

# The Deterrent Effects of Prison: Evidence from a Natural Experiment

---

Francesco Drago

*University of Naples Parthenope, Center for Studies in Economics and Finance, and Institute for the Study of Labor*

Roberto Galbiati

*Centre National de la Recherche Scientifique–EconomiX and Cefremap*

Pietro Vertova

*University of Bergamo and Econpubblica, Bocconi University*

The Collective Clemency Bill passed by the Italian Parliament in July 2006 represents a natural experiment to analyze the behavioral response of individuals to an exogenous manipulation of prison sentences. On the basis of a unique data set on the postrelease behavior of former inmates, we find that 1 month less time served in prison

We are particularly indebted to the editor Steven Levitt and to an anonymous referee for precious suggestions that substantially improved the paper. We are grateful to Ciro Avitabile, Samuel Bowles, Paolo Buonanno, Eve Caroli, Dimitry Christelis, Ethan Cohen-Cole, Philip Cook, Edward Glaeser, Tullio Jappelli, Dora Kadar, Eliana La Ferrara, Alex Mas, Alicia Perez-Alonso, Nicola Persico, Imran Rasul, Sevi Rodriguez-Mora, Jesse Shapiro, Adriaan Soetevent, Christian Traxler, Giulio Zanella, and seminar participants at the University of Amsterdam, Center for Economic Studies–Sorbonne, the Center for Studies in Economics and Finance–Innocenzo Gasparini Institute for Economic Research Symposium on Economics and Institutions, Columbia University, the Maryland Economics Crime and Justice Policy Workshop, Max Plank Institute Bonn, Group d'Analyse et de Théorie Economique–Lyon, University of Naples Parthenope, University of Paris X, and the Paris School of Economics for valuable discussions and comments on various drafts. We thank the Italian Ministry of Justice, in particular, Stefano Anastasia, Federico Bozzanca, Enrico Erba, Anna Fino, Luigi Manconi, Ferdinando Mulas, and all those involved in providing the data. This paper has been screened to ensure that no confidential information is revealed. All remaining errors are our own.

[*Journal of Political Economy*, 2009, vol. 117, no. 2]  
© 2009 by The University of Chicago. All rights reserved. 0022-3808/2009/11702-0003\$10.00

commuted into 1 month more in expected sentence for future crimes reduces the probability of recidivism by 0.16 percentage points. From this result we estimate an elasticity of average recidivism with respect to the expected punishment equal to  $-0.74$  for a 7-month period.

## I. Introduction

In modern criminal justice systems, imprisonment is the most important form of sanction. Prisons have two basic functions. First, they incapacitate criminals from committing other crimes. Second, the threat of being incarcerated, or the experience of incarceration, should deter potential criminals from offending (Becker 1968). While the incapacitative effect of imprisonment is due to the mechanical removal of criminals from society, its deterrent effect presumes that individuals change their criminal behavior in response to the severity of prison sentences. Policy makers often advocate the deterrent role of imprisonment as an effective approach to crime reduction. However, understanding whether criminals do in fact respond to any policy changing the incentives to commit a crime is problematic. The major problem is that it is very difficult to observe an “exogenous” variation of prison sentences at the individual level in reality.<sup>1</sup>

The Collective Clemency Bill<sup>2</sup> passed by the Italian Parliament in July 2006 represents a unique opportunity to identify how people respond to exogenous variations in prison sentences. This law provided for an immediate 3-year reduction in detention for all inmates who had committed a crime before May 2, 2006. Upon the approval of the bill, almost 22,000 inmates—about 40 percent of the prison population of Italy—were released from Italian prisons on August 1, 2006. The bill states that if a former inmate recommit a crime within 5 years following his release from prison, he will be required to serve the remaining sentence suspended by the pardon (varying between 1 and 36 months) in addition to the sentence given for the new crime.<sup>3</sup> This is equivalent to a policy manipulating incentives to commit a crime since it commutes 1 month of time of the original sentence to be served in 1 month more of expected sentence for future crimes. More important, this institutional framework manipulates prison sentences at the individual level in a

<sup>1</sup> Levitt and Miles (2007) have recently surveyed the relevant empirical literature, noting many of the critical issues hampering the identification of the effects of sanctions on criminal behavior.

<sup>2</sup> See Law 241/2006 in the *Gazzetta Ufficiale* of the Italian Republic, July 31, 2006.

<sup>3</sup> Consider an individual who, having a residual sentence of 2 years to serve on July 31, 2006, is released from prison as a consequence of the Collective Clemency Bill. If he recommit a crime within the 5 years following July 31, 2006, his expected sanction is equal to the sanction for the new crime plus an additional sentence of 2 years of prison.

random fashion. In particular, conditional on inmates' original sentences, the variation in the remaining sentence at the date of the pardon (and hence in the expected sentence for any crime) depends only on the date of an inmate's entry into prison, which is plausibly as good as random. A closer inspection of the data corroborates this intuition: conditional on the original sentence length, inmates' observable characteristics are balanced for individuals below and above the median of the remaining sentence.

We were granted access to the Italian Department of Prison Administration (DAP) database records on all the individuals released as a result of the collective pardon law between August 1, 2006, and February 28, 2007. The full sample includes 25,814 individuals; 81 percent of the sample is composed of prisoners released on August 1, 2006. For each individual in the sample, in addition to a large set of variables at the individual level, these data provide information on whether or not the former inmate reoffended within the period between his release from prison and February 28, 2007.

Using this data set, we exploit the variation in the remaining sentence at the date of the pardon to identify how former inmates' propensity to recommit a crime responds to a policy that exogenously manipulates prison sentences. Our results show that a marginal increase in the remaining sentence reduces the probability of recidivism by 0.16 percentage points (1.3 percent). This means that for former inmates, 1 month less time served in prison commuted into 1 month more in expected sentence significantly reduces their propensity to recommit a crime. By further inspecting our data, we can make some interesting comparisons of the behavior of different categories of former inmates. The effects we find are fairly homogeneous across inmates with different individual characteristics. Only individuals convicted to relatively longer sentences do not seem to be deterred, whereas foreign inmates are slightly more responsive than Italians. Young individuals have a behavioral response similar to that of adults.

This evidence allows us to make some considerations regarding both policy and theory. First, prison sentences represent effective disincentives to individuals' criminal activity. In particular, a policy commuting actual sentences in expected sentences significantly reduces recidivism. This suggests that alternative approaches to incapacitation relying on the behavioral response of criminals to disincentives to engage in criminal activity may be effective in reducing crime. Second, given that existing estimates reveal a nonpositive effect of time served on recidivism (Kuziemko 2007), we can draw some quantitative inferences on the possible effect of expected sentences on propensity to recommit a criminal act. For a 7-month period we estimate an elasticity in the propensity to recommit a crime with respect to the average sentence that individuals

expect equal to  $-0.74$ . This means that increasing the expected sentence by 50 percent should reduce recidivism rates by about 35 percent in 7 months.

