custodies for 1990 and later were used to allow the creation of a variable for number of prior offenses in the previous year. Since no data exist prior to 1989, including cases prior to 1990 in the analysis would have introduced bias, as the prior arrest variable for such cases would not reflect a full year of data, as it would for all subsequent cases. For each case, a variable was created for the date on which the next subsequent felony DWS, HO or DUII arrest was observed for the individual involved in the custody. Many individuals were not rearrested within the observation period. A "dummy variable," that is, a dichotomous variable having the value of either one or zero, was created to indicate whether the rearrest variable contained the date of a subsequent arrest, or whether there was no rearrest observation in the study period. Cases for which there was no rearrest are considered to be *censored* by the end of the study period. Censoring of data is discussed in the methods section, below. Another dummy variable was flagged to indicate cases where there had been a vehicle seizure at the time of arrest (N = 610).²⁸ An additional dummy variable was flagged for cases for which the vehicle was subsequently auctioned (N = 226). In addition to these variables, each case contains a variable for age at time of offense and a dummy variable indicating the sex of the subject. The race of the offender was broken down in to six categories: White, Black, Hispanic, Asian, American Indian and Other.

28. Due to errors in data entry in the PPDS system, a number of custodies where a citation for DWS was issued were not included in the sample, and thus there are fewer cases in the data set corresponding to seizures than there were actual seizures. As there is no reason to believe that these cases are not missing at random, their omission presents no difficulties for the data analysis.

Enforcement Level Covariate Vector

It is likely that the probability of being arrested at any given time depends in part on the level of police enforcement in effect at that time. Traffic enforcement is carried out both by the officers of the Traffic Division and by regular patrol officers on the street. There are, unfortunately, no available data on Bureau-wide traffic enforcement activity. Missing data can often be extrapolated from available data if a model with reasonable assumptions can be fitted which reliably predicts missing values as a function of other complete data. The Traffic Division in the past has issued monthly reports containing information on its patrol activities. Complete data does exist for the total number of DUII citations issued per month Bureau-wide through December, 1994, as well as for the number of DUII citations per month issued by the Traffic Division through August, 1993. If a model were found which could reliably predict Traffic Division hours patrolled as a function of Traffic Division DUII citations issued, then this model could be used to predict Bureau-wide patrol hours on traffic enforcement from Bureau-wide DUII citations issued, assuming that regular officers, when engaged in traffic enforcement, are approximately as efficient at issuing citations as Traffic Division officers.

Unfortunately, the best model capable of being constructed with the available data was only able to account for approximately 39% of the variance in Traffic Division hours patrolled as a function of Traffic Division citations issued. Introduction of controls to account for seasonal variation in offense rates did not significantly improve the model. In other words, approximately 60% of the variation in DUII citations issued by the Traffic Division is accounted for by factors other than hours patrolled and seasonal variance. As sufficient data is not available to reliably

predict missing values for Traffic Division hours patrolled, there is no way to predict Bureau-wide traffic enforcement, even if the assumption of equal enforcement efficiency were justified.

While we cannot extrapolate the total Bureau-wide traffic enforcement, the number of patrol hours by the Traffic Division in the evening (when most citations are issued) does significantly predict over 37% of the variance in Bureau-wide DUII citations issued. Traffic Division evening patrol hours may therefore be a significant predictor of a portion of the variance in the likelihood that an individual will be arrested for DWS, DUII or HO at any given time. We may test this hypothesis by analyzing the subset of cases for which complete Traffic Division evening patrol data are available. The data on Traffic Division enforcement were used to create for each case a vector of 44 variables containing values for hours patrolled in each of the up to 44 months subsequent to the date of arrest for which data exist. Although this is less than ideal, the subset of complete cases from January, 1990, through August, 1993, is sufficiently large to allow testing of whether Traffic Division hours patrolled had a significant effect on rearrest rates.

