Do Prisons Make Us Safer?

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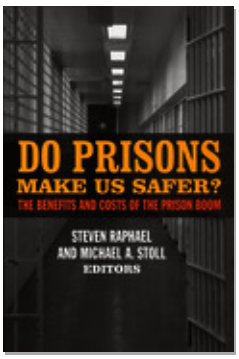

Steven Raphael
and
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2 Why Are So Many Americans in Prison?

The United States currently incarcerates its residents at a rate that is greater than any other country in the world. Aggregating the state and federal-prison populations as well as inmates in local jails, there were 737 inmates per 100,000 U.S. residents in 2005 (International Centre for Prison Studies 2007). This compares with a world average of 166 per 100,000 and an average among European Community member states of 135. Of the approximately 2.1 million U.S. residents incarcerated in 2005, roughly 65 percent were inmates in state and federal prisons, while the remaining 35 percent resided in local jails.

Moreover, current U.S. incarceration rates are unusually high relative to historical U.S. figures. For the fifty-year period spanning the 1920s through the mid-1970s, the number of state and federal prisoners per 100,000 varied within a ten- to twenty-unit band around a rate of approximately 110. Beginning in the mid-1970s, however, state-prison populations grew at an unprecedented rate, nearly quadrupling between the mid-1970s and the present. Concurrently, the rate of incarceration in local jails more than tripled.

Why are so many Americans incarcerated? Why did the incarceration rate increase so much in such a short time period?

A nation's incarceration rate is determined both by the criminal behavior of its residents as well as by policy choices made by the electorate, elected officials, and representatives of the criminal-justice system. The relationship between criminal behavior and incarceration is simple and mechanical: the more people that engage in criminal activity, the greater the proportion of the population at risk of doing time. The determinants of criminal behavior, however, are complex and multifaceted. Public policies defining which offenses are punishable by incarceration along with

the pronounced severity of the punishment also play a key role in determining the overall incarceration rate. Clearly, the greater the scope of activities deemed deserving of a prison spell are the higher the fraction of the population that will be incarcerated. Moreover, holding offense type constant, longer sentences will result in more prisoners.

The past twenty-five years have witnessed several shocks to the likely behavioral determinants of incarceration as well as many drastic policy changes pertaining to the scope and severity of punishment. Changes in illicit drug markets, the deinstitutionalization of the mentally ill, the declining labor-market opportunities for low-skilled men, changes in sentencing policy, and a more punitive community corrections system are all commonly offered as explanations of recent trends. This chapter seeks to sort out these competing hypotheses and to offer a comprehensive evaluation of the sources of the increase in U.S. incarceration rates.

We focus primarily on the growth in state-prison incarceration, though we often analyze variation in the overall incarceration rate inclusive of federal prisons and jails. Over the last two and a half decades, we observe two principal changes that bear the lion's share of responsibility for growth in the nation's incarceration rate. First, conditional on the violation that led to the prison sentence, average time served has increased considerably. Second, the likelihood of being sent to prison conditional on committing a crime has increased substantially. These facts suggest that changes in sentencing policy along the extensive margin (defining the difference between offenses meriting incarceration and those that do not), as well as along the intensive margin (determining average time served), explain most of the increase in U.S. incarceration rates. A relatively small proportion of the overall increase in incarceration is attributable to increases in criminal behavior (at most, 17 percent of overall growth).

We begin by presenting a simple model of the steady-state incarceration rate. The model is used to outline an empirical decomposition that permits attributing relative importance of changes in sentencing policy and changes in criminal behavior in understanding the increase in incarceration rates. We then present estimates of the key component statistics (time served by offense, admissions rates, crime rates, and so on) needed to perform the decomposition.

Next, we analyze the possible effects of several potential shocks to criminal behavior. In particular, we explore and quantify the potential contribution of changing demographics, the deinstitutionalization of the mentally ill, the declining value of real wages earned by less-skilled men, and the influence of recent drug epidemics. In all, the collective influence of these factors is minor relative to the impact of changes in sentencing and corrections policy choices.

INCARCERATION GROWTH IN THE UNITED STATES: A SIMPLE MODEL

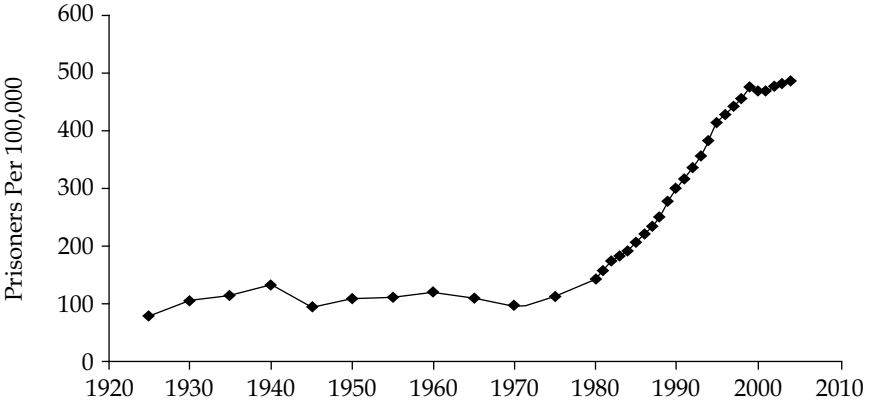
Over the past three decades, the U.S. prison incarceration rate has increased to unprecedented levels. Figure 2.1 displays the number of state and federal prison inmates per 100,000 U.S. residents. Prior to the mid-1970s, the incarceration rate was stable, hovering around 110 inmates per 100,000. Between 1975 and 2004, the prison incarceration rate more than quadrupled, from a rate of 111 to 484 per 100,000. The annual incarceration rate increased by an average of 15.7 inmates per 100,000 per year during the 1980s, 16.8 inmates per year during the 1990s, and 3.1 inmates per year during the first few years of the twenty-first century.

Behind this steady increase in the incarceration rate are large flows of inmates into and out of the nation's prisons. While there are certainly many prisoners serving very long sentences in the nation's penitentiaries (inmates most likely to be captured by point-in-time snapshots of the prison population), many more U.S. residents serve relatively short spells in prison and cycle in and out of correctional institutions serving sequential short spells over substantial portions of their adult lives. As demonstrated by Jeremy Travis (2005), nearly all inmates are eventually released from prison, most within five years of admission. Most tellingly, annual admissions to U.S. prisons have consistently hovered around one-half the size of the prison population, while roughly half of all inmates are released in any give year. In recent decades, admissions have consistently exceeded releases, resulting in sustained increases in incarceration rates.

To broadly characterize the policy and behavioral forces driving the increases in figure 2.1, here we present a simple model of steady-state incarceration rates that helps illuminate the basic determinants of the size of this institutional population. Let c_{it} be the number of crimes per capita of type i (i = 1 , . . . , I) committed in year t, and let p_{it} be the corresponding number of prison admissions per crime committed. The latter parameter measures the incarceration risk per criminal act. Let θ_{it} be the proportion of prison inmates incarcerated at the beginning of year t for commission of crime i who are released over the course of the year.

The probability that a nonincarcerated person is sent to prison in year t for committing crime i is given by $c_{it}p_{it}$, while the proportion flowing into prison for this crime is given by one minus the beginning-of-period overall incarceration rate, times this transition probability. The proportion of the population convicted of this crime that is flowing out of prison over a year is the starting incarceration rate for crime i multiplied by the release rate θ_{it}. The average release rate also provides a proxy measure for the amount of time that the typical inmate serves during a given spell in prison. The higher the release rate, the lower the average time served. A

Figure 2.1 *Prisoners in State or Federal Prison per 100,000 U.S. Residents, 1925 to 2004*



Source: Authors' calculations.

simple approximation is that the average time served is equal to one divided by the release rate.[1] Thus, a release rate of 0.5 corresponds to an average time served of two years, while a release rate of 0.33 corresponds to an average time served of three years.

In the implicit steady state at time t, the equilibrium incarceration rate for committing crime i is approximately equal to the transition probability for the flow rate into prison divided by the sum of the admissions and release rate transition probabilities,[2] or

$$Inc_{it} \approx \frac{c_{it}p_{it}}{c_{it}p_{it} + \theta_{it}} \tag{2.1}$$

In practice, the transition probability into prison ($c_{it}p_{it}$) for a given crime will be a very small number, while the release rate θ_{it} will be relatively large. Thus, approximating the denominator by $1/\theta_{it}$ and making use of our approximation of time served, the steady-state incarceration rate for crime i can be rewritten as

$$Inc_{it} = E(T_{it})c_{it}p_{it} \tag{2.2}$$

where $E(T_{it})$ is the expected value of time served. Finally, the overall steady-state incarceration rate is derived from the crime-specific incarceration rates by summing over i, giving

$$Inc_{.t} = \sum_i E(T_{it}) c_{it} p_{it} \tag{2.3}$$

Equation 2.3 provides a simple accounting identity that is helpful in thinking through the potential sources of the patterns in Figure 2.1. Assuming that crimes are homogeneous within categories i, there are three potential sources of increase in the incarceration rate, two of which are determined by policy and one by behavior (although, of course, these three components may react to one another). Beginning with the policy determinants, increases in the expected value of time served for any or all of the crimes will increase the steady-state incarceration rate. Thus, sentence enhancements, truth-in-sentencing policies that dictate that inmates must serve larger fractions of their maximum sentences, or changes to parole policy that lowers the release probability conditional on time served will all increase incarceration rates through $E(T_{it})$. Indeed, the 1980s and 1990s witnessed many such changes to state as well as federal sentencing policy. Thus, such an expansion of the incarceration rate along the intensive margin is likely to be important (Raphael and Stoll 2007).

Second, increases in the likelihood that committing a given crime results in a prison admission will also increase the incarceration rate. Here, more intensive policing, increases in arrest rates, and a greater propensity to punish a given crime with incarceration will all increase the incarceration rate through the values of p_{it}. Simple comparisons of prison admissions per crime suggest that enforcement, prosecutorial, and sentencing policies have shifted decisively toward generating more admissions per crime committed.

Finally, changes in criminal behavior operating through the crime rate will impact the overall incarceration rate. Since the late 1970s, the United States has experienced several shocks that may have altered the distribution of the behavioral predisposition of U.S. residents toward criminal activity. For example, changing demographics and levels of educational attainment (tending toward less criminal activity), declining earnings prospects at the bottom of the earnings distribution (tending toward more crime), the continued deinstitutionalization of the mentally ill (tending toward more crime), and the introduction and diffusion of crack cocaine and crystal methamphetamine (tending toward more crime) have all occurred over the last three decades.

A simple method for decomposing the change in incarceration rates between two periods into a component attributable to policy change and a component attributable to behavioral change is as follows: Define time periods t = 0 and t = 1, between which the incarceration rate, the expected time served parameters, and the admissions per crime parame-

ters all increase. Define the counterfactual crime rates, c_{i1}*(for i = 1, . . . , I) as the crime rates that would have occurred in period 1 had the policy parameters not changed between periods 0 and 1. These counterfactual crime rates will differ from actual crime rates in period 1 due to the fact that under the sentencing parameters in period 0, the incarceration rate would be lower. A lower incarceration rate translates into smaller deterrence and incapacitation effects of prison on crime, and thus, more crime.