This paper contributes to the literature providing evidence that potential criminals do respond to a change in prison sentences. The natural experimental setting allows us to solve some fundamental problems involved in identifying individuals' response to a variation in the severity of punishment, which is typically tested by analyzing how crime rates are affected by an increase in criminal sanctions. When we register a drop in crime rates following an increase in criminal sanctions, two explanations compete: the discouragement of criminal behavior is induced by the increase in its relative price (*the deterrent effect*), or the reduction in crime is mechanically due to the removal of criminals from the community (*the incapacitation effect*; Levitt 1996; Owens, forthcoming).<sup>4</sup> However, it is unclear how much of existing estimates of the effects of an increase in prison sentences may be accounted for by the incapacitation effect (Lee and McCrary 2005). By exploiting the exogenous variation in prison sentences at the individual level generated by the natural experiment, we identify the behavioral response of potential criminals without any possible bias connected to the incapacitation effect and the endogenous response of policy makers.

The paper develops as follows. In Section II we discuss the related literature. Section III presents the historical and political background of the Clemency Bill approved in Italy in July 2006 and describes the provisions of the bill in detail. Section IV provides the empirical analysis. Section V presents concluding remarks.

## II. Related Literature

Our paper relates to the literature studying the effect of the severity of punishment on criminal activity.<sup>5</sup> To understand this effect, most works in this field have studied the effect of incarceration rates on aggregate crime rates (Levitt 2004).<sup>6</sup> For example, in an influential paper, Levitt (1996) uses variation in the prison population induced by prison overcrowding litigation to break the simultaneity of crime and incarceration,

<sup>4</sup> Moreover, the identification of the deterrent effect of an increase in expected sanctions is hampered by the fact that criminal sanctions may be endogenously determined. For example, state and local governments may respond to high crime rates by hardening criminal sanctions (Ehrlich 1973; Levitt 1998, 2004).

<sup>5</sup> A second stream of empirical literature testing the theory of deterrence focuses on the crime-reducing effects of the police. It is worth citing Marvell and Moody (1996), Levitt (1997), Cormann and Mocan (2000), and Di Tella and Schargrodsky (2004).

<sup>6</sup> Most works in the literature use data from the United States. An exception is Marselli and Vannini (1997), which is one of the first papers estimating the deterrent effect of sanctions using aggregate data from Italy.

finding that releasing one prisoner is associated with an increase of 15 crimes per year. This estimate, however, includes deterrence and incapacitative effects. The strong evidence in support of incapacitation effects (see, e.g., Owens, forthcoming) urges further caution in attributing a causal role to deterrence in such contexts. In a recent paper trying to isolate deterrent effects, Kessler and Levitt (1999) exploit sentence enhancements targeting the most frequent and dangerous criminals in California. They argue that in the short run there should not be an incapacitation effect after the law changes and find that some crime rates fell by 4 percent after sentence enhancement, which, for example, increased the sentence for any "serious" felony offender by 5 years. Levitt (1998) evaluates the responsiveness of juvenile criminal activity to the transition from the juvenile to the adult criminal justice system. In this setting, data suggest that young offenders are at least as responsive to expected punishment as adults. Katz, Levitt, and Shustorovich (2003) take a different approach to estimating the deterrent effect of prison. Rather than focusing on sentence enhancements that mechanically lead to incapacitation effects on crime, they focus on the effect of harsh prison conditions on crime rates at the state level in the United States. By using death rates among prisoners as a proxy for prison conditions, Katz et al. show that in the period 1950–90, states with more punitive facilities experienced lower crime rates.

The use of aggregate data to test for the deterrent effect of prison reflects the inherent difficulty of observing exogenous variation in prison sentence at the individual level. In reality, variation in prison sentence usually arises because of differences in criminal histories among individuals (e.g., a former inmate usually expects a longer sentence compared to somebody who has no history of dealings with the judicial system), which makes the source of variation unattractive for estimating the causal impact of prison sentence on criminal activity. Two recent works in the literature exploit quasi-experimental variation in sanctions. Lee and McCrary (2005) exploit the jump in expected sentence length at age 18 in the United States. Using a regression discontinuity design, they find only a very small behavioral response from juveniles when they turn 18. The presence of self-control problems in perceiving sanctions is the leading explanation for the small deterrent effect of expected punishment. The paper casts doubts on the effectiveness of expected punishment on the criminal activity of young individuals and suggests that previous estimates of deterrence based on aggregate data are largely due to incapacitation effects. More in general, the results of Lee and McCrary are indicative of the difficulty of designing effective alternative approaches to incapacitation to reduce crime. Helland and Tabarrok (2007) take advantage of the three strikes legislation in California. They compare the postrelease behavior of crim-

inals with two strikes with that of those who were tried for a second strikeable offence but convicted of a nonstrikeable one. Conditional on the assumption that former inmates in the two groups do not differ in unobservable characteristics influencing future recidivism, they find that those with two strikes substantially reduce their criminal activity.

Our paper is also related to recent contributions studying the effects of prison treatment on recidivism. Chen and Shapiro (2007) use individual-level data to estimate the effect of prison conditions on recidivism rates. By exploiting a discontinuity in the assignment of federal prisoners to security levels, they estimate that serving a sentence in higher security levels implies a significantly higher postrelease propensity to commit a crime. In a related paper, Hjalmarsson (forthcoming) capitalizes on discontinuities in punishment that arise from Washington State's juvenile sentencing guidelines to identify the effect of incarceration on the postrelease criminal behavior of juveniles. Her results show that incarcerated individuals have lower propensities to be reconvicted of a crime. Kling (2006) uses a variety of research designs to estimate the effect of increases in incarceration length on the employment and earnings prospects of individuals, finding no significant effects of time served. Kuziemko (2007) exploits policy shocks and institutional features of the prison system in Georgia (United States) and analyzes the effect of time served on recidivism and the efficiency of a parole system versus a fixed-sentences regime. She finds that the abolition of the parole system has increased both per-prisoner costs and recidivism and that an additional month of time served has a large negative effect on the propensity to reoffend.

### III. The Italian Collective Pardon and the Institutional Framework

Here we briefly describe the process by which inmates enter and are released from correctional facilities in the Italian penal system and then the motivations for and the provisions of the collective pardon law approved by the Italian Parliament in July 2006.

#### A. *The Italian Sentencing System*

Inmates enter a prison after having been arrested or after having been sentenced. A fundamental constitutional guarantee<sup>7</sup> provides that nobody can be arrested and kept in prison for more than 48 hours without the decision of a court. Pursuant to a court decision, inmates can enter

<sup>7</sup> The individual freedom guarantee is stated in sec. I, art. 13, of the Italian Constitution, which fixes the limit of 48 hours for detention unless it is decided by a court.

the correctional facility system as a consequence of a trial<sup>8</sup> leading to a definitive conviction or, in some cases, before the definitive sentence (i.e., while still on trial). More specifically, an individual can be kept in jail before a definitive conviction only if he is officially charged and a special court (Giudice per le Indagini Preliminari) identifies that there is a danger that the defendant may recommit the same crime or pollute evidence that could be used during the trial. These conditions are specifically designed to reduce the risk of incarcerating innocents. It is worth noting that our data on arrests after the release from prison following the collective clemency regard this kind of arrest as “confirmed” by the court.