METHODS

REGRESSION

Basic Concepts

Fitting a model to data which estimates how the value of a dependent variable, such as time to rearrest, depends on values for a number of independent variables, such as age, sex, vehicle seizure, etc., is usually accomplished by means of multiple regression. While there are many types of regression, in general each employs a "regression equation" which expresses the dependent variable as a function containing terms for each of the independent variables. Constants for each of the independent terms in the regression model are estimated in such a way as to maximize the goodness of fit of the predicted values with the actual values observed for the dependent variable. The significance of the contribution of a variable, that is, the likelihood that the variation in the dependent variable explained by it is attributable to random chance (often measured by the statistic/?), can be assessed by constructing a restricted model from which the variable is omitted, and comparing the improvement of fit of the full model (including the variable) over the restricted model, given certain other parameters.

Problems with Time-to-Event Data

The most common regression methods are often inappropriate for analysis of the effects of independent variables on a dependent variable containing time to an event. In most techniques, values for the dependent variable be a number or must be dichotomous categorical. Although these methods can be used with time-to-event data, for example, if the dependent variable is coded to reflect whether or not, or how

often, an event has occurred in an arbitrarily specified follow-up period, such an approach is wasteful of information for a number of reasons. First, and most obviously in the present case, all custodies whose follow-up period extends beyond the end of the study period would have to be eliminated from analysis, since we could not specify a value for the dependent variable for them. If the follow-up period were, for example, one year, no custodies after December 31, 1993 could be used as cases in the analysis, since the period for which data exist ends December 31, 1994, and these custodies would not have a full year of subsequent observations for the determination of the dependent variable. Second, even for cases where the initial offense occurred before December 31, 1993, information about reoffenses which may occur subsequent to the follow-up period would be lost to analysis. Lengthening the follow-up period only reduces the number of usable cases by lengthening the period prior to the end of the study in which cases could not be used, while ameliorating the loss of cases by shortening the follow-up period exacerbates the loss of potentially interesting reoffense data beyond the follow-up period.

A third problem with customary regression techniques when applied to time-to-event data is apparent when we consider that in the case of criminal recidivism, the amount of time from initial offense to reoffense is highly interesting. This information is available in our data set, but is wasted when only whether or how often an individual is rearrested within a given period is considered. It might be thought that this deficiency could be corrected in a linear regression model by using time to reoffense as the dependent variable. However, for individuals who are not rearrested by the end of the study period, the value of the dependent variable is unknown, or *censored* by the arbitrary imposition of the time cut-off at the end of the study period. Assigning the end date of the study period to the dependent variable would

introduce bias by underestimating the actual time to reoffense in most cases, while assigning any other date would be completely arbitrary and result in an under or overestimation for an unknowably large part of the sample. The only other alternative would be to treat censored cases as missing, and thus exclude them from analysis, introducing yet a different bias and losing valuable cases. A further problem with common regression methods for time-to-event data is the fact that certain independent variables, such as an individual's age, are not constant, but vary through time. Ordinary regression techniques offer no way to estimate the effects of time-dependent variables. A different approach is obviously needed.

*EVENT HISTORY ANALYSIS*²⁹

Basic Concepts

The various techniques of event history analysis are superior to other regression techniques for time-to-event data in that they allow censored observations adequately to be taken in to account, and they permit the use of time-dependent variables. A number of concepts are common to all methods of event history analysis. A case for which an event, such as reoffense, could occur at some time is said to be "at risk" at that time. The total number of cases at risk in any given time period is known as the "risk" set. The probability that an event will occur in a particular time period for a particular case in the risk set is termed the "hazard rate." Certain event history models incorporate regression techniques to allow the estimation the effects of covariates on hazard rates. Of these, the Cox proportional

29. See Paul D. Allison, *Event History Analysis: Regression for Longitudinal Event Data* (1984), for an accessible discussion of the various techniques of event history analysis and their relative merits.

hazards log-linear regression model³⁰ is especially powerful and non-restrictive, given that certain assumptions are adequately fulfilled.