The change in the overall incarceration rate over this time period is given by

$$Inc_{.1} - Inc_{.0} = \sum_i E(T_{i1})c_{i1}p_{i1} - \sum_i E(T_{i0})c_{i0}p_{i0} \tag{2.4}$$

The counterfactual incarceration rate that would have occurred had the policy parameters not changed is given by

$$Inc_{.*} = \sum_i E(T_{i0})c_{i*}p_{i0}, \tag{2.5}$$

where the counterfactual crime rate for crime is multiplied by the corresponding spell length and admissions probability for year zero and then summed over all crimes. Adding and subtracting equation 2.5 to the right-hand side of equation 2.4 gives the final decomposition

$$Inc_{.1} - Inc_{.0} = (Inc_{.1} - Inc_{.*}) - (Inc_{.*} - Inc_{.0}) \tag{2.6}$$

The first term on the right-hand side of equation 2.6 provides the extent to which the changing policy parameters increase the incarceration rate above and beyond the counterfactual change that would have occurred regardless. The second component displays what would have been observed had policy remained constant. Thus, the first term provides the estimate of the contribution of changes in criminal-justice policy, while the second term provides the contribution of changes in criminal behavior.

TRENDS IN THE BEHAVIORAL AND POLICY DETERMINANTS OF INCARCERATION RATES

Our simple model relates the steady-state incarceration rate to crime rates, average time served, and the likelihood of doing time conditional on committing a crime. Each of these broad components has changed in

recent decades. We document these changes and use our empirical model to provide a rough decomposition of the growth in incarceration into policy and behavioral components.

Basic Trends

Table 2.1 provides estimates of all of the needed elements to calculate the steady-state incarceration rates in equations 2.3, 2.4, and 2.5 and the decomposition in equation 2.6. The first two columns present estimates of the time that an inmate admitted in either 1984 or 2002 can expect to serve on a given admission by reason for admission. These numbers come from synthetic cohort estimates of the time-served distributions for inmates admitted in 1984 and 1998 presented by Steven Raphael and Michael A. Stoll (2007), based on data from the National Corrections Reporting Program.[3] Over the time period analyzed, there are notable increases in the expected value of time served for all categories (on the order of 30 percent, but as high as 50 percent for larceny and other violent offenses, 64 percent for other property offenses, and nearly 80 percent for sexual assault). Even for inmates admitted for a parole violation (those not admitted with a new term for a new offense), average time served increased by 13 percent.

The next two columns present estimates of the number of prison admissions per 100,000 by offense category—that is, the joint product of the admissions per crime and the crime rate (cp).[4] With the exception of murder and burglary, there are increases in the overall admissions rate for each category. The most notable increases occur for drug crimes (from 7.73 to 43.93 per 100,000) and parole violators (from 20.48 to 80.75 per 100,000).

To split these overall admissions rates into crime rates and admissions per crime, one must divide the overall admissions rates by some measure of criminal offending for each year. For seven of the offense categories listed (murder, rape, robbery, assault, burglary, larceny, and motor-vehicle theft), the Federal Bureau of Investigations Uniform Crime Reports (UCR) provide estimates of the number of crimes per 100,000 reported to the police. We make use of these data for these crimes. To measure offending for drug crimes, we use the number of drug arrests per 100,000 for each year.[5] To measure crime rates for other violent crimes, other property crimes, and other crimes, we first estimate the average admissions per crime for each of the seven offenses with UCR crime-rate data (by dividing the admissions rate by the crime rate). These admissions-per-crime figures are used to approximate admissions per crime for the offenses lacking data on crime rates.[6] In combination with the total admissions rate for each of these offenses, the imputed admissions-per-crime rate allows us to back out crime rates for each of these addi-

Table 2.1 *Comparison of Expected Time Served, Prison Admission Rates, Incarceration Risk per Crime, and Crime Rates for the United States by Type of Criminal Offense, 1984 and 2002*

	Expected Value of Time Served in Years ($E(T)$)		Prison Admissions per 100,000 (pc)		Crime Rate per 100,000 (c)			Prison Admissions per Crime Committed (p)	
	1984	2002	1984	2002	1984	2002	2002 Counterfactual	1984	2002
Murder	6.49	8.13	5.47	4.98	7.92	5.63	6.95	0.69	0.89
Rape	2.98	5.30	4.35	7.70	35.71	33.11	42.01	0.12	0.23
Robbery	3.13	3.80	12.51	9.97	205.44	146.12	207.38	0.06	0.07
Assault	2.01	2.86	5.00	12.03	290.23	309.54	309.50	0.02	0.04
Other violent	2.30	3.47	1.72	3.53	21.34[a]	35.65[a]	44.45[c]	0.06[e]	0.10[e]
Burglary	1.99	2.48	19.08	14.21	1263.70	747.22	1,034.25	0.02	0.02
Larceny	1.44	2.17	13.93	17.83	2791.30	2,450.72	2,915.05	0.00	0.01
Motor vehicle	1.42	1.87	0.99	2.79	437.11	432.91	564.38	0.00	0.01
Other property	1.52	2.49	3.01	4.98	828.26 [a]	725.46[a]	904.65[c]	0.00[f]	0.01[f]

Drugs	1.63	2.11	8.73	43.93	264.31[b]	469.68[b]	469.68[d]	0.03	0.09
Other	2.92	2.27	12.45	20.26	138.37[a]	184.18[a]	229.67[c]	0.06[g]	0.07[g]
Parole violators	1.27	1.44	20.48	80.75	—	—		—	—

Source: Time-served estimates come from Raphael and Stoll (2007). Each value is rescaled so that the expected value of time served is equal to the value implied by the national prison release rate for the year described. Prison-admissions rates are estimated by applying the distribution of admissions by offense category estimated from the 1984 and 2002 NCRP files to the overall national admissions rates. Crime rates are based the Uniform Crime Reports unless otherwise noted. Counterfactual crime rates are estimated using crime-specific incapacitation and deterrence effect estimates of incarceration on crime taken from Johnson and Raphael (2007).

[a] Crime-rate estimates based on imputed admissions per crime and the observed admissions rates.

[b] Crime rates for drug crimes are equal to the number of adult arrests for drug crimes per 100,000 U.S. residents.

[c] Assumes a 25 percent increase in offending above the 2002 level (equal to the 2002 admissions weighted sum of the predicted increase above 2002 for the seven part 1 offenses).

[d] Set equal to the arrest rate for 2002.

[e] Based on average admissions per crime committed for nonhomicide violent crimes by year.

[f] Based on average admissions per crime committed for nonburglary property crimes by year.

[g] Based on the weighted average admissions per crime for all crimes by year.

tional categories. A baseline crime rate for parole violations cannot be measured.

The data indicate that crime has been declining for most categories, although there are a few categories with slight increases between 1984 and 2002. The table displays substantial declines in crime rates for murder, rape, robbery, burglary, larceny, motor-vehicle theft, and the other property crime variables. The notable exception is for drug crimes, where drug arrests increase by nearly 80 percent. By contrast, the number of prison admissions per crime (estimates of p_{it}) increase uniformly over the time period.

The sizable increases in the expected values of time served as well as the increases in the admissions-crime ratio indicate that sentencing and enforcement policy are key driving forces behind the increasing incarceration rates displayed in figure 2.1. To more precisely decompose these changes, however, we need estimates of the counterfactual crime rates that would have occurred had the policy parameters remained constant at their 1984 values. To construct these counterfactual crime rates, we use the crime-specific estimates calculated by Rucker C. Johnson and Steven Raphael (2007) of the number of crimes prevented per prisoner incarcerated (the joint incapacitation and deterrence effects) to calculate what these crime rates would have been under this counterfactual scenario.[7] We first calculate the disparity between the incarceration rate in 2002 and 1984, and then we multiply this difference by estimates of the number of crimes per 100,000 prevented by incarcerating the average inmate. We then add this hypothetical prevented-crime total to the base crime in 2002. These numbers should be thought of as what the crime rate would be in 2002 were policymakers to reduce the incarceration rate to 1984 levels.[8] For drug crimes, we simply use the observed arrest rate as the counterfactual path.[9]

The counterfactual crime rates in table 2.1 suggest that had policy not changed, 2002 crime rates would have been closer to the 1984 levels, with some increases and some decreases. In particular, we would have still observed declines in the murder, rape, robbery, burglary, motor-vehicle crime, and other crimes rates. However, these declines would have been smaller than what actually occurred.

Decomposing the Changes into Policy and Behavioral Determinants

Table 2.2 presents estimates of the overall steady-state incarceration rate as well as rates by offense category for 1984 and 2002. The table also provides the counterfactual incarceration rate that would have been observed had sentencing policy not changed (that is, the rate described by

Table 2.2 *Estimates Change in Steady-State Incarceration Rates, Overall and by Commitment Offense, and Calculation of Counterfactual Incarceration Rates Holding Policy Parameters Constant to 1984 Values*

	Implied Steady-State Incarceration Rates			Change, 1984 to 2002	
	1984	2002	2002 Counterfactual	Difference, 2002–1984	Difference, 2002 Counterfactual–1984
Murder	35.52	40.43	31.25	4.91	–4.27
Rape	12.98	40.81	15.27	27.84	2.29
Robbery	39.15	37.91	39.52	–1.23	0.38
Assault	10.03	34.36	10.70	24.33	0.67
Other Violent	3.97	12.24	6.46	8.27	2.49
Burglary	37.97	35.22	31.08	–2.75	–6.89
Larceny	20.02	38.62	20.90	18.60	0.89
Motor vehicle	1.41	5.22	1.82	3.81	0.41
Other property	4.57	12.41	4.99	7.85	0.42
Drugs	14.20	92.58	25.23	78.38	11.03
Other	36.30	45.94	60.26	9.63	23.95
Parole violators	26.05	116.38	—	90.34	—
Overall or total change in steady state	242.15	512.13	—	269.97	—
Overall or total change in steady state less parole violators	216.11	395.74	247.47	179.63	31.36
Actual overall incarceration rate	190.08	484.87	—	294.78	—

Source: Authors' calculations. See equations 2.1 through 2.3 in the text for the expressions for the steady-state incarceration rates.

equation 2.5). The last three rows of the table provide estimates of the overall steady-state incarceration rate, the steady-state incarceration not inclusive of those serving time for parole violations, and the actual incarceration rate for each year. The steady-state model predicts an incarceration rate of 242 per 100,000 in 1984 and 512 per 100,000 in 2002, for a total increase of 270 per 100,000. Relative to actual incarceration rates, the steady-state model overpredicts (more so in 1984 relative to 2002). These overpredictions are due to the fact the actual incarceration rates in each year deviate from steady-state rates, due to the fact that in each year the incarceration rate is in the process of converging to the higher steady state.[10] However, the predicted change in steady-state incarceration rates of 270 per 100,000 is quite close to the actual change of 295, thus providing a good ballpark approximation of actual trends.

The third column in table 2.2 presents estimates of the counterfactual incarceration rates by offense, overall, and overall excluding parole violators. The numbers suggest that under the sentencing and enforcement parameters of 1984, the 2002 incarceration rate would not have increased appreciably. In fact, for some crime categories there are small, predicted declines, and there is little change for others. Under this counterfactual scenario, the nonparolee incarceration rate is estimated at 247 per 100,000, only slightly more than the steady-state rate of 216 per 100,000 in 1984. Note, as this difference pertains to the behavioral component of the decomposition in equation 2.6, a counterfactual increase of 33 suggests that no more than 17 percent of the increase in nonparolee incarceration rates is attributable to behavior, with the remaining 83 percent attributable to stiffer, more punitive policy.