In the Italian sentencing system, the Penal Code fixes a range of sentences for each kind of offense, specifically providing minimum and maximum sentences. In the case of conviction, the court fixes a sentence length within the range established by the Penal Code. In fixing the sentence length, the court must take into account the defendant’s criminal history and his potential dangerousness according to the evidence collected before and during the trial. When it comes to the process of release from prison, inmates have the right to ask for probation. An inmate can be given probation only as the result of the decision of a specific court (Magistrato di Sorveglianza).<sup>9</sup> The minimum proportions of the original sentence that an inmate has to serve before being eligible to ask for probation are fixed by law in the Italian Penal Code.<sup>10</sup> The Magistrato di Sorveglianza can grant probation only to those inmates who have served this minimum and who have demonstrated progress toward rehabilitation. The postrelease supervision of inmates on probation basically consists of the obligation to report to a police station daily and of the obligation to communicate to the authorities any change of residence. It is worth noting that those inmates released as a result of the Collective Clemency Bill are not subject to any kind of postrelease supervision.

<sup>8</sup> The Italian criminal justice system is characterized by two levels of judgment: first trial and appeal trial. A third level of judgment concerns the Supreme Court, which cannot decide on the guilt or innocence of the defendant but can only check the correctness of the trial procedure.

<sup>9</sup> According to the Department of Prison Administration, the proportion of inmates on probation is 5 percent of the total number (DAP 2008).

<sup>10</sup> The cases in which probation can be granted are established by sec. 176 of the Penal Code. Note that the general rule is that probation can be granted only to those inmates who have already spent two-thirds of their original sentence in the correction system.

B. *Motivation for the Collective Clemency Bill and Institutional Background*

In recent years the Italian prison system has been characterized by harsh conditions of overcrowding. At the end of the 1990s, the total number of inmates was 55,000 with a total of 42,000 available places; the average overcrowding index was 131 inmates to 100 places in prison.<sup>11</sup> This situation became clear to the eye of public opinion in 2000, in particular after a campaign promoted by the Catholic Church that started with the visit of Pope John Paul II to Regina Coeli, one of the criminal residential facilities in Rome. In the following months there was a huge debate in the media, and several deputies in the Camera dei Deputati (one of the two chambers of the Italian Parliament) tabled a bill proposing an amnesty<sup>12</sup> and a collective pardon.<sup>13</sup> The public debate did not lead to the passing of the bill, but the harsh situation in the prison system remained under the media spotlight. The political debate gained new strength after the official visit of Pope John Paul II to the Italian Parliament.<sup>14</sup> In his official speech he put great emphasis on the situation of prison inmates and suggested an amnesty. Despite this widespread attention, the Italian Parliament passed the collective pardon bill only 4 years later on July 30, 2006. The reasons for this delay can be found in the exceptional nature of such a legislative measure. According to the Italian Constitution, any law providing for the implementation of an amnesty or a collective pardon must be approved by both chambers of Parliament with a majority of two-thirds of the votes regarding each article of the law (sec. II, art. 79, of the Italian Constitution). These conditions are the same as those for the approval of a constitutional reform (art. 138). In the following subsection we describe the provisions of the collective pardon bill in greater detail.

C. *Law 241/06, Collective Clemency Bill*

The bill provides for a reduction in the length of detention for those who committed a crime before May 2, 2006. This backdating of the collective pardon, which was announced immediately when Parliament began to debate the bill, rules out any possible effect of the collective

<sup>11</sup> See Italian Department of Prison Administration, Statistics Office, [http://www.giustizia.it/statistiche/statistiche\\_dap/det/detg00\\_organigramma.htm](http://www.giustizia.it/statistiche/statistiche_dap/det/detg00_organigramma.htm).

<sup>12</sup> The Italian juridical system makes a distinction between amnesty and collective pardon. An amnesty extinguishes both the criminal record and the sanction. The collective pardon shortens or eliminates sanctions but does not extinguish an individual criminal record.

<sup>13</sup> [http://www.camera.it/\\_dati/leg13/lavori/stampati/sk7500/articola/7086.htm](http://www.camera.it/_dati/leg13/lavori/stampati/sk7500/articola/7086.htm).

<sup>14</sup> This official visit of the pope to the Parliament gained widespread media attention. It was the first visit of a pope to the Parliament in the history of the Italian Republic.

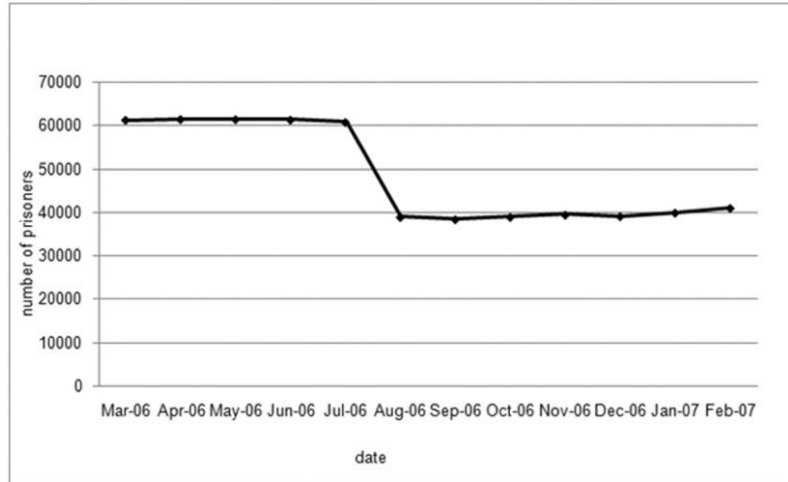


FIG. 1.—Number of prisoners in Italian facilities

pardon on crime rates during the months before the approval of the measure. The legislative measure reduces prison sentences by 3 years for a large number of inmates but does not extinguish the offense. As a consequence, on August 1, 2006, all those with a residual prison sentence of less than 3 years were immediately released from residential facilities. Some types of crime are excluded from the collective pardon, in particular those related to the mafia, terrorism, armed gangs, massacres, devastation and sacking, usury, felony sex crimes (in particular against juveniles), kidnapping, and the exploitation of prostitution.