Advantages of the Cox Proportional Hazards Model

Two of the advantages which Cox models have over many other methods of event history are worthy of note. First, as we have noted, certain covariates, such as the age of a research subject, may change in value during the time that the subject is at risk, and Cox models can use time-dependent variables in regression analysis. Second, many other continuous-time methods use "parametric" models. Such models require the researcher to specify prior to analysis the over-all form of the hazard rate as a function of time. Often, there is very little information available on which to base such a specification. As "non-parametric" models, Cox models require no specific assumptions about the form of the underlying hazard function, and are thus much more general and flexible than parametric models. It is primarily because the Cox model combines the use of time dependent variables with a non-parametric model that it has become the method of choice for event history analysis when it is appropriate.

The Proportionality Assumption

Cox models are not, however, always appropriate for all data. For a Cox model to be appropriate, it must be assumed that the effects of differing values for the independent variables are proportional over time. For example, if the covariate "sex" is included in the model, the Cox model is appropriate only if the hazard function for males differs from that for females only by a constant factor at all times. A simple statistical method of checking proportionality with respect to a variable is available

30. D. R. Cox, Regression Models and Life Tables, 34 Journal of the Royal Statistical Society, Series Bat 187(1972).

by means of testing the significance of the effect of the interaction of that variable with the log of the time on study minus the log of the mean time to event for the entire sample. If the effect of this interaction variable is not significant at a chosen level of significance (as it is not for the variables used in this analysis at $p < 0.05$), then the data may be assumed to be roughly proportional and the Cox model may be used.³¹

Stepwise Regression and Model Building

Building the best model for predicting observed values of a dependent variable involves testing candidate independent variables for inclusion and removal from the model such that the final model contains only those independent variables which contribute significantly to the overall goodness of fit of the model, and excludes those which do not. With any more than a few explanatory variables, manually building a model can be very time consuming. A stepwise regression is an automated procedure for performing this potentially tedious task. In our analysis, variables considered likely to contribute to the model based on theoretical considerations and exploratory results were included in the model on the first step, and those considered unlikely to make a significant contribution were excluded. In subsequent steps, variables in the model were tested for removal and variables not in the model were tested for inclusion. Variables were removed if their removal did not significantly degrade the predictive accuracy of the model, and were included if their inclusion significantly improved the model (p to include ≤ 0.1 , p to remove ≥ 0.15). Significance levels were

31. Hans-Peter Blossfeld et al., *Event History Analysis: Statistical Theory and Application in the Social Sciences* 147-149 (1989); but see Allison, *supra* note 29, at 38 (suggesting that because of the generality of the proportional hazards model, concern for the violation of the proportionality assumption may often be exaggerated.)

calculated using the maximum partial likelihood ratio method. Stepwise regression proceeds iteratively until no variables meet the significance criteria for inclusion or removal. The variables still remaining at this point constitute the final model.

Constant explanatory variables tested for inclusion and removal were the sex and race of the subject, the number of prior felony DWS, HO or DUII offenses in the preceding year, whether the subject's vehicle had been seized at the time of custody, and whether the vehicle was subsequently auctioned. The time-dependent variable of the age of the perpetrator was tested using the entire sample, as was the monthly number of evening hours patrolled by the Traffic Division in a model using only cases through August of 1993.

RESULTS

EFFECTS OF VARIABLES ON REARREST RATE

Table 1 shows the effects of explanatory variables on time to rearrest in terms of regression coefficients with associated significance levels from the Cox proportional hazards regression model. Only variables having a significant effect on time to rearrest are included in Table 1. Evening hours patrolled by the Traffic Division did not have a significant effect on rearrest in the subset of cases through August, 1993. The model therefore was estimated using all available cases from January 1, 1990, through December 31, 1994.

Table 1
Effects of Explanatory Variables on Time to Rearrest

Variable	Coeff.	Predicted # Rearr./Mo. % Increase (Decrease)	Predicted Time to Rearr. % Increase (Decrease)
Sex (Male)	0.4467*	56.32	(36.03)
Age	-0.0192*	(1.90)	1.94
Race: Black	0.6900*	99.38	(49.84)
Asian	-1.8141*	(83.70)	513.50
Other	0.3934**	48.19	(32.52)
Prior Offenses	0.2543*	28.96	(22.46)
Vehicle Seized	-0.6887*	(49.78)	99.12

* $p < 0.05$.