The data in table 2.1 can be utilized further to characterize the relative importance of sentencing-policy changes along the intensive and extensive margins. Specifically, the steady-state incarceration rate of 242.15 for 1984 is tabulated by calculating the product of time served and admissions by category in 1984 and then summing over crime categories. That is,

$$Inc_{1984} = \sum_{i=1}^{I} E(T_{i1984}) c_{i1984} p_{i1984}$$

A comparable calculation was used to arrive at the steady-state incarceration rate of 512.13 for 2002. To isolate the importance of changes in time served, we calculate what the steady-state incarceration rate would have been had the expected value of time served remained at 1984 levels while admissions rates followed their observed empirical path. This counterfactual incarceration rate is given by the equation,

$$Inc_c = \sum_{i=1}^{I} E(T_{i1984}) c_{i2002} p_{i2002}.$$

This calculation yields a steady-state incarceration of 417.57 per 100,000, a difference relative to the steady state for 2002 of approximately 95. In other words, had expected time served not increased between 1984 and 2002, the nation's incarceration rate would have been lower by 95 persons per 100,000. This constitutes roughly 35 percent of the overall increase in incarceration rate. Thus, with 35 percent of the increase attributable to expansion of incarceration along the intensive margin, and roughly 83 percent attributable to policy changes overall, roughly 48 percent of the overall increase in incarceration can be attributed to a greater propensity to incarcerate given the crime committed.

What About Parole?

The prison admissions rates in table 2.2 indicate that prison admissions due to parole violations have increased tremendously between 1984 and 2002, becoming by far the numerically most important source of prison admissions in recent years. In 1984, the number of parole admissions per 100,000 was relatively similar to the number of prisoners admitted for burglary (approximately 20 per 100,000 for each category). By 2002, the admissions rate for parole violators increased to slightly over 80, more than four times the admissions rate for burglary and nearly double the admissions rate for drug crimes.

Certainly, a large portion of this increase in parole admissions is driven by a growing population of parolees under the close scrutiny of parole officers. Returning a parolee to custody in many states is a much easier task than sentencing someone anew to prison, since parolees are technically serving the remainder of their sentence in the community and thus their partial liberty can be revoked without a new conviction (Petersilia 2003). However, in recent years the rate at which parolees are returned to custody has increased while the average severity of the conviction offense for those on parole has likely decreased. Specifically, between 1980 and 2003 the proportion of parolees nationwide that are returned to custody over the course of a year increased steadily from approximately 13 percent to 29 percent. Meanwhile, the average inmate (and by extension the average parolee) was older (and thus less criminally prone) and admitted to prison for offenses that generally receive shorter sentences (Raphael and Stoll 2007). In conjunction, these two facts suggest that parole policy has become tougher and thus is a key source behind the policy-driven increase in prison admissions.

While it is quite difficult to put a precise number on the relative contribution of changes in parole-failure rates, we can perform some simple simulations that permit a characterization of the likely order of magnitude of the effect of changes in parole policy on increasing incarceration growth. Specifically, we first perform a base simulation of the evolution of overall incarceration rates driven by changes in the transition probabilities between noninstitutionalization, prison, and parole. We then use the underlying model to simulate an alternative counterfactual incarceration rate under the assumption that the parole-failure rate remained at the 1984 level.

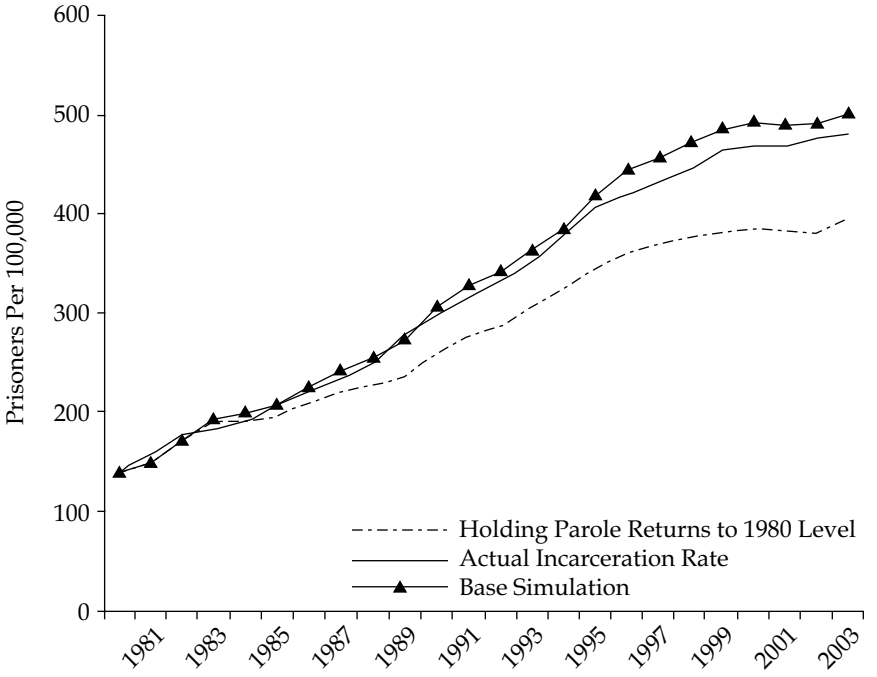
Specifically, we calculate the 1981 incarceration rate by first calculating the proportion of the noninstitutionalized population flowing into prison during 1980, the proportional flow from parole failures, and the proportional flow from 1980 prisoners that are not released from custody, and then summing these three components. The 1981 proportions on parole, not on parole, and not incarcerated can be calculated in a similar manner. Repeating these calculations for 1982 (using the calculated proportions for 1981) and for subsequent years would then provide the aggregate incarceration rate as a function of the sequence of observed admission and release rates.[11] Figure 2.2 presents a comparison of the simulated national incarceration rate using this iterative process for the period from 1980 to 2003 with the actual annual prison incarceration rates for these years. While the simulated incarceration rate increases by slightly more (to 504 per 100,000), the differences between the simulated and actual rates are never more than 5 percent and are often smaller.[12]

Using this simulation process, we then perform a counterfactual simulation designed to answer the following question: Assuming the rate at which parolees are returned to custody is held at its 1980 value, what path would the national incarceration rate have followed between 1980 and 2003? The results from this hypothetical simulation along with the base simulation are also displayed in figure 2.2. The simulations suggest that had the parole-failure rate remained constant, the incarceration rate in 2003 would be roughly 20 percent lower than that actually observed. Thus, changes in parole policy have clearly been an important source of growth in admissions over the past few decades.

POTENTIAL SOURCES OF CHANGES IN CRIMINAL BEHAVIOR

Having pinned down the overall likely contribution of behavioral shifts, we turn our attention to specific factors that are external to the criminal-justice system that may have altered the average criminality of the American public. In particular, we look at four topics: the nation's changing de-

Figure 2.2 *Actual Incarceration Rate, Incarceration Rate Simulated from Empirical Transition Rates, and the Simulated Incarceration Rate Holding Parole Failure Rates to the 1980 Level*



Source: Authors' calculations.

mography, the potential role of the deinstitutionalization of the mentally ill, changes in the legitimate labor-market opportunities available to low-skilled men, and shocks to drug markets in the United States—in particular, the introduction of crack cocaine.

Changing Demographics

In recent decades, we have observed several important demographic changes that bear directly on criminal offending and changes in incarceration rates. First, the proportion of the population that is foreign born has increased substantially, a pattern generally associated with lower incarceration rates (Butcher and Piehl 1998, 2006).[13] Second, the population has aged.[14] Since the likelihood of committing a crime decreases with age, this demographic shift should have also decreased crime and incarceration.

Finally, American adults have become more educated—an important trend considering that education is generally associated with lower offending and a lower likelihood of incarceration (Lochner and Moretti 2004).

The associations between these demographic factors and the likelihood of being incarcerated are evident in the tabulations in table 2.3. The table uses data from the 1980 and 2000 Public Use Microdata Samples (PUMS) of the U.S. Census of Population and Housing to calculate the proportion of men between eighteen and sixty-five years of age that were residing in institutionalized group quarters on the day of the census. From 1980 on, the lion's share of the nonelderly in such institutions are either in prison or jail.[15] Black men, men less than forty years of age, and the least educated men are the most likely to be institutionalized, with uniform increases in these rates between 1980 and 2000.

The nation's recent demographic trends have shifted population across these subgroups in a manner that should have decreased incarceration. In other words, the increases that we have experienced have bucked demographic trends given the correlations between these dimensions and the likelihood of being in prison or jail. This is most evident when looking at the distribution of the nonelderly adult male population across the subgroups defined by the categories in table 2.3. To demonstrate this fact, we first split the nonelderly adult male population into eighty demographic subgroups defined by the complete interaction of the four race-ethnicity groups, the five age groups, and four educational attainment groups used in table 2.3. Next, we use the 1980 PUMS data to calculate the proportion institutionalized for each group, and we then rank these groups by their institutionalization rates from lowest to highest. Finally, we compare the distribution of the male population across these eighty ranked groups in 1980 and 2000.

Figure 2.3 presents the results of this exercise. The figure presents the cumulative proportion of the male population in these eighty demographic groups ranked from least to highest institutionalization rates for 1980 and 2000. The distribution for 2000 is everywhere to the left of the distribution for 1980, indicating that the adult male population has shifted decidedly toward lower-offending demographic groups. The implications of this shift are made explicit in figure 2.4. The figure presents actual institutionalization rates for 1980 and 2000 as well as a hypothetical calculation giving what the institutionalization rate would have been in 2000 had the rates for the eighty individual groups not changed while at the same time the distribution of men across groups shifted as in figure 2.3. For all men and for men defined by race-ethnicity, the institutionalization rate in 2000 would have declined relative to that for 1980.