The provisions of the bill concerning the reduction of incarceration length imply that every inmate convicted of a crime (other than those listed above) committed before May 2, 2006, is eligible for immediate release from prison as soon as his residual sentence becomes less than 3 years. Notice that the effects of the collective pardon will persist for many years. For example, of inmates who had committed a crime before May 2, 2006, those who had 3 years (or less) of detention in prison to serve were immediately released on August 1, 2006; those who had 3 years and 1 month to serve were released on September 1, 2006; those who had to serve exactly 20 years of further detention will be released on August 1, 2023, instead of August 1, 2026. As a consequence of the collective pardon, almost 37 percent of the inmates of Italian prisons were released in the first 2 months: from 60,710 individuals on July 31, 2006, the total prison population dropped to 38,847 on August 1, 2006 (see fig. 1). The number of beneficiaries of the collective pardon is

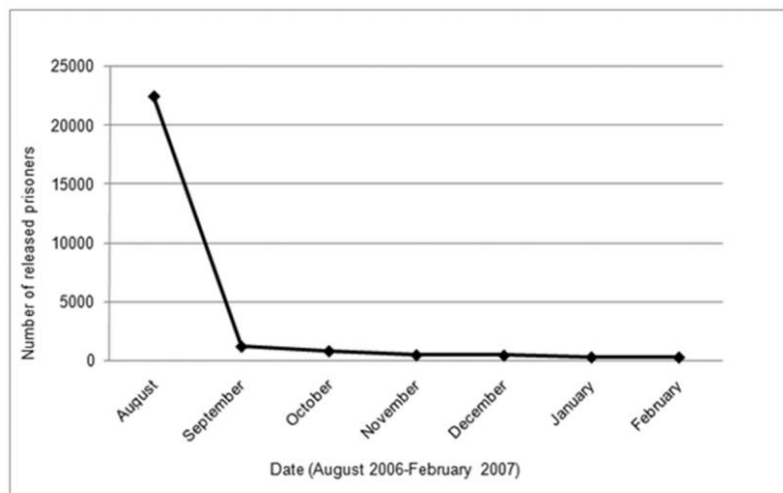


FIG. 2.—Number of released prisoners

decreasing over time. Indeed, on June 30, 2006, 19.2 percent of inmates with a definitive sentence had to serve from 3 to 6 years in prison, 7.6 percent from 6 to 10 years, 6 percent from 10 to 20 years, and 4.5 percent more than 20 years or life imprisonment (see fig. 2).

As far as our research question is concerned, the crucial consequence of the bill is the variation in prison sentences at the individual level (we provide evidence consistent with the notion that this variation is exogenous in the next section). The bill provides that all those recommitting a crime within the 5 years following July 31, 2006, and receiving a further sentence greater than 2 years lose the benefit of the clemency. This means that within the 5 years following their release from prison as a result of the collective pardon, former inmates face an additional expected sanction equal to the residual sentence pardoned by the bill. Take for instance two criminals convicted with the same sentence and having a residual sentence of less than 3 years on August 1, 2006. They are both released from prison on August 1, 2006. Suppose that the first individual entered prison 1 year before the other and has a pardoned sentence of 1 year whereas the second has a pardoned residual sentence of 2 years. In the following 5 years, for any possible kind of crime, they face a difference in expected sentence of 1 year. For a robbery with a maximum official expected sentence of 10 years, the first individual expects a sentence of 11 years (10 years for the robbery plus 1 year residual sentence pardoned by the Collective Clemency Bill), and the

second expects a sentence of 12 years (10 years plus 2 years of residual sentence).

#### **IV. Empirical Results**

##### *A. Data*

The source of data for this study is an internal database that the Italian DAP maintains on offenders under its care. We were granted access to the DAP database records on all the individuals released as a result of the collective pardon law between August 1, 2006, and February 28, 2007. The full sample includes 25,813 individuals; 81 percent were released on August 1, 2006. For each individual, the data provide information on whether or not he or she reoffends within the period between release from prison and February 28, 2007. This means that for most of the individuals the data report recidivism in the first 7 months after release from prison. Moreover, the data set contains information concerning a large set of variables at the individual and facility levels. For each individual, information is reported on the facility where the sentence was served, the official length of the sentence, the actual time served in the facility, the kind of crime committed (i.e., the last crime committed in the individual's criminal history), age, sex, level of education, marital status, nationality, province of residence, employment status before being sentenced to prison, and whether the individual had a final sentence or was waiting for the first verdict or for the result of an appeal at the date of release. As data on subsequent convictions are not available, we use a subsequent criminal charge and imprisonment as the measure for recidivism.

Our analysis is restricted to people serving their sentence in prison; that is, we exclude from the analysis individuals convicted to serve a sentence in a judiciary mental hospital (98 individuals). Moreover, we exclude from the sample any individual with a residual sentence higher than 36 months. This is the case of individuals cumulating different charges with a sentence for at least one but awaiting verdicts on others. We do not consider individuals for whom sentence data are missing. Because we want to perform the empirical analysis with a sample that is homogeneous along both the date of release and the length of window (7 months), we exclude individuals with a residual sentence equal to 36 months. We do not know the exact date of release of each inmate, but we know that any other inmate released after August 1, 2006, necessarily had a residual sentence of 36 months. The final sample used in the empirical investigation is made up of 20,950 individual-level observations. In column 1 of table 1, descriptive statistics on the individual-level data are reported. Those reoffending constitute 11.5 percent of

TABLE 1  
INDIVIDUAL CHARACTERISTICS FOR RESIDUAL SENTENCES ABOVE AND BELOW THE  
MEDIAN ( $N = 20,950$ )

	MEAN			DIFFERENCE (4)
	Whole Sample (1)	Residual Sentence below the Median (2)	Residual Sentence above the Median (3)	
Original sentence (in months)	38.982 (.225)	39.089 (.306)	38.891 (.325)	-.198 (.447)
Residual sentence (in months)	14.511 (.070)	8.475 (.063)	19.730 (.093)	-11.255 (.113)
Recidivism	.115 (.002)	.129 (.003)	.102 (.003)	.027 (.004)
Age on exit	38.764 (.069)	38.762 (.104)	38.766 (.102)	-.004 (.146)
Married	.284 (.003)	.275 (.005)	.292 (.004)	-.017 (.006)
Permanently employed	.339 (.005)	.342 (.007)	.337 (.007)	.006 (.010)
Percentage of males	.954 (.001)	.957 (.002)	.951 (.002)	.006 (.003)
Share of Italians	.621 (.003)	.595 (.005)	.643 (.004)	-.048 (.007)
First judgment taken	.998 (.001)	.999 (.001)	.998 (.001)	.001 (.001)
Area of residence:				
North	.425 (.003)	.425 (.005)	.425 (.005)	.000 (.007)
Center	.185 (.003)	.182 (.004)	.187 (.004)	-.005 (.005)
South	.378 (.003)	.380 (.005)	.377 (.005)	.004 (.007)
Education:				
Compulsory	.901 (.003)	.907 (.004)	.898 (.004)	.008 (.005)
High school	.079 (.002)	.076 (.003)	.082 (.003)	-.007 (.005)
College (degree or equivalent)	.009 (.001)	.008 (.001)	.010 (.001)	-.002 (.002)
Kind of offense:				
Drug offenses	.404 (.003)	.412 (.005)	.398 (.005)	.014 (.007)
Crime against property	.412 (.003)	.416 (.005)	.408 (.005)	.008 (.007)
Crimes against public safety	.005 (.000)	.005 (.001)	.005 (.001)	.000 (.000)

TABLE 1  
(Continued)

	MEAN			DIFFERENCE (4)
	Whole Sample (1)	Residual Sentence below the Median (2)	Residual Sentence above the Median (3)	
Gun law	.012 (.001)	.011 (.001)	.013 (.001)	-.002 (.001)
Immigration bill	.029 (.001)	.030 (.002)	.028 (.002)	.002 (.002)
Violent crimes	.094 (.002)	.092 (.003)	.098 (.003)	.006 (.004)