** $p < 0.01$.

Model Chi-Square=724.02, DF=7, $p < 0.01$.

Regression coefficients indicate the magnitude and the direction of the effect of each explanatory variable on the hazard rate. A positive coefficient indicates a greater number of expected rearrests in a one month period of time based on an increase of one unit in the value of an explanatory variable, and a shorter expected time to rearrest based on the same increase. A negative coefficient indicates the opposite effect. By calculating the exponent of the coefficient, we arrive at the percent increase or decrease in the hazard rate predicted by a positive change of one for an explanatory variable. Thus being male, as opposed to female (the arbitrarily chosen reference category), corresponds to a 56.32% increase in the number of expected rearrests per month. 100% minus the inverse of this percentage gives the percent expected increase or decrease in time to rearrest — for males, a 36.03% decrease in expected time to reoffense as opposed to females.

No entry for "Race: White" is included in Table 1, as Whites are the reference category for the categorical variable "race" (though any other category could have been chosen). All estimates for the effect of race contrast the effect of being in a certain racial category as opposed to being White. We can thus see that expected time to rearrest is slightly less than half as long for Blacks than for Whites, and over five times longer for Asians than for Whites. Time to rearrest did not differ significantly for Hispanics or American Indians from that for Whites, and these categories are therefore not shown in Table 1. Considered together, other races than those considered specifically had a predicted time to rearrest about a third shorter than that for Whites. Each additional year of age increased the expected time to rearrest by about 2%. We can also see that each prior arrest predicts a 32.52% decrease in expected time to rearrest. Most interestingly, having a vehicle seized nearly doubled expected time to rearrest. Having a vehicle actually forfeited did not have a significant

effect over and above that associated with simply having it seized. All of these results are highly statistically significant. Vehicle seizure is a strong and significant predictor of reduced rearrest for DWS, HO and DUII with several other important factors taken into account.

INTERPRETATION

Interpretation of statistical results is not a deductive process, but rather involves choosing among explanations which are consistent with an outcome based on their plausibility. Before concluding that seizure has resulted in reduced recidivism, we must consider consistent alternatives. A classic example of a sanction reducing rearrest rates within a certain geographical area without affecting recidivism is the case of prostitution. There is good reason to believe that when stronger anti-prostitution enforcement is applied in a certain area, arrests in that area may fall, but often only because prostitutes and "Johns" relocate to a different area where they may conduct their business with less interference. A similar phenomenon is common with respect to drug activity and enforcement. As state-wide data on offenders were not available for analysis, it may be questioned whether individuals whose automobiles were seized merely continued to reoffend in jurisdictions other than Portland, just as prostitutes or drug-dealers may ply their trades in less well-patrolled sections of town when enforcement is strengthened in their customary area of operations. Could individuals whose vehicles have been seized simply have continued to reoffend at the same rate, but in another jurisdiction as subsequent to vehicle seizure?

There is a fundamental difference between driving on the one hand, and prostitution and drug-dealing on the other, which suggests that the answer to this question is negative. Stepped-up enforcement in one area only requires that a

prostitute or drug-dealer travel to a different area to conduct his or her business. No relocation of domicile is required. But an individual whose license has been suspended cannot simply continue to drive in another jurisdiction without relocating his or her place of residence. To completely avoid the prospect of seizure while continuing to drive, an offender must physically relocate his or her residence to another jurisdiction.