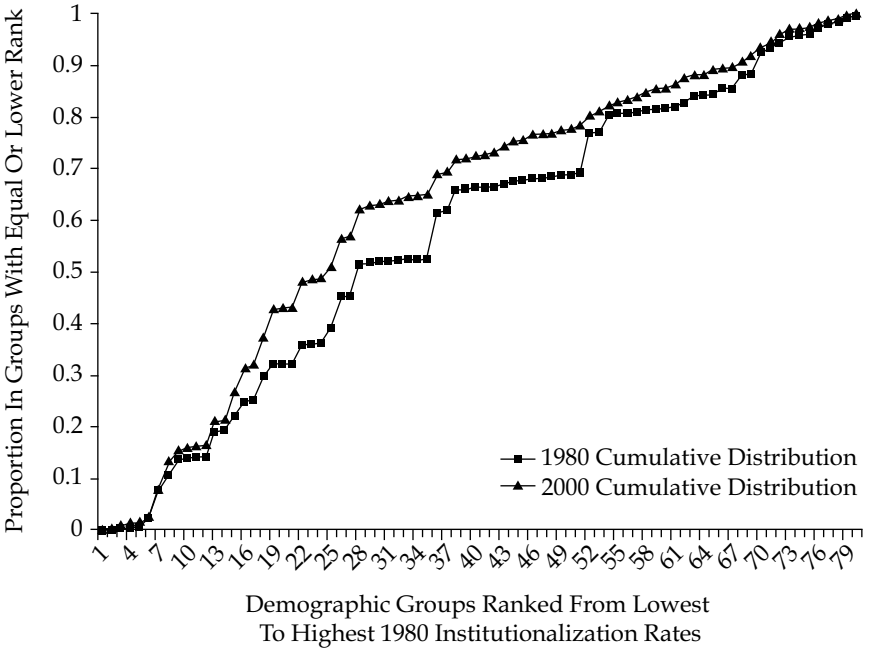
Note that we have only characterized the direction of the effect on in-

Table 2.3 *The Proportion of U.S. Males Eighteen to Sixty-Five Institutionalized by Race-Ethnicity, Age, and Education, 1980 and 2000*

	White		Black		Other		Hispanic	
	1980	2000	1980	2000	1980	2000	1980	2000
All	0.008	0.013	0.033	0.084	0.010	0.014	0.014	0.029
Age								
18 to 25	0.010	0.017	0.045	0.107	0.014	0.018	0.018	0.033
26 to 30	0.009	0.016	0.050	0.121	0.011	0.022	0.015	0.033
31 to 40	0.007	0.017	0.033	0.106	0.009	0.014	0.015	0.033
41 to 50	0.006	0.011	0.016	0.062	0.004	0.011	0.009	0.024
51 to 65	0.008	0.007	0.017	0.029	0.008	0.006	0.007	0.013
Education								
High School dropout	0.019	0.040	0.047	0.185	0.020	0.041	0.019	0.035
High School grad.	0.006	0.017	0.027	0.081	0.013	0.020	0.010	0.034
Some college	0.004	0.008	0.023	0.015	0.005	0.010	0.009	0.019
College graduate	0.002	0.003	0.008	0.047	0.002	0.002	0.004	0.008

Source: Tabulated from the 1980 and 2000 5 Percent Public Use Microdata Samples from U.S. Census of Housing and Population.

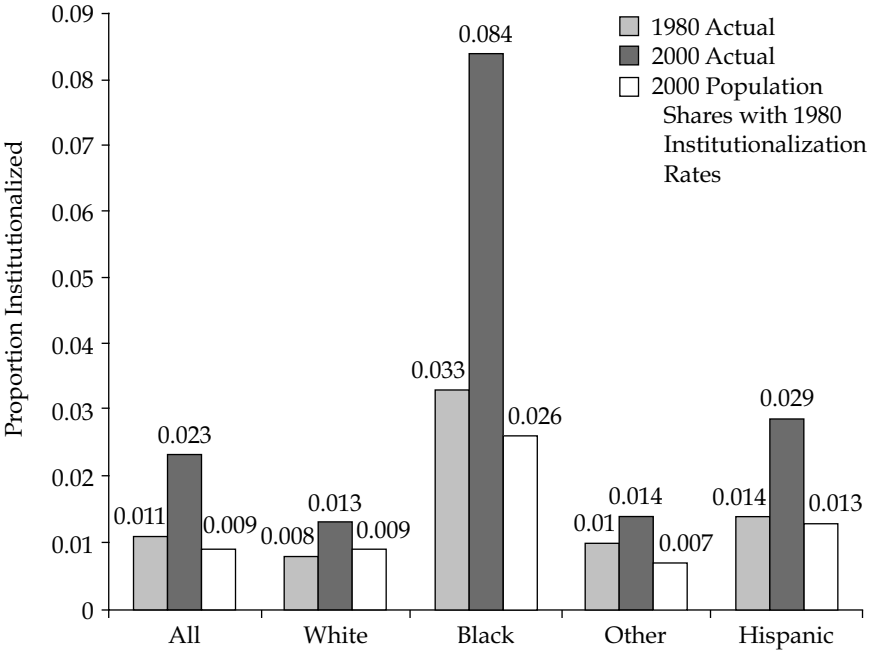
Figure 2.3 *Comparison of the Distribution of the U.S. Male Population Eighteen to Sixty-Five Across Demographic Groups Defined by Age, Education, and Race After Ranking Groups from Lowest to Hightest According to Their 1980 Institutionalization Rates*



Source: Authors' calculations.

carceration of the shifts in the distribution of the male population across groups defined by age, education, and race-ethnicity. Other demographic factors have also changed that are likely to have reduced the average criminality of the American public. First, the increasing proportion of foreign-born individuals tends to reduce crime as documented in the research of Kirsten F. Butcher and Anne Morrison Piehl (1998, 2006). An additional factor that has received much attention that we have not addressed is the impact of abortion legalization on changes in the composition of the population beginning around 1990. John Donohue and Steven Levitt (2001) hypothesize that the legalization of abortion has shifted the composition of those born toward wanted pregnancies and away from unwanted pregnancies. To the extent that children born under the latter category are more

Figure 2.4 *Actual Male Institutionalization Rates for 1980 and 2000 and Hypothetical Rates Using 2000 Population Shares and 1980 Institutionalization Rates*



Source: Authors' calculations.

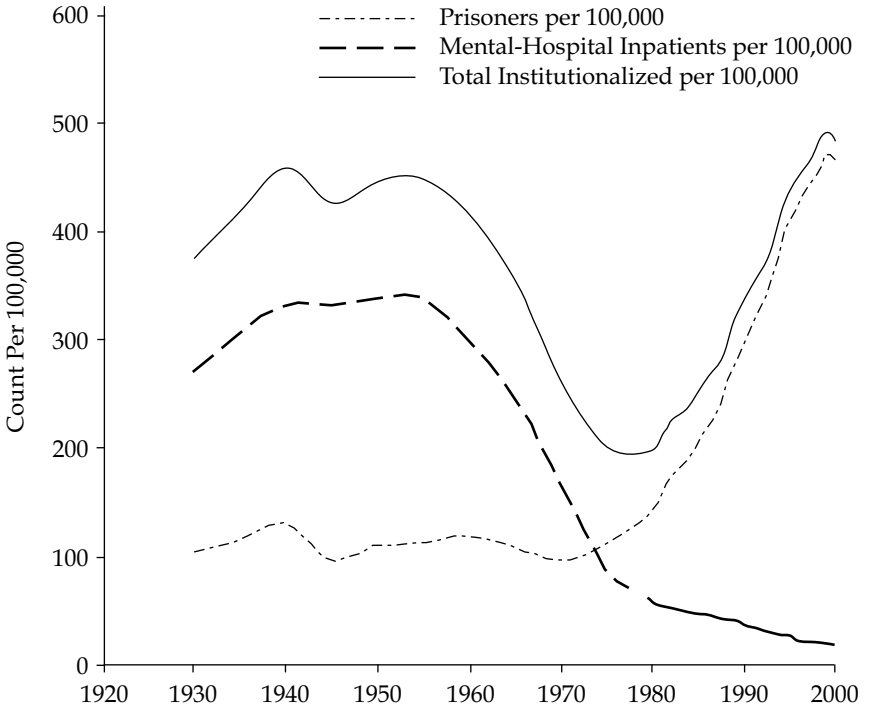
likely to commit crimes as a young adult, legalization should have had a lagged effect on criminal behavior, a supposition consistent with aggregate movement in violent-crime and property-crime rates.

Overall, the combination of these factors, as well as additional research findings, indicates that demographic trends should have reduced incarceration, all else held equal.

The Deinstitutionalization of the Mentally Ill

According to the BJS, there are nearly 300,000 mentally ill inmates in U.S. prisons and jails (Ditton 1999). These inmates account for 16 percent of state prisoners, 7 percent of federal prisoners, and 16 percent of local-jail inmates. Considering that roughly 2.8 percent of the adult pop-

Figure 2.5 *Prisoners per 100,000 Mental Hospital Inpatients per 100,000, and Total Institutionalized per 100,000, 1930 to 2000*



Source: Authors' calculations.

ulation suffers from severe mental illness over the course of a year (Torrey 1997), these figures indicate an incarceration rate for the mentally ill considerably greater than that of the general population. By contrast, by the end of the twentieth century there were roughly 60,000 inpatient residents in state and county mental hospitals. Thus, the population of incarcerated mentally ill is nearly five times the inpatient mental-hospital population.

That the incarcerated mentally ill population exceeds the inpatient population of mental hospitals is a relatively new development. In fact, as of midcentury, the number of mental-hospital inpatients per 100,000 U.S. residents greatly exceeded the overall prison incarceration rate. This fact

is illustrated in figure 2.5. The figure presents state and county mental-hospital inpatients per 100,000, state and federal prisoners per 100,000, and the sum of these two series for each year between 1930 and 2000.[16] Through the 1950s, the mental-hospital inpatient rate was approximately three times the prison-incarceration rate. Beginning with the deinstitutionalization of the mentally ill in the 1960s, the inpatient rate declines precipitously, falling below the incarceration rate in the mid-1970s and continuing to decline thereafter.

Most notably, the overall institutionalization rate (defined as the sum of prisoners per 100,000 and inpatients per 100,000) at in the late 1990s was not high by historical standards. While the overall rate declines with deinstitutionalization, growth in state- and federal-prison populations more than compensates for this decrease by the late 1990s. The juxtaposition of these two trends begs the question of whether the mentally ill have been transinstitutionalized from mental hospitals to prisons and jails. If so, the deinstitutionalization of the mentally ill may have contributed to growth in U.S. incarceration rates.

Several studies have attempted to estimate the extent to which the mentally ill move between hospitals and correctional institutions. Lionel Penrose (1933) is perhaps the first to raise this issue. Data on eighteen European countries revealed a negative correlation between the size of the prison and mental-hospital populations. George B. Palermo, Maurice B. Smith and Franklin J. Liska (1991) find significant negative correlations between the size of mental-hospital population and prison and jail population in the United States over the period 1926 to 1989.

At least one recent study by Bernard E. Harcourt (2006) argues that, given trends in mental-hospital population counts, the explosion in the U.S. prison population may be more illusory than real. His study documents the inverse correlation between the two populations at the national level and tests for a negative association between total institutionalization and homicide rates. Harcourt writes,

> As a practical matter, empirical research that uses confinement as a value of interest should use an aggregated institutionalization rate that incorporates mental hospitalization rates. At a theoretical level, these findings suggest that it may be the continuity of confinement—and not just the incarceration explosion—that needs to be explored and explained. (1751)

Despite this research, there are several reasons to believe that the deinstitutionalization of the mentally ill plays only a minor role in explaining the massive increases in incarceration rates depicted in figure 2.1. Prime among these reasons is the large compositional differences between those

Table 2.4 *Distribution of Institution and Noninstitutional Populations Across Age Groups, Race-Ethnicity Groups, and Gender, 1950 Through 1980*

	1950			1960		
	Mental Hospital	Prison and Jails	Non-institutional	Mental Hospital	Prison and Jails	Non-institutional
Age groups	100%	100%	100%	100%	100%	100%
<10	0.85	0.84	19.51	0.43	0.03	22.03
10 to 17	1.06	11.10	11.51	1.66	2.85	14.21
18 to 25	5.31	27.54	12.13	5.03	30.01	9.86
26 to 30	6.32	17.28	8.19	4.30	16.38	6.13
31 to 35	8.02	12.88	7.54	5.94	13.76	6.73
36 to 40	8.40	8.69	7.45	7.36	11.86	6.90
41 to 45	8.34	7.23	6.53	8.32	8.39	6.39
46 to 50	11.16	5.24	6.08	9.52	6.40	5.89
51 to 55	11.69	4.08	5.20	10.11	4.78	5.28
56 to 64	18.54	3.25	7.75	18.61	4.50	7.71
65+	20.30	1.88	8.10	28.72	1.03	8.88
Race-Ethnicity	100%	100%	100%	100%	100%	100%
White	87.62	62.20	87.99	85.03	58.86	86.63
Black	10.52	33.40	9.90	12.73	35.57	10.47
Other	0.43	1.26	0.43	1.00	1.87	0.89
Hispanic	1.43	3.14	1.68	1.24	3.69	2.01
Gender	100%	100%	100%	100%	100%	100%
Male	52.55	90.79	49.60	53.23	95.10	49.01
Female	47.45	9.21	50.40	46.77	4.90	50.99
Population Estimate (000)	621	315	151,274	698	356	178,247

who are incarcerated in the late 1990s and those who were the inpatients of mental hospitals at midcentury.