NOTE.—Standard errors are in parentheses. Robust standard errors are in col. 4. Column 1 reports summary statistics for the whole sample. Columns 2 and 3 report summary statistics for the sample divided in evenly sized groups as follows. For each group of inmates with the same original sentence length, the median of the residual sentence is calculated. Column 2 reports summary statistics for those observations in which the residual sentence is below the median for that original sentence length, and col. 3 reports summary statistics for those observations in which the residual sentence is above the median for that original sentence length. Column 4 reports the point estimates of the differences between the means in cols. 2 and 3.

the sample. Most of the sample is composed of males (95 percent) and Italians (62 percent). The average age on exit is 38.76 years. Only 28 percent are married, and 34 percent were permanently employed before entering prison; 90 percent had attended compulsory schooling. The average residual sentence—varying between 1 and 35 months—is equal to 14.51 months, whereas the average original sentence is about 39 months. The variation in the original sentence length is large. There are individuals with a sentence longer than 360 months who were convicted for violent crimes (e.g., murder) as well as individuals with very short sentence lengths. The majority of the sample were convicted for crimes against property or offenses related to the drug law. The Appendix provides a description of the crimes included in the different categories. Some crime categories (e.g., mafia, terrorism, and felony sex crimes) are missing from our sample because they were excluded from the collective pardon.

To provide evidence consistent with the hypothesis that, conditional on original sentence, the residual sentence is as good as a random variable, in columns 2 and 3 of table 1 we report summary statistics for those observations in which the residual sentence is above the median for that original sentence length and those observations in which the residual sentence is below the median for that original sentence length. In column 4 we report the differences in the means for each of the observable characteristics. This is equivalent to a test of observables being balanced for individuals with a residual sentence above and below the median after conditioning on the original sentence. Considering the large sample size, it appears that observables are remarkably similar.

A few differences are statistically distinguishable from zero (sex, marital status, and drug offense), but all point estimates in column 4 are extremely small and well below 5 percent of a standard deviation from the mean for each observable characteristic. There is an exception. Italians are overrepresented by 4.8 percentage points in the group of those inmates with a residual sentence above the median (the point estimate of 0.048 is 9.5 percent of the standard deviation from the mean of the share of Italians).<sup>15</sup> In the regression analysis, splitting the sample between Italians and non-Italians, we observe that the effect of the residual sentence on recidivism is large and precisely estimated for both groups of inmates (differential effects are presented in subsec. F). Moreover, when we control for being Italian (as well as for nationality fixed effects) and for all the observables, results remain essentially unchanged. From table 1 we also observe that the average recidivism of former inmates with a residual sentence below and above the median is 0.129 and 0.102, respectively, which indicates that former inmates with longer residual sentences have an average recidivism about 25 percent lower than that of those with shorter residual sentences.

### *B. Graphical Evidence*

To provide a graphical representation of the last piece of evidence presented above (i.e., former inmates with residual sentence above the median reoffend less, conditional on the original sentence length), in figure 3 we report the recidivism rate for each sentence for former inmates with residual sentences both above and below the median. In doing this we report only sentence groups between 23 and 43 months, which is the range of sentences to which most individuals are convicted. As is clear from figure 3, the recidivism rate for individuals with residual sentences above the median is systematically lower for each sentence. In particular, for this group of inmates, the average residual sentences are equal to 9.34 and 23.46 months for inmates with residual sentences below and above the median, respectively. The average recidivism of the former group is 13.12 percent and that of the other group is of 9.69 percent. Overall, figure 3 shows preliminary evidence that former inmates respond to higher residual sentences by reducing their criminal activity.

<sup>15</sup> A closer inspection of the data revealed that this result is mostly driven by three national groups: Moroccans, Tunisians, and Algerians. In addition, this problem of differential entry into prison is restricted to those inmates who entered Italian prisons between July 2005 and July 2006.

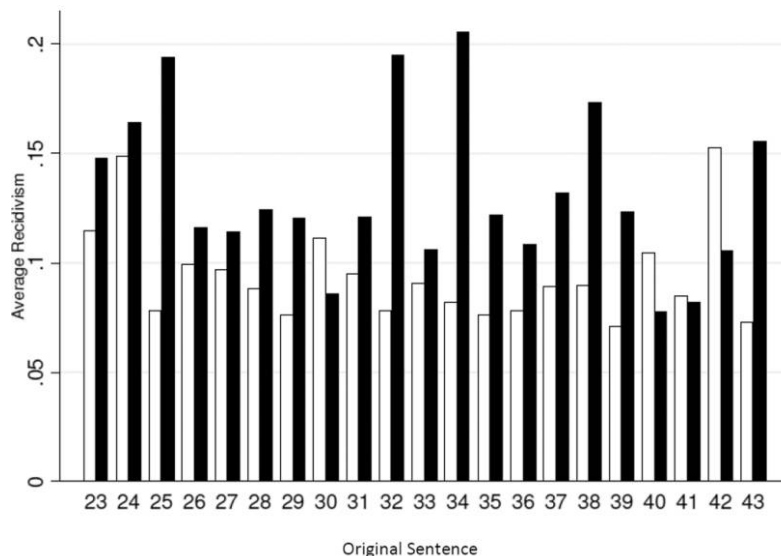


FIG. 3.—Residual sentence and recidivism. Black bars represent average recidivism for individuals with residual sentences below the median conditional on the original sentence, and white bars represent average recidivism for individuals with residual sentences above the median conditional on the original sentence.

C. Regression Analysis

Denote by  $y_i$  the postrelease outcome of an individual  $i$ , with sentence $_i$  his initial sentence and sentres $_i$  his residual sentence<sup>16</sup> in the month he is released pursuant to the collective clemency bill. The post-release outcome we observe is whether or not former inmates reoffend ( $y_i$  takes the value one if the individual was rearrested in the period under consideration and zero otherwise). The basic regression model is

$$y_i = \alpha + \beta_0 \text{sentence}_i + \beta_1 \text{sentres}_i + \varepsilon_i. \tag{1}$$

The identifying assumption needed to obtain a consistent estimate of the coefficient of interest  $\beta_1$  is that, conditional on sentence length, variation in the residual sentence is not systematically correlated to variation in unobservables that affect the postrelease outcome, that is,

<sup>16</sup> Throughout the analysis both sentence (the original sentence) and sentres (the residual pardoned sentence) are expressed in months.

TABLE 2  
BASELINE RESULTS

	(1)	(2)	(3)
Residual sentence	-.0016 (-6.54)	-.0017 (-6.87)	-.0017 (-7.02)
Original sentence	-.0001 (-1.93)	.0002 (2.22)	.0002 (2.61)
Individual characteristics	No	Yes	Yes
Type of crime	No	No	Yes
Pseudo $R^2$	.005	.028	.032
Observations	20,950	19,316	19,316

NOTE.—Logit estimates are reported. The dependent variable is equal to one if the individual returned to prison after release and zero otherwise. Coefficients are marginal effects evaluated at the mean of the independent variables. Robust Zstatistics are in parentheses. Individual variables include education levels, age at the date of release, a dummy indicating marital status, nationality, juridical status, and employment condition before imprisonment.