Such an individual might theoretically reduce his or her chances of apprehension by striving to the greatest degree possible to drive in other jurisdictions when conducting business, minimizing time spent driving within Portland. Yet such a strategy would still involve the risk of regular driving within the city limits, and require a great deal of additional time in performing even the most routine errands. It is highly unlikely that such relocation, either of domicile or driving, is responsible for the dramatic increase in expected time to rearrest predicted by vehicle seizure. More plausible than relocation is the possibility that offenders are continuing to drive after seizure or forfeiture, but that they are driving more carefully to avoid detection. While it is highly likely that this occurs, it seems doubtful that it accounts for the magnitude of the effect on rearrest rates. Presumably, the offenders did not try to get caught the first time. It should also be noted that even if the only effect of the forfeiture program were to run offenders out of town, to cause them to drive as much as possible in other jurisdictions or just to drive much more carefully, this result in itself would be highly desirable from the standpoint of Portland motorists.

If seizure does result in reduced recidivism, how does it do so? Could seizure of vehicles be physically preventing people from driving? While actual forfeiture did not predict any reduction in rearrest over and above that predicted by seizure alone, this does not mean that physical prevention of driving through the loss of a vehicle is not an important factor in reducing rearrest rates. Vehicles which are not forfeited are

released to lien holders, spouses and other innocent owners on the understanding that their use will be withheld from offenders. Yet any offender who is able and who wishes to may purchase a beat-up used car for very little money, neglect to register and insure it, and continue driving. If offenders are not driving subsequent to seizure, it is likely not because, strictly speaking, they are physically prevented from doing so, but rather that they choose not to take the necessary steps and resume driving, that is, *they are deterred*.

Why would seizure deter where other sanctions have failed? While offenders may view brief jail terms with indifference and simply fail to pay fines, the loss of use of a vehicle through seizure or forfeiture is a tangible penalty. Many offenders have few financial resources. The investment which is lost in a vehicle which is forfeited may be considerable to them, even if the vehicle was of relatively little value. The cost of replacing a vehicle can serve as an unavoidable fine, even if a vehicle is only seized and released, if an offender also loses access to it. With vehicles which are released, the consequences incurred at the hands of third parties also may enhance the deterrent effect of seizure. New York prosecutor Sterling Johnson, speaking of young suburbanites who travel to the city to buy crack and whose cars are seized, put it well: "When they come home without momma's car or without daddy's car, the criminal justice system is going to be the least of their worries...."⁶²

32. Purdum, *supra* note 25, at A24-1.

CONCLUSION

Proper consideration of the outcome of this study requires that the sharp distinction between the facts revealed and their theoretical explanation be reiterated. One may perhaps dispute the explanation, but inasmuch as our data are accurate and our methods sound, the facts are known to be true beyond dispute. It is a fact that, other things being equal, having a vehicle seized reliably predicts a doubled expected time to rearrest for individuals arrested for DWS in the city of Portland between Jan 1, 1990 and December 31, 1994. Explanation of the facts is based on inference and is open to interpretation. Reduced driving as a result of physical incapacitation or deterrence, or driving more carefully are plausible explanations and are consistent with the observed reduction in rearrest rates. Most probably, a combination of these factors is responsible for this result. What is important is that following any of these plausible strategies for avoiding rearrest also serves to make an offender less of a danger on Portland's roads. Any positive modification of the behavior of a group of offenders as recalcitrant as the subjects of this study is an accomplishment indeed. If Portland's forfeiture program achieves nothing else, it is still a verifiable success story.

It is believed that this study represents the only application of multivariate statistical analysis techniques to the assessment of the effectiveness of a forfeiture policy directed at any kind of criminal activity in the United States. While it may serve as a vindication for Portland's forfeiture program and an incentive to move forward, it still does little to fill the research void with respect to this issue of national importance. Portland's forfeiture program must be considered within the broader context of the proliferation of uses for forfeiture across the nation over the last

decade. In examining the current state of knowledge about forfeiture, we considered a number of jurisdictions which have extended the use of forfeiture to new areas of law enforcement. Not only is Portland's forfeiture program at least as innovative as that of any jurisdiction which has received national attention, it also has the unique attribute of having verifiably worked. As Portland shares its experience with other law enforcement jurisdictions around the state, the region and the country, it is hoped that those who wish to follow Portland's leadership in policy will also be encouraged to take the steps necessary to encourage more and better research of this type in the future.