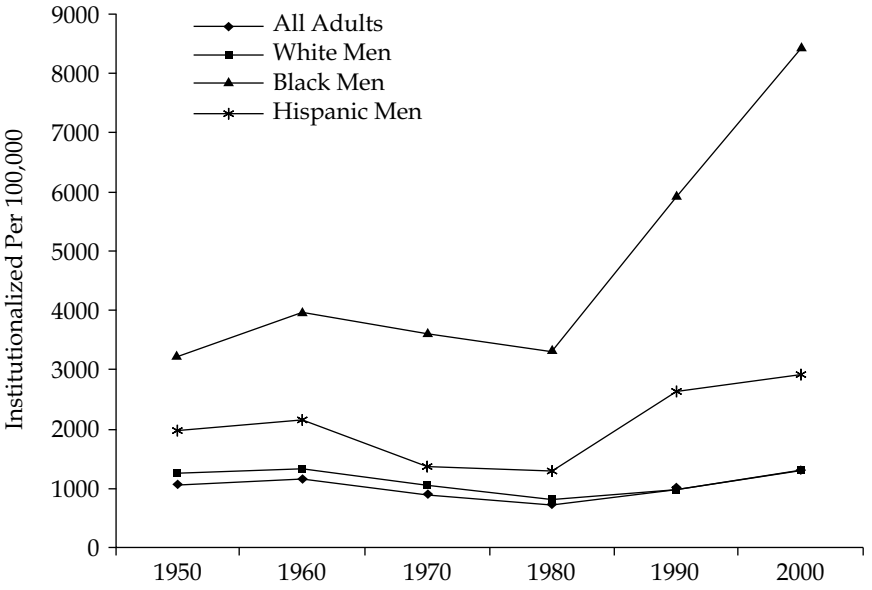
Prison and jail inmates in the United States are overwhelmingly male, disproportionately minority, and are relatively young. The same cannot be said for mental patients at midcentury. Table 2.4 uses data from the PUMS census files for 1950 through 1980 to characterize mental-hospital inpatients, prison and jail inmates, and the noninstitutionalized.[17] In 1950, there are several notable differences between the inpatient population

1970			1980		
Mental Hospital	Prison and Jails	Non-institutional	Mental Hospital	Prison and Jails	Non-institutional
100%	100%	100%	100%	100%	100%
0.57	0.15	18.48	0.73	0.04	14.77
3.59	3.43	16.18	6.26	2.23	13.69
9.09	39.67	12.76	14.63	43.15	14.80
6.13	16.67	6.43	9.18	21.66	8.41
5.75	11.24	5.50	9.02	12.90	7.41
6.50	9.15	5.51	6.91	7.65	5.97
8.04	6.69	5.85	6.95	4.60	5.06
8.02	5.34	5.90	5.81	2.67	4.91
9.00	3.29	5.28	7.76	2.41	5.20
18.33	3.35	8.11	12.52	1.63	8.54
24.99	1.03	10.00	20.24	1.06	11.24
100%	100%	100%	100%	100%	100%
82.80	54.67	85.52	79.40	47.14	81.50
15.45	40.29	11.03	17.15	42.65	11.65
0.93	1.82	1.18	1.95	5.14	3.41
0.82	3.23	2.27	1.50	5.07	3.45
100%	100%	100%	100%	100%	100%
55.95	94.84	48.45	60.79	94.10	48.37
44.05	5.16	51.55	39.21	5.90	51.63
440	341	202,257	246	461	226,024

Source: Tabulates from the 1950, 1960, 1970, and 1980 1 percent Public Use Micro Data Samples from the U.S. Decennial Censuses of Population and Housing.

and correctional population. First, the mental-hospital population is considerably older, with larger proportions over forty years old; the population that is sixty-five years and older is more than ten times the comparable figure for the correctional population. Second, the proportion that is black or Hispanic is not appreciably larger than the comparable proportions for the noninstitutionalized population, while minorities are very much overrepresented in prisons and jails. Finally, nearly half of the mental-hospital population is female, while in 1950 only 9 percent of

Figure 2.6 *Institutionalization Rates, All Adults and Adult Men by Race-Ethnicity*



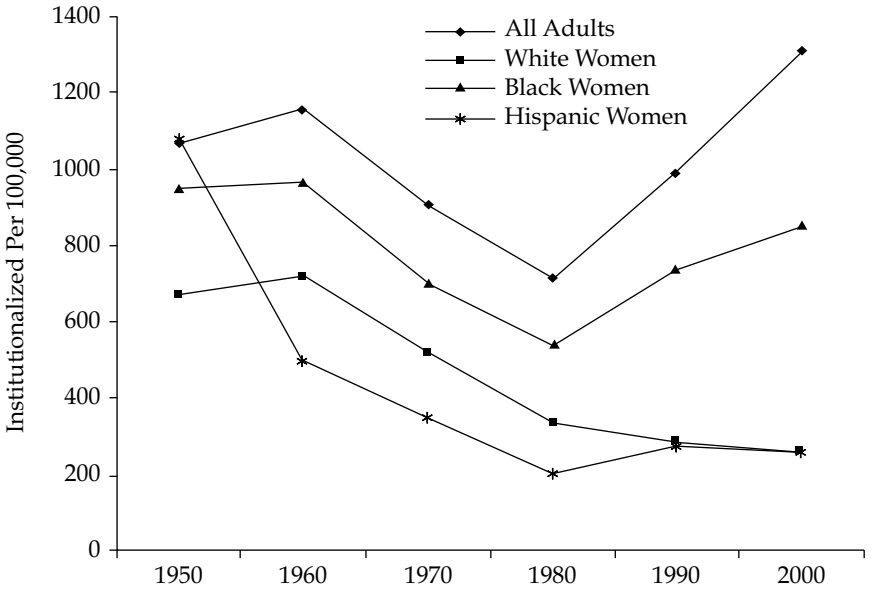
Source: Authors' calculations.

those in prison or jail were women. By 1980, this proportion declined to 6 percent.

Between 1950 and 1980, the mental-hospital inpatient population became younger, more minority, and more male, although the elderly and women still constitute larger proportions of the population of mental-hospital inpatients than they do of prison and jail inmates. These changes suggest that deinstitutionalization proceeded in a nonrandom fashion.

The limitations of deinstitutionalization as a major contributor to growth in incarceration are best illustrated by looking at overall institutionalization rates (combining mental-hospital, jail, and prison populations) by demographic subgroups. Figure 2.6 displays overall institutionalization rates for adult men between eighteen and sixty-five years of age by race-ethnicity using data from the PUMS files for 1950 to 2000. For the latter two years (1990 and 2000), the data do not permit separately identifying mental-hospital inpatients and prison and jail inmates. Nonetheless, the mental-hospital population in these years is trivially small rela-

Figure 2.7 *Institutionalization Rates for All Adults and For Adult Women by Race-Ethnicity, 1950 to 2000*



Source: Authors' calculations.

tive to correctional population, and thus the overwhelming majority of the institutionalized in these years are in jails or prisons. The most notable pattern in this figure is the large increase in the overall institutionalization rate for black men (the group that has contributed the most to increases in incarceration since 1980). Prior to 1980, the peak institutionalization rate for this group was slightly less than 4,000 per 100,000. By 2000, this rate exceeded 8,000. For white and Hispanic men, overall institutionalization rates more closely mimic the time path of overall institutionalization rates for all adults.

Figure 2.7 presents comparable results for women. Here, the most notable fact is the large sustained decline in the overall institutionalization rate of white women (a demographic group that constituted a sizable portion of the mental-hospital inpatient population in 1950). Hispanic women also experience large declines in overall institutionalization rates, while the time path for black women mimics the time path for all adults.

This group-specific analysis can be used to place an upper bound on

the potential contribution of changes in the inpatient population on prison and jail growth. We perform this analysis in table 2.5. The first column presents the number of mental-hospital inpatients per 100,000 adults between eighteen and sixty-five years old for men and women by race and ethnicity in 1980. The second column presents the change in the overall institutionalization rate between 1980 and 2000 for each group using data from the census. Note that because the census data do not permit separately identifying prison, jail, and mental-hospital populations in each year, these changes show the net increase after accounting for further deinstitutionalization post-1980. The third column presents the maximum proportional contribution of deinstitutionalization to increases in the incarceration rate for each group. We calculate this figure by simply dividing the inpatient rate in 1980 by the change in institutionalization between 1980 and 2000. For white women, we set this rate at zero because overall institutionalization declined. For other women, we set this rate at one because the inpatient rate in 1980 exceeds the increase in institutionalization between 1980 and 2000.

The fourth column presents the absolute increase in the number institutionalized for each group, with the total population in correctional institutions increasing by roughly 1.3 million between 1980 and 2000.[18] The next column presents estimates of the contribution of deinstitutionalization assuming that the mental-hospital population is reduced to zero and that the transinstitutionalization rate is one for one. The final column presents similar estimates assuming a transinstitutionalization rate of one new prisoner per 100,000 for every two-person decline in the number of mental-hospital patients per 100,000.

The larger of the two estimates suggests that deinstitutionalization contributed at most 255,702 individuals to the growth in the nation's prison and jail populations. This would constitute roughly 20 percent of growth between 1980 and 2000. However, this estimate is certainly too large, as the mental-hospital population in 2000 was not zero (it was actually closer to 60,000), and because many of those in mental hospitals in 1980 were elderly or were individuals unlikely to commit serious felonies. Assuming a transinstitutionalization rate of 0.5 yields a contribution of 127,851 (roughly 10 percent of the increase).