$\text{Cov}(\text{sentres}_i, \varepsilon_i | \text{sentence}_i) = 0$ .<sup>17</sup> This hypothesis is supported by the results presented in table 1 and discussed in the previous section.

Table 2 reports the results. In column 1 we present the results of model (1) estimated with a logit regression. The coefficients reported are marginal effects evaluated at the mean of the independent variables. Standard errors are robust. The coefficient for the residual sentence is negative and precisely estimated: an additional month in the residual sentence decreases the probability of recidivism by 0.16 percentage points (about 1.3 percent). In column 2 we report the results of the basic regression model, which includes a set of individual characteristics such as age, sex, nationality, education, marital status, employment dummy, and juridical status. In column 3 results of a model that includes both individual characteristics and type of crime committed before release are presented. As columns 2 and 3 show, the effect of the residual sentence is essentially the same as that reported in column 1.<sup>18</sup> Given that the number of individuals who commit a criminal act but are not arrested is likely to be much higher than the number of individuals who are arrested but have not committed a criminal act, the estimated impact

<sup>17</sup> This assumption can also be stated by saying that the determinants that led individuals with a sentence equal to  $T$  months to enter prison in any month in the interval  $[T - 36, T]$  before August 2006 are orthogonal to the probability of recidivism.

<sup>18</sup> Results remain unchanged when we estimate conditional logit models grouped by province of residence fixed effects, national group fixed effects, and prison fixed effects. Province of residence fixed effects absorb unobserved heterogeneity across police jurisdictions that may influence the probability of being rearrested. Prison fixed effects and national group fixed effects take account of fixed differences across prisons and nationalities that drive criminal behavior.

of the residual sentence should be interpreted as a lower bound of the effect of the residual sentence.<sup>19</sup>

#### *D. Deterrent Effects of Prison Sentences*

By construction, the residual sentence is equal to the sentence minus the number of months served in prison, which means that time served, residual sentence, and original sentence are collinear. Hence, the estimated effect on recidivism has to be interpreted as the joint deterrent effect of an additional month in the expected sentence and of 1 month less served in prison (i.e., the effect of the policy that commutes 1 month of the actual sentence to be served to 1 month of the expected sentence for future crimes). While the nature of the basic experiment does not allow us to separately identify the impact of the expected sentence on recidivism, it is possible to make some quantitative inferences on this effect given that existing estimates reveal a nonpositive impact of time served on recidivism (Kuziemko 2007).<sup>20</sup>

Assuming a zero effect of time served on recidivism, a reduction of 0.16 percentage points in the probability of recidivism (see table 2) implies an elasticity of the average recidivism rate to expected punishment (considering the average original sentence plus the average residual sentence) of  $-0.74$ . This means that when expected sentences are increased by, for example, 25 percent, the propensity to reoffend in 7 months should decrease by about 18 percent. We do not have data on the average recidivism rate after 12 months, but we know that the recidivism rate after 17 months was 22 percent (see the next subsection). Hence, considering the estimated effect and an annual average recidivism rate between 0.18 and 0.20, we would have an elasticity of the

<sup>19</sup> Note that in Italy incarceration before conviction is an extreme measure that generally occurs only when there is the evident risk of reiteration of crime and the possibility of counterfeiting of evidence. In the first 6 months of 2008, only 20 percent of criminal trials in Italy concluded with the acquittal of the defendant ("Rapporto sul processo penale in Italia," Unione Camere Penali Italiane; data collected by the Italian union of criminal attorneys). Moreover, to give an idea of how many criminal acts do not result in arrests in Italy, in 2006 police did not find the offender for about 78 percent of criminal acts reported (*Relazione sull'attività giudiziaria nell'anno 2006*, p. 22; data come from the Italian Supreme Court).

<sup>20</sup> As Kuziemko (2007) mentions, existing estimates of time served on recidivism are plagued by endogeneity problems but appear to be close to zero. In her study, using individual data from the state of Georgia, she exploits a mass release in the 1970s that generated exogenous variation in time served. She finds that inmates serving a longer period in prison have a significantly lower propensity to recommit a criminal act. She estimates that serving an extra month in prison reduces the probability of recidivism by about 7 percent. Rehabilitation programs or a simple specific deterrent effect of previous time served can explain these results (the concept of specific deterrence refers to the effect that the previous punishment has on the probability of committing a crime). In a recent paper, Maurin and Ouss (2009) obtain similar results exploiting data from the French Bastille Day pardon.

average recidivism rate with respect to sentence length between  $-0.43$  and  $-0.47$ . This elasticity is even larger than existing estimates of the elasticity of crime with respect to imprisonment that includes the effect of expected punishment and incapacitation on criminal activity. The biggest estimates of the elasticity of the annual crime rate with respect to the prison population are provided by Levitt (1996), who finds elasticities of  $-0.40$  and  $-0.30$  for violent and property crimes, respectively. This estimate, however, includes both an incapacitation and a deterrent effect. Although it is difficult to make quantitative comparisons with previous studies relying on U.S. aggregate data, a presumable annual elasticity between  $-0.43$  and  $-0.47$  does seem large compared to this evidence.

#### *E. Short-Time Period*

One issue meriting discussion is the relatively short period (7 months) over which we observe former inmates. Some of the concerns with this time period are addressed by the fact that considering only inmates released on August 1, 2006, we have a sample homogeneous along both the date of release and the length of the window. However, even under the assumption that the residual sentence is a variable as good as random, our estimates would be upward biased if some former inmates recommitted a crime only after the 7-month period in a way that the proportion of recidivists with a longer residual sentence increases over time. While it is not possible to completely rule out this hypothesis, we can provide evidence suggesting that, in fact, it is unlikely that the results overestimate the effect of the residual sentence. Individual data are not available (to researchers) for a longer time span, but the DAP has provided some aggregate descriptive statistics on recidivists for the total of former inmates released as a result of the Collective Clemency Bill until December 31, 2007 (hence for a period of 17 months). As we report in table 3, the recidivism rate after 17 months is 22 percent, hence about double that after 7 months (DAP 2008). It appears that almost all the means of the primary observable characteristics reported by the DAP for the recidivists after 17 months are more or less double those that we calculated after 7 months, which suggests that the means of observables of recidivists remain quite stable over time. A drastic change in the observable variables of recidivists after 17 months would have created the suspicion that some categories of individuals recommit crime only in the long run. Overall, table 3 provides evidence consistent with the

TABLE 3  
RECIDIVISM RATES

	Recidivism after 7 Months (Mean) (1)	Recidivism after 17 Months (Mean) (2)
Whole sample	.11	.22
Males	.12	.23
Females	.05	.11
Italians	.11	.20
Non-Italians	.11	.19
Kind of offense:		
Drug offenses	.10	.21
Crime against property	.14	.26
Immigration bill	.09	.21
Violent crimes	.09	.24

NOTE.—Column 1 reports summary statistics for recidivists in our sample for those released in August 2006 for a 7-month period. Column 2 reports summary statistics of recidivists calculated on all beneficiaries of the Collective Clemency Bill for a 17-month period (as of December 31, 2007).

hypothesis that it is unlikely that with a longer period our results would change dramatically.<sup>21</sup>

#### F. Differential Effects

We now investigate whether the deterrent effect varies across inmates with different characteristics. To begin, we explore whether former inmates with different original sentences are differentially deterred by their future sentence. Table 4 presents the results for individuals grouped by quartile of original sentence distribution (1–18, 19–34, 35–50, and 51–368). In the four groups of inmates, we do not observe behavioral responses that are statistically different from each other. The groups appear to be equally deterred. Given that the last quartile includes individuals with moderately long sentences and very long sentences, we investigated whether individuals with an original sentence

<sup>21</sup> Another potential issue concerns how the police target released potential criminals. Suppose that the police believe that individuals with higher residual sentences are less likely to commit a crime. If in addition the police have an incentive to increase the number of arrests, they could direct their efforts toward individuals with lower residual sentences. In this case we would overestimate the deterrent effect of expected sanctions. This explanation requires that the police know the residual sentences of former inmates and discriminate between potential criminals on this basis. Even if one is willing to assume that the police are well informed about former inmates and do discriminate, there is a general equilibrium effect induced by this potential police behavior that should compensate for the difference in the probability of being arrested for individuals with long and short residual sentences. Indeed, those former inmates with long residual sentences would increase their criminal activity in response to a lower relative cost of crime (because if the police target individuals with short residual sentences, those with long residual sentences face a lower probability of being arrested). Note that this effect goes in the opposite direction of what we find in the data.

TABLE 4  
DIFFERENTIAL EFFECTS BY ORIGINAL SENTENCE

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Residual sentence	-.0023 (-1.55)	-.0017 (-2.83)	-.0013 (-3.02)	-.0013 (-3.46)
Original sentence	.0020 (1.60)	-.0012 (-1.18)	.0001 (1.03)	.0002 (2.05)
Individual characteristics	Yes	Yes	Yes	Yes
Type of crime	Yes	Yes	Yes	Yes
Pseudo $R^2$	.028	.032	.034	.051
Average recidivism	.133	.122	.105	.098
Observations	4,965	4,752	4,859	4,740

NOTE.—Logit estimates are reported. The dependent variable is equal to one if the individual returned to prison after release and zero otherwise. Coefficients are marginal effects evaluated at the mean of the independent variables. Robust Zstatistics are in parentheses. Individual variables include education levels, age at the date of release, a dummy indicating marital status, nationality, juridical status, and employment condition before imprisonment. The first quartile includes individuals with sentences less than 19 months; the second, sentences between 19 and 34 months; the third, sentences between 35 and 50 months; and the fourth, sentences above 50 months.

longer than 69 months (this is the median sentence in the last quartile; the average recidivism for inmates with original sentences above and below 69 months is 0.097 and 0.100, respectively) have the same behavioral response to the remaining sentences. For these inmates it appears that this behavioral response is very small and is estimated with large standard errors (results not reported in the table).<sup>22</sup> As the original sentence should reflect the seriousness of the crime committed, this finding suggests that the more dangerous inmates are not deterred.

In columns 1 and 2 of table 5, we explore whether women and men have a different behavioral response to the expected punishment. Women have a much lower recidivism rate (0.046) than men (0.118), and it appears that the impact of the residual sentence is lower. However, the difference in the coefficients for men and women is not statistically different from zero at conventional levels. Instead, the data suggest that Italians are less responsive than foreign inmates (cols. 3 and 4), who represent about 40 percent of the total of former inmates compared with only 5 percent of the total population. In columns 5 and 6 we observe that there is no difference in response between former inmates initially convicted for violent and property crimes.

An important issue in the literature is whether young individuals are as responsive to expected punishment as adults. Levitt (1998) finds evidence consistent with the fact that there is little difference in how adults and juveniles respond to expected punishment. Lee and McCrary (2005) document a very small response to expected punishment from juveniles of age 18. Having individuals who are former inmates, we cannot observe very young individuals of age 18. However, it is inter-

<sup>22</sup> The coefficient is  $-0.0006$  with a robust Zstatistic equal to  $-1.11$ . This coefficient is statistically different from the coefficients reported in table 4.

TABLE 5  
DIFFERENTIAL EFFECTS BY GENDER, NATIONALITY, TYPE OF CRIME, AGE, AND MARITAL STATUS

	GENDER		NATIONALITY		TYPE OF CRIME		
	Female (1)	Male (2)	Non-Italians (3)	Italians (4)	Property (5)	Violent (6)	
Residual sentence	-.0005 (- .71)	-.0018 (-6.90)	-.0017 (-4.04)	-.0015 (-5.04)	-.0014 (-3.14)	-.0015 (-2.36)	
Original sentence	-.0002 (-.65)	.0003 (2.70)	-.0002 (-1.05)	.0003 (3.44)	.0005 (2.77)	.0001 (.49)	
Individual characteristics	Yes	Yes	Yes	Yes	Yes	Yes	
Type of crime	Yes	Yes	Yes	Yes	Yes	Yes	
Pseudo $R^2$	.066	.033	.033	.039	.019	.035	
Average recidivism	.046	.118	.115	.115	.140	.084	
Observations	735	18,399	7,182	12,117	7,893	1,853	
	AGE						
	Quartile 1 (7)		Quartile 2 (8)	Quartile 3 (9)	Quartile 4 (10)	MARITAL STATUS	
						Nonmarried (11)	Married (12)
Residual sentence	-.0019 (-2.75)	-.0017 (-2.90)	-.0017 (-5.02)	-.0027 (-5.02)	-.0010 (-2.96)	-.0019 (-6.04)	-.0012 (-3.15)
Original sentence	.0005 (1.31)	.0000 (-.10)	.0006 (3.00)	.0006 (3.00)	.0001 (1.15)	.0002 (1.41)	.0003 (2.59)
Individual characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Type of crime	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo $R^2$	.021	.027	.031	.031	.037	.027	.028
Average recidivism	.144	.128	.124	.124	.070	.130	.078
Observations	4,696	4,561	4,724	4,724	5,277	13,831	5,485

NOTE.—Logit estimates are reported. The dependent variable is equal to one if the individual returned to prison after release and zero otherwise. Coefficients are marginal effects evaluated at the mean of the independent variables. Robust  $Z$ -statistics are in parentheses. Individual variables include education levels, age at the date of release, a dummy indicating marital status, nationality, juridical status, and employment condition before imprisonment. The first age quartile is composed of individuals aged less than 32; the second, between 32 and 37; the third, between 38 and 44; and the fourth, above 44 years.

esting to compare how older and younger inmates behave in our sample. In the bottom panel of table 5, we report the coefficients on the residual sentence for individuals grouped by quartile of age distribution. All four groups seem to be deterred. Only the third group, aged between 38 and 44, has a higher and statistically different response compared to the three other groups. We also observed that individuals aged less than 25 have a behavioral response that is not statistically different from that of older inmates. Although the outside options or the key drivers of criminal activity are arguably different for individuals of different ages (as appears from the large differences in the average recidivism rates), it seems that the response of these individuals to an increase in the threat of future punishment is the same. More generally, from this analysis we note that for groups with very different recidivism rates, we do not find statistically significant differences in response to expected punishment. The few differences regard groups with very similar recidivism rates (e.g., Italians and foreign inmates, or inmates with an original sentence length less than or equal to 69 and longer than 69 months).