An alternative method of pinning down the contribution of deinstitutionalization would be to directly estimate this transinstitutionalization rate and use this figure to estimate the likely contribution. This is the strategy employed by Raphael (2000). The study uses state-level data for the period 1971 to 1996 to estimate the effect of the state mental-hospital inpatient rate on the state prison incarceration rate. After adjusting for state and year fixed effects and observable covariates, the model yields a transinstitutionalization rate of approximately –0.15. When combined

Table 2.5 *Assessing the Maximum Possible Contribution of Deinstitutionalization to Growth in Prison and Jail Incarceration Between 1980 and 2000*

	Mental-Hospital Inpatients per 100,000 (1980)	Change in Institution-alization per 1000,000 (1980 to 2000)[a]	Maximum Possible Proportional Contribution of Deinstitu-tionalization[b]	Actual Absolute Change in Population Institutionalized (1980 to 2000)	Absolute Contribution of Deinstitutionalization With Transinstitu-tionalization Rate of 1[c]	Absolute Contribution of Deinstitutionalization with Transinstitu-tionalization Rate of 0.5[c]
Men						
White	157	479	0.33	328,326	107,207	53,604
Black	323	5,120	0.06	584,251	36,836	18,418
Other	148	68	1.00	47,738	47,738	23,869
Hispanic	83	1,631	0.05	294,197	14,958	7,479
Women						
White	91	–73	0.00	–33,066	0	0
Black	134	311	0.43	48,786	21,000	10,500
Other	25	15	1.00	7,816	7,816	3,908
Hispanic	51	57	0.89	22,692	20,147	10,073
Total	—	—	—	1,300,740	255,702	127,851

Source: Authors' compilation.
[a]Figures provide the change in the total institutionalization rate between 1980 and 2000.
[b]Maximum proportion contribution is set to 1 when the change in institutionalization rate exceeds the 1980 mental-hospital inpatient rate.
[c]Tabulations assume that complete deinstitutionalization between 1980 and 2000.

with the decline in the number of mental-hospital inpatients per 100,000, this rate implies that deinstitutionalization increased the state incarceration rate by roughly 18 per 100,000 between 1971 and 1996 (roughly 5 percent of the increase in incarceration rates over this time period).

Thus, our upper-bound estimates indicate that deinstitutionalization accounted for no more than 10 percent of the increases in incarceration in recent decades. Research that attempts to directly estimate the trans-institutionalization rates suggests an even smaller role (5 percent).

The Effects of Increasing Earnings Inequality

The increase in U.S. incarceration rates since the mid-1970s coincides with profound changes in the distribution of earnings and income. Beginning in the mid-1970s, wage inequality increased greatly, with real absolute declines in the earnings of the least skilled workers and stagnating wages for workers at the center of the wage distribution (Autor and Katz 1999). Coincident with these changes in the earnings distribution are pronounced declines in the labor-force participation rates of less-skilled men (Juhn 2003). In particular, the labor-force participation and employment rates of relatively less-educated black men have dropped precipitously (Raphael 2005).

The potential connection between these labor-market changes and the increase in incarceration is relatively straightforward. The wage that one's time can command in the legitimate labor market represents the opportunity cost of allocating one's time toward other uses, such as participating in crime, taking leisure, engaging in home production, and so on. The lower one's potential earnings, the more attractive are criminal opportunities with income-generating potential. For individuals who are amoral and risk neutral, the necessary and sufficient conditions for committing a crime are that the expected return to devoting a small amount of time to crime must exceed both the value placed on free time (one's reservation wage) as well as potential legitimate earnings should this time be supplied to the labor market. For those morally averse to criminal activity and averse to risk, participating in criminal activity requires that the difference between the expected returns to crime and returns to legitimate work exceed a threshold that is increasing in the degree of moral as well as risk aversion.[19] Regardless, the likelihood of engaging in criminal activity (or stated differently, one's supply of time to criminal pursuits) should increase as potential earnings in legitimate employment decline.

Declining wage offers for the least skilled workers will induce a greater proportion to participate in crime, as those who are more risk averse and who are the least morally predisposed toward relative to those already en-

gaged in criminal activity crime are peeled out of the legitimate labor market and into criminal activity on the margin. This relatively larger pool of criminals increases the fraction of the group at risk for incarceration and, holding the incarceration risk constant, increases the incarceration rate.

There is now considerable evidence that economically motivated crime increases with unemployment and decreases with average wages, especially the average wages of low-skilled workers. For example, Steven Raphael and Rudolf Winter-Ebmer (2001) find consistently positive effects of higher unemployment rates on property crime in an analysis of state-level panel data covering roughly the last quarter of the twentieth century. Using similar data, Eric D. Gould, Bruce A. Weinberg, and David B. Mustard (2002) find that property crime decreases with increasing wages. Jeff Grogger (1998) models the decision to participate in crime as a function of the wages one could earn in the labor market using microdata from the 1979 National Longitudinal Survey of Youth (NLSY79); he finds that a 10 percent increase in wages decreases the likelihood of participating in income-generating criminal activity by roughly 2.5 percentage points. As a final example, Richard B. Freeman (1987) finds that those youth who believe that they could earn more on the streets than in legitimate employment are more likely to engage in criminal activity.[20]

With regards to the question at hand, it is possible to formally characterize the chain of effects linking wage declines to incarceration, and then to glean estimates of these various effects to provide a rough assessment of the potential importance of increasing earnings inequality. To see this, suppose that the proportion of the population that engages in crime, c, is a decreasing function of wages (that is, $c = c(w)$ where $c'(w) < 0$). Assuming only one type of criminal offense, the steady-state incarceration rate will thus be given by the equation

$$Inc = \frac{c(w)p}{c(w)p + \theta}, \tag{2.7}$$

where we express the proportion engaging in crime as a function of wages in the legitimate labor market. The change in the incarceration rate caused by a small change in wages can be found by differentiating equation 2.7 with respect to wages. Doing so gives,

$$\frac{\partial Inc}{\partial w} = \frac{\partial Inc}{\partial c} \cdot \frac{\partial c}{\partial w} = \frac{\theta}{(cp + \theta)^2} \cdot p \cdot \frac{\partial c}{\partial w} \tag{2.8}$$

The final expression in equation 2.8 indicates that the effect of a small change in wages on the incarceration rate can be broken down into three

components from right to left. First, a change in wages will impact the proportion of men supplying time to criminal pursuits (accounted for by the term $\frac{\partial c}{\partial w}$). Second, this increased criminality will generate new admissions to prison, as some proportion of new offenders (given by the parameter p) will be caught and incarcerated.

Finally, the impact of the increase in prison admissions on the incarceration rate (generated by $p\frac{\partial c}{\partial w}$) will be magnified by the amount of time an imprisoned offender is likely to serve. This magnification factor derives from the term $\frac{\theta}{(cp+\theta)^2}$. Note that in practice the product cp is likely to be a relatively small number (less than 0.003), while the release rate, θ, is likely to be relatively large. These two empirical facts imply that the magnification factor should be approximately equal to the ratio $1/\theta$. This term provides a relatively accurate approximation of the expected value of time served. Thus, longer average times served (or lower release rates) result in greater likely effects of a change in wages on the overall incarceration rate.

We use equation 2.8 to provide a rough approximation of the potential impact of changes in the national wage structure on the overall incarceration rate. Specifically, let i = (1, . . . , I), index I racial groups; and let j = (1, . . . , J), index J educational-attainment groups. For subgroups of men defined by race and educational attainment, we estimate how much lower the 2000 incarceration rate would have been had the average wages of the group not declined between 1980 and 2000. Specifically, we tabulate the estimates

$$\Delta I\hat{n}c_{ij} = \frac{\theta}{(cp+\theta)^2} \cdot p \cdot \frac{\partial c}{\partial \ln w_{ij}} \cdot d\ln w_{ij}, \tag{2.9}$$

where we have substituted the natural log of wages for wage levels, and where $d1n\ w_{ij}$ gives the change in the average log wages for group ij between 1980 and 2000. Because average wages decline for those groups experiencing the largest increase in incarceration, the calculation in equation 2.9 provides us with an estimate of what the incarceration rate in 2000 would be if wages were restored to their earlier levels.

With the group-specific calculations in equation 2.9, we can estimate the proportion of the increase in incarceration attributable to changes in the wage structure. Specifically, taking a weighted average of the group-specific incarceration-wage effects would give

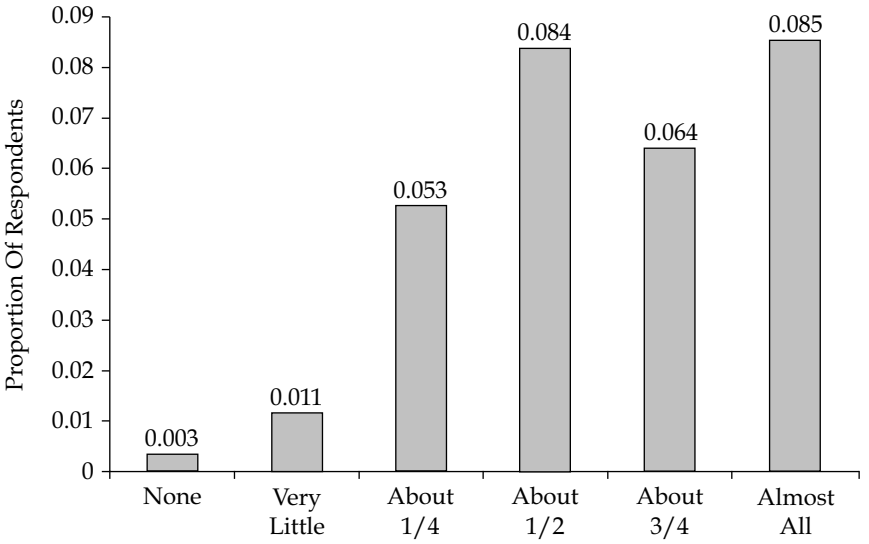
$$\Delta\hat{I}nc = \sum_i \sum_j M_{ij} \Delta I\hat{n}c_{ij}, \tag{2.10}$$

where M_{ij} is the proportion of adult males accounted for by demographic group ij. Equation 2.10 gives the overall effect of changes in the wage structure on the 2000 incarceration rate, accounting for the proportional representation of the different race-education groups among the adult male population. Comparing the group-specific changes from equation 2.9 to actual increases in incarceration provides an estimate of the proportional contribution of changes in labor-market opportunities for each group. Comparing the weighted change in equation 2.10 to the overall change in male incarceration rates provides an overall estimate of the effect of economic changes.

Estimating equations 2.9 and 2.10 requires that we choose values for the parameters in these equations. Beginning with the term $\frac{\partial c}{\partial \ln w}$, the only estimate of the responsiveness of criminal participation to changes in wages that we are aware of is provided by Grogger (1998). He estimates that the effect of a change in the natural log of hourly earnings (hence the substitution to log wages in equation 2.9) on the likelihood of engaging in income-generating activity is approximately –0.25. Note that this estimate pertains to a NLSY79 sample from 1980 of males between fifteen to twenty-two years of age not enrolled in school or the military, where disadvantaged minority men were oversampled. This particular demographic group is likely to be the most predisposed towards criminal activity, and thus the estimated responsiveness will certainly be on the high side when applied to older and more educated men. As this is the only estimate we have to work with, our calculations presented below should be interpreted as upper-bound estimates.