## V. Concluding Remarks

In this paper we contribute to the empirical literature on the study of criminal punishment by providing evidence that individuals vary their criminal activity in response to a change in prison sentences. Our research design exploits the natural experiment provided by the Collective Clemency Bill passed by the Italian Parliament in July 2006. The institutional features of the bill imply, for all the individuals released upon the approval of the bill, an exogenous variation in prison sentences at the individual level. This experimental setting allows us to identify the deterrent effect of a change in prison sentences separately from its incapacitation effect and from the possible endogenous reactions of policy makers to crime.

Our findings show that a policy that commutes actual sentences in expected sentences significantly reduces inmates' recidivism. Moreover, the results provide credible evidence that a 1-month increase in expected punishment lowers the probability of committing a crime. This corroborates the theory of general deterrence. The results indicate a large deterrent effect of expected punishment. However, from a policy perspective, caution should be used in concluding that sentences should be increased for any kind of crime. Indeed, it is not clear whether these results can be extended to individuals who have never received prison treatment. Finally, without the provision in the bill that introduces the mechanism of residual sentences, recidivism rates would have been much higher. This suggests that inmates given probation should have a lower propensity to recommit a crime, given that if they reoffend, they

have to serve the remaining sentence in addition to the new sentence. If, on the one hand, a longer time served might reduce the risk of recidivism (Kuziemko 2007), on the other hand, the threat of a longer sentence also decreases it. Future works should address whether the benefits of granting some inmates probation outweigh the cost associated with the risk that these former inmates will reoffend.

## Appendix

### Description of the Categories of Crime

*Drug offenses:* In this category are included all the violations of the law on the use and selling of drugs (Decree of the President of the Republic, October 9, 1990, number 309, and subsequent modifications and amendments).

*Crimes against property:* In this category are included theft, larceny, robbery, bag snatching, and in general all the offenses regulated by book II, section XIII, of the Italian Penal Code.

*Crimes against public safety:* In this category are included all crimes related to possible danger to the safety of people, things, public utilities, and buildings. All the crimes in this category are included in book II, section VI, of the Italian Penal Code.

*Gun law:* In this category are included all the violations of the law on using and carrying guns and other arms (Law 110/75 and subsequent modifications and amendments).

*Immigration bill:* In this category are included all the violations of the law on the regulation of immigration and the juridical status of foreign citizens (Law July 25, 1998, n. 286, and subsequent amendments and modifications).

*Violent crimes:* In this category are included assault, homicide, and in general all the offenses regulated by book II, section XII, of the Italian Penal Code.

## References

- Becker, Gary S. 1968. "Crime and Punishment: An Economic Approach." *J.P.E.* 76 (March/April): 169–217.
- Chen, Keith M., and Jesse M. Shapiro. 2007. "Do Harsher Prison Conditions Reduce Recidivism? A Discontinuity-Based Approach." *American Law and Econ. Rev.* 9 (June): 1–29.
- Corman, Hope, and Naci H. Mocan. 2000. "A Time-Series Analysis of Crime and Drug Use in New York City." *A.E.R.* 90 (June): 584–604.
- DAP (Dipartimento dell'Amministrazione Penitenziaria). 2008. *Statistiche DAP*. Rome: DAP.
- Di Tella, Rafael, and Ernesto Schargrotsky. 2004. "Do Police Reduce Crime? Estimates Using the Allocation of Police Forces after a Terrorist Attack." *A.E.R.* 94 (March): 115–33.
- Ehrlich, Isaac. 1973. "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation." *J.P.E.* 81 (May/June): 521–65.
- Helland, Eric, and Alexander Tabarrok. 2007. "Does Three Strikes Deter? A Nonparametric Estimation." *J. Human Resources* 22 (Spring): 309–30.

- Hjalmarsson, Randi. Forthcoming. "Juvenile Jails: A Path to the Straight and Narrow or Hardened Criminality?" *J. Law and Econ.*
- Katz, Lawrence, Steven D. Levitt, and Ellen Shustorovich. 2003. "Prison Conditions, Capital Punishment, and Deterrence." *American Law and Econ. Rev.* 5 (August): 318–43.
- Kessler, Daniel, and Steven D. Levitt. 1999. "Using Sentence Enhancements to Distinguish between Deterrence and Incapacitation." *J. Law and Econ.* 42 (April): 343–63.
- Kling, Jeffrey R. 2006. "Incarceration Length, Employment, and Earnings." *A.E.R.* 96 (June): 863–76.
- Kuziemko, Ilyana. 2007. "Going Off Parole: How the Elimination of Discretionary Prison Release Affects the Social Cost of Crime." Working Paper no. 13380 (September), NBER, Cambridge, MA.
- Lee, David S., and Justin McCrary. 2005. "Crime, Punishment and Myopia." Working Paper no. 11491 (July), NBER, Cambridge, MA.
- Levitt, Steven D. 1996. "The Effect of Prison Population Size on Crime Rates: Evidence from Prison Overcrowding Litigation." *Q.J.E.* 111 (May): 319–51.
- . 1997. "Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime." *A.E.R.* 87 (June): 270–90.
- . 1998. "Why Do Increased Arrest Rates Appear to Reduce Crime: Deterrence, Incapacitation, or Measurement Error?" *Econ. Inquiry* 36 (July): 353–72.
- . 2004. "Understanding Why Crime Fell in the 1990's: Four Factors That Explain the Decline and Six That Do Not." *J. Econ. Perspectives* 18 (Winter): 163–90.
- Levitt, Steven D., and Thomas J. Miles. 2007. "Empirical Study of Criminal Punishment." In *Handbook of Law and Economics*, vol. 1, edited by A. Mitchell Polinsky and Steven Shavell. Amsterdam: North-Holland.
- Marselli, Riccardo, and Marco Vannini. 1997. "Estimating a Crime Equation in the Presence of Organized Crime: Evidence from Italy." *Internat. Rev. Law and Econ.* 17 (March): 89–113.
- Marvell, Thomas B., and Carlisle E. Moody. 1996. "Specification Problems, Police Levels, and Crime Rates." *Criminology* 34 (November): 609–46.
- Maurin, Eric, and Aurelie Ouss. 2009. "Sentence Reductions and Recidivism: Lessons from the Bastille Day Quasi Experiment." IZA Discussion Paper no. 3990 (February), Inst. Study Labor, Bonn.
- Owens, Emily G. Forthcoming. "More Time, Less Crime? Estimating the Incapacitative Effect of Sentence Enhancements." *J. Law and Econ.*