To estimate the likelihood of being caught and incarcerated, one could pursue a number of potential strategies. Here we look to those who admit to engaging in criminal activity, and we assess the likelihood that they serve time during a given period. The 1980 survey question that is used to gauge criminal participation in the study by Grogger (1998) inquires about the extent to which one's income over the previous year came from illegal activity. Taking those who indicated any income from crime as the base population, the proportion interviewed in prison or jail at the time of the 1980 survey provides an indicator of the likelihood of being caught and incarcerated. Figure 2.8 presents the proportion of NLSY79 male respondents interviewed in prison or jail by their self-reported relative proportion of income derived from criminal activity. The figure clearly reveals that those more engaged in crime are more likely to end up incarcer-

Figure 2.8 *Proportion of NLSY79 Male Respondents Interviewed in Prison or Jail in 1980*



Source: Authors' calculations.

ated. However, the average incarceration probability across all those engaging in crime is relatively low (0.02), as the majority of respondents (75 percent) who report income from crime report very little income from crime.

We take 0.02 as an estimate of the likelihood of ending up in prison or jail for those who commit income-generating crimes in 1980.[21] As the ratio of prison admissions to crimes committed has roughly tripled between 1980 and the present, we assume that the risk of incarceration in 2000 for those engaged in income-generating crimes is 0.06.[22]

The magnification factor, $\frac{\theta}{(cp+\theta)^2}$, will increase as the release rate decreases (alternatively stated, it will increase as the expected value of time-served increases). The overall release rate in the late 1990s was roughly 0.50, indicating an estimate of a magnification factor of two. However, those offenders coaxed into criminal activity by declining wages are likely to commit fewer and less serious crimes relative to those already in-

carcerated. Thus, we assume that such marginal offenders that end up in prison or jail serve no more than 1.5 years on average.

Finally, we use the results of Chinhui Juhn (2003) as estimates of the changes in average log wages by race and educational attainment. Juhn presents estimated changes in the legal opportunity cost of crime for white men and black men by educational attainment.[23] For Hispanic men and other men, we assume that the changes in the wage structure experienced by black men with similar levels of educational attainment apply.

The results of this exercise are presented in table 2.6. The first column presents estimates of the change in log wages between 1979 and 1998 for men by race and ethnicity (approximately equal to the proportional change in wage levels). The numbers document the well-known erosion of the legal opportunity cost for the least skilled men. The second column presents group-specific estimates of the effects of these wage changes on group-incarceration rates (corresponding to equation 2.9). For each race-ethnicity group, we also estimate an overall change by taking the average of the effects by educational attainment weighted by the proportion of the group's representation at each education level. These overall figures suggest that changes in the wage structure increased the 2000 incarceration rate by 0.001 for white males, 0.002 for black males, 0.003 for Hispanic males, and 0.001 for other males.

Column 3 of table 2.6 presents estimates from the 1980 and 2000 censuses of the actual change in the proportion of males institutionalized by race-ethnicity as well as by race-ethnicity and education (taken from table 2.3). Note that these figures pertain to men in either jail or prison. This seems like a reasonable benchmark as the NLSY79 data used to calculate the risk of incarceration are based on whether the respondent is interviewed in prison or jail. The final column presents the ratio of the predicted wage effects on incarceration to the actual changes.

The results suggest that changes in the wage structure account for 23 percent of the increase in incarceration among white men, 4 percent of the increase among black men, 21 percent of the increase among Hispanic men, and 33 percent of the increase among other men. For all men, estimating equation 2.10 suggests that changes in the wage structure accounts for roughly 13 percent of the increase in incarceration. The disproportionate contribution of black male incarceration to overall growth pulls this estimate disproportionately toward the lower number for blacks.

Changes in Drug Markets

The second half of the twentieth century witnessed the rise and fall of several illicit drug epidemics. Each of these epidemics entails separate

Table 2.6 *Estimates of the Effect of Changes in Earnings Opportunities on Male Incarceration Rates (Jail and Prison Incarceration Combined)*

	ΔLn Wage Offers, 1979 to 1998[a]	Predicted Effect of Wages on Percent Incarcerated ($-\hat{I}nc_{ij}$)[b]	Actual Change in Incarceration Observe in the Census[c]	Proportion of Increase Attributable to Change in Ln(Wages)
White men				
< High school	–0.26	0.006	0.021	0.28
High school	–0.14	0.003	0.011	0.28
Some college	–0.04	0.001	0.004	0.21
College plus	0.13	–0.003	0.001	–2.95
All white men	—	0.001[d]	0.005	0.23
Black men				
< High school	–0.24	0.005	0.138	0.04
High school	–0.11	0.002	0.053	0.05
Some college	–0.04	0.001	0.024	0.04
College plus	0.04	–0.001	0.007	–0.12
All black men	—	0.002[d]	0.051	0.04

Hispanic men				
< High school	–0.24	0.005	0.016	0.34
High school	–0.11	0.002	0.024	0.10
Some college	–0.04	0.001	0.010	0.09
College plus	0.04	–0.001	0.004	–0.21
All Hispanic men	—	0.003[d]	0.015	0.21
Other men				
< High school	–0.24	0.005	0.021	0.26
High school	–0.11	0.002	0.007	0.34
Some college	–0.04	0.001	0.005	0.18
College plus	0.04	–0.001	0.000	0.00
All other men	—	0.001[d]	0.004	0.33

[a]Figures in this column are estimates of changes in wage opportunity costs accounting for labor-market dropouts (Juhn 2003). We assume that the changes in wage offers by education for black men apply to these other two race-ethnicity groups.
[b]The predicted effect of changes in wages on incarceration is calculated by multiplying the likelihood of being sent to prison conditional on engaging in criminal activity (we assume 0.06), the magnification factor (1.5), the effect of a change in ln wages on criminal participation (estimate of –0.25 from Jeff Grogger 1998), the actual change in the natural log of wages, and –1.
[c]Based on figures reported in table 2.3.
[d]The change in incarceration figure in these cells is the sum across education groups of the product of the proportion of males in the group of the given education level multiplied by the predicted change in incarceration for the race-education group.

subcultures of use and sales, idiosyncratic economic relationship and market organizations, and particularly pathways by which drug use and sales likely impacted crime and incarceration. During the 1960s and 1970s, intravenously injected heroine was the hard drug of choice among urban users in American inner cities. During the late 1970 and 1980s, recreational use of powder cocaine, inhaled or freebased, became popular and widespread. The introduction of crack cocaine in the mid-1980s greatly increased cocaine use in relatively poor minority neighborhoods and is commonly cited as a key determinant of the spike in violent crime occurring between the mid-1980s and the early 1990s. Finally, with the waning of the crack epidemic, marijuana use among criminally active youth increased substantially during the 1990s (Johnson, Golub, and Dunlap 2000).

The effects of these individual drug epidemics on incarceration growth operate primarily through an impact on crime. Moreover, the introduction of a new drug can be thought of as a behavioral shock to the criminality of a nation's residents. Bruce Johnson, Andrew Golub, and Eloise Dunlap (2000) present three avenues by which specific drug epidemics are likely to impact criminality; they provide a useful framework for thinking about the consequences of recent drug epidemics for crime and incarceration. First, each drug has unique psychopharmacological effects on users that may impact aggression, heighten a sense of paranoia, or alter other psychological factors that could predispose one towards violence. Second, users may turn to income-generating crime to support their habits. Such "economic-compulsive" criminal behavior may take the form of drug dealing, robbery, or burglary. Finally, as drug transactions are not governed by the legal system (that is, there are no formal mechanisms for contract enforcement and the protection of property rights), violent crime is likely to arise in the process of settling disputes, protecting market share, and in collecting payments.

The timing of the crack epidemic along with the particular connections between the market for crack and violence suggests that this particular behavioral shock may have been an important behavioral contributor to growth in incarceration. First, while the exact timing of the beginning of the epidemic is uncertain, two careful studies of this question date the introduction of crack to 1984 at the earliest, with sales and use spreading throughout the country by 1988 (Grogger and Willis 2000; Fryer et al. 2005).[24]

Second, the psychopharmacological effects of crack cocaine are more likely, relative to other drugs, to predispose the user toward violence. In contrast to heroin and marijuana, which are depressants, cocaine is a stimulant that induces hyperactive states.

Third, the number of transactions per user is particularly high for

crack cocaine, reflecting its sale in small, relatively inexpensive quantities.[25] A higher frequency of contact between dealers and users increases the number of opportunities for violence. Each contact carries a risk of the user victimizing the dealer, the dealer victimizing the user, or a third party bent on robbery victimizing the user, the dealer, or both.

Finally, the structure of the crack-cocaine market was such that many young men were effectively employed by drug-selling operations in various capacities (MacCoun and Reuter 2001), with competing organizations often engaging in violent confrontations with one another over market share. At least one author (Grogger 2000) has hypothesized that the waning of violent crime during the 1990s was driven in part by a greater level of cooperation among drug-selling gangs and a greater propensity to rely on nonviolent means for settling turf conflicts.

Despite the timing of the epidemic and the clear connections between crack and violent crime, there are reasons to believe that the potential role of crack cocaine in explaining the explosion in incarceration growth is limited. First, the decomposition of the increase in prison admissions indicates that changes in criminal behavior explain a relatively small portion of the increase in incarceration. Second, the crack epidemic has diminished since 1990, while the incarceration rate has continued to grow. Finally, the one study (Fryer et al. 2005) that attempts to estimate the effect of crack-cocaine usage on prison admissions finds no evidence of an impact. We reproduce their basic finding here. Specifically, we match the crack-cocaine index measured at the state level by Roland G. Fryer and colleagues (2005) to state-level data on overall prison admissions per 100,000, new commitments per 100,000, and admissions due to returns to custody per 100,000. We restrict the data to the period from 1985 to 2000, due to the fact that the authors have little confidence in the signal associated with variation in their index prior to 1985. We then use these data to estimate a series of linear regression models where the key dependent variable is the state-level prison admissions rate and the key explanatory variable is the crack index.

Table 2.7 presents these results. The first row of numbers provides the coefficient on the crack index from a simple bivariate regression of the specific prison admissions rate on the index. The next row presents the same coefficient estimates after adding a complete set of state fixed effects. The inclusion of these fixed effects means that the effect of crack is being estimated using variation that occurs within states over time in the intensity of crack usage. The final specification adds a complete set of time fixed effects. This is perhaps the most important specification because these fixed effects remove all year-to-year changes in incarceration and crack usage that are common across states. In essence, this final regression estimates the effect of the introduction of crack by assessing

Table 2.7 *Estimated Marginal Effects of Variation in the State-Level Crack Index on Prison Admissions per 100,000 State Residents Based on State-Level Panel Data Covering the Period 1985 Through 2000*

	Total Admissions Rates	New Commitment Rate	Returns to Custody per 100,000
No state or year effects	11.83	6.22	7.63
	(2.59)	(1.59)	(1.79)
State effects only	14.71	10.49	4.65
	(2.40)	(1.51)	(1.35)
State and year fixed effects	–6.24	–0.57	–7.81
	(2.32)	(1.62)	(1.38)

Source: Standard errors are in parentheses. Figures in the table are the coefficient on the crack index taken from Fryer and colleagues (2005).

whether admissions rates increased earlier in states where crack appeared first (these results also correspond to the models estimated by Fryer and colleagues [2005]).

Beginning with the total admissions rates, there is a significant positive association between admissions and the crack index (as is evident from the simple bivariate regression coefficient), there is a somewhat larger positive estimate when we only use variation within states, but there is a significant negative effect when time effects are included in the specification. The largest estimate of the effect of crack on prison admissions (the coefficient of 14.71 in the model with state fixed effects only) predicts that the change in the crack index increased prison admissions between 1985 and 2000 by approximately 14 admissions per 100,000. As the actual rate increased by 114 over this period, the largest estimate in the first column of table 2.7 suggests that crack explained no more than 12 percent of the growth in prison admissions over this time period.

This certainly is an overestimate, however. The fact that the marginal effect of the intensity of crack usage does not survive adjusting for common year-to-year shifts casts serious doubt on this estimate. The results in the final row indicate that states where the intensity of crack use increased above and beyond the average increase for the nation experienced declines in the prison admissions rate. While this result may be biased by a reverse causal effect of prison on the crack epidemic (the explanation offered by Fryer and colleagues), the large disparity between

the estimated impact of crack when omitting year effects and the effect when including these effects suggests that crack cocaine has played a minor role.

CONCLUSION

Why then are so many Americans in prison? We find that the answer to this question lies mostly with the collective series of policy innovations at the state and federal level. In other words, so many Americans are in prison because through our collective public choices regarding sentencing and punishment, we have decided to place so many Americans in prison. For those who would have been sentenced to prison in the past, we have increased the amount of time that such offenders will serve. For many other less-serious offenders, we now punish with a prison sentence rather than an alternative, less punitive sanction that would have been applied in the past. Collectively, changes in who goes to prison (expansion along the extensive margin) and for how long (expansion along the intensive margin) explain 80 to 85 percent of prison expansion over the last twenty-five years. Thus, the characterization by William Spelman (2000) of the doubling of the prison population between the mid-1970s and 1980s, and then the doubling once more through the late 1990s, as one of the largest policy experiments of the century is indeed correct.

To be sure, we do find evidence that there have been changes to some of the underlying fundamental determinants of criminal behavior that have militated toward higher criminal activity. With regard to shocks that are likely to have increased crime, the severely mentally ill are much less likely to be institutionalized today than in the past, a factor likely to contribute to some violent crimes and public-order violations. Moreover, the labor-market prospects of low-skilled men, especially low-skilled minority men, have deteriorated considerably since the mid-1970s. Finally, the introduction of crack cocaine in the mid-1980s clearly wreaked havoc on American inner cities, contributing substantially to youth homicide and likely contributing to growth in the incarceration rate.

Nonetheless, we have shown that the likely behavioral impact of each of these shocks is small. There is also evidence of demographic shifts that, all else held equal, should have reduced criminal offending as well as incarceration rates. Specifically, the U.S. population has aged, the percentage of immigrants has increased (a factor associated with lower crime and incarceration rates), and U.S. adults have become considerably more educated. All of these shifts would have decreased crime and incarceration had incarceration rates not increased within demographic groups defined by age, race, and education groups. Moreover, research by the economists John Donohue and Steven Levitt (2001) pertaining to the crime-abating

effects of legalized abortion suggests another factor likely to have reduced the overall tendency towards criminal behavior among the noninstitutionalized (and perhaps, even the institutionalized) public. In conclusion, while there were some quite visible shocks to criminal behavior and to public order, there were many less visible underlying changes in the nation's demography that tended to counter the effects of the former on crime rates. In the end, it is not surprising that we find that behavior plays a small role in explaining the increase in the nation's incarceration rate.

NOTES

1. This approximation would be exact when the distribution of actual time served follows an exponential distribution.
2. The incarceration for crime i in year t is equal to the sum of new admissions between $t-1$ and t plus surviving inmates from the previous period, or

$$Inc_{it} = c_{it}p_{it}\,(1 - Inc_{it-1} - Inc_{i`t-1}) + (1 - \theta_{it})\,Inc_{it-1},$$

   where $Inc_{i`t-1}$ is the incarceration rate in time period $t-1$ for all crimes other than crime i. With sufficient time and stability in the transition parameters, the steady-state proportion incarcerated for crime i settles to

$$Inc_{it} = \frac{c_{it}p_{it} - c_{it}p_{it}Inc_{i'}}{c_{it}p_{it} + \theta_{it}}.$$

   In practice, the second term in the numerator will be extremely small (less than or equal to 1/100,000). Thus, the approximation in equation 2.1 applies.
3. Raphael and Stoll (2007) use admissions and releases data from the National Corrections Reporting Program to estimate the proportion of inmates admitted in a given year that are then released over subsequent years. We assume that after 1998, the time-served distribution remained constant. This latter assumption is likely to result in conservative estimates of the average time served, as many sentence-enhancement policies are adopted post-1998.
4. We generated these overall admissions rates by first tabulating the distribution of admissions across these categories using the prisoner admissions files from the 1984 and 2002 NCRP data, and then distributing total admissions for the states (available from the National Prison Statistics database) across these categories using these distributions. This imputation assumes that the admissions distribution for states not reporting to the NCRP is similar to the admissions distributions for states that do.
5. Certainly, the number of drug crimes is much greater than the number of drug arrests. However, since the incarceration rate depends on the product of the overall admissions rate (given by the crime rate multiplied by admis-

sions per crime), this simple imputation will not impact our inference regarding the causes of the changes in the incarceration rate. Regarding the implicit attribution of the entire change in arrests to changes in behavior, this will certainly bias upwards the estimate of the contribution of behavior to incarceration growth. There have been concerted efforts to step up enforcement of drug laws and to punish drug offenders more severely.

6. For other violent crimes, we estimate the admissions-per-crime variable using the average admissions-per-crime values for nonhomicide violent crime, using the composition of prison admits for that year as weights. For other property crime, we use the average of the admissions-crimes ratio for larceny and motor-vehicle theft. For other crimes, we use the overall average admissions-crime ratio weighted by the proportional distribution of admissions in each year for the seven offenses with observable crime rates.
7. Johnson and Raphael (2007) estimate the joint incapacitation and deterrence effects of putting someone away for a year using a state-level panel of crime and incarceration rates. The estimates adjust for the endogeneity of prison in crime regressions and arrive at estimates that are consistent with the some of the larger crime-abating effects in the extant literature (for example, Levitt 1996). The counterfactual crime rates in this chapter are based on the crime-specific effects from Johnson and Raphael unless otherwise noted.
8. Again, this should bias our estimates of the change in behavior upwards. This is because any increase in crime would generate some increase in incarceration, which would mitigate the added crime of such a prisoner release.
9. In addition, since Johnson and Raphael (2007) only provide crime-prevention estimates for the seven offenses in the UCR, we apply the proportional change for these offenses above the 2002 level to the three offenses that are not included in the UCR (that is, other violent crimes, other property crimes, and other crimes).
10. Johnson and Raphael (2007) model this dynamic adjustment process and show that, given the typical parameter sizes for prisoner release and admissions rates in the United States, a typical shock will induce a four- to six-year adjustment process between equilibrium.
11. More formally, define the vector $\mathbf{P_t}$ as

$$P`_t = \left\lfloor P^1{}_t \; P^2{}_t \; P^3{}_t \right\rfloor, \quad where \quad \sum\nolimits_j P^j{}_t = 1$$

where the index values indicate the three potential states of not in prison and not on parole (j = 1), in prison (j = 2), and on parole (j = 3). Define the matrix $\mathbf{T_t}$ as

$$T_t = \begin{bmatrix} T^{11}{}_t & T^{12}{}_t & T^{13}{}_t \\ T^{21}{}_t & T^{22}{}_t & T^{23}{}_t \\ T^{31}{}_t & T^{32}{}_t & T^{33}{}_t \end{bmatrix}, \quad where \quad 0 \le T^{ij}, \le 1, \quad \forall i, j, \quad and \quad \sum\nolimits_j T^{ij}{}_t = 1, \quad \forall j.$$

The proportional distribution of the U.S. population across the three states in any given year can be rewritten as a linear function of the state distribution in the previous year and the transition probability matrix,

$$P`_{t+1} = P`_t T_t.$$

Similarly, the subsequent distribution of the population can be tabulated by applying the next matrix of transition probabilities to the first calculation, or

$$P`_{t+2} = P`_t T_t T_{t+1}, \text{ and so on.}$$

12. The disparity between the simulation rates and the actual incarceration rates is likely the result of measurement error in admissions and releases. Note that the structure of the calculations ensures that errors cumulate over the years of the simulation.
13. In 1970, foreign-born individuals accounted for 4.7 percent of the U.S. population. By 2000, the percentage that was foreign born increased to 10.4 percent. During these three decades, the resident immigrant population increased by 16.2 million, accounting for roughly one-quarter of overall population growth (U.S. Census Bureau 2001).
14. Our tabulations of the 1980 and 2000 Public Use Microdata Samples of the U.S. Census of Population and Housing indicate that for men between eighteen and sixty-five years of age, average age increased from thirty-eight to forty for non-Hispanic whites, from thirty-five to thirty-seven for non-Hispanic blacks, from thirty-five to thirty-seven for non-Hispanic Asians, and from thirty-four to thirty-five for Hispanics.
15. Raphael (2005) presents a detailed comparison of the incarceration estimates using these data and estimated correctional populations from the Bureau of Justice Statistics.
16. Data on inmates in state and county mental hospitals through 1970 were drawn from findings of George B. Palermo, Maurice B. Smith, and Franklin J. Liska (1991); post-1970 data were drawn from findings of Steven Raphael (2000).
17. For each of the census years, one is able to distinguish those in mental hospitals from those in correctional institutions using the detailed group quarters variable.
18. Note that the overall mental-hospital population declined over this period. Because those in nonmilitary institutionalized group quarters are predominately prisoners, jail inmates, and mental-hospital inpatients, this implies that the net change is a lower bound for the absolute increase in the number of jail and prison inmates.
19. Grogger (1998) presents one of the clearest microtheoretical expositions of these ideas. The author presents a model of time allocation between criminal activity, legitimate work, and leisure, where it is assumed that the return to crime diminishes with the amount of effort devoted to crime. With risk-

neutral and amoral decision-makers, committing a crime requires that the return of the first hour of criminal activity exceeds potential wages and the individual's reservation wage. The model also predicts that many will find it optimal to both work in the legitimate labor market and engage in criminal activity. This latter result follows from the assumption of decreasing returns to crime.

20. Fagan and Freeman (1999) provide a detailed summary of existing research regarding the interaction between work and criminal participation conducted through the mid-1990s.
21. With an annual incarceration risk of 0.02 and assuming no desistence among this population as they age, one can simulate the fraction that will eventually be interviewed in prison or jail over the course of the panel. Specifically, the likelihood of not having been incarcerated after t periods is given by 0.98^t. For any given period, one minus this calculation provides an estimate of the fraction that has ever served time. By 1996, the proportion of men who admit to engaging in income-generating crime in 1980 who are interviewed in prison or jail at least once is roughly 0.11 (consistent with the tabulations presented by Freeman [1996]). Assuming no desistance and a 2 percent annual incarceration risk, roughly 30 percent should have been interviewed in prison or jail. While criminal activity is likely to have declined with age, this overestimate is also likely to indicate that our assumed incarceration risk parameter is perhaps too high. Thus, similar to the estimate of wage responsiveness that we employ, the assumed risk of incarceration further reinforces our interpretation of these figures as upper-bound estimates.
22. We explored several alternative strategies for estimating p. One possibility is to estimate the amount of crimes reported to the police that would be generated by the typical prison inmate, and then to estimate the likelihood of being caught and incarcerated for this amount of crime. Johnson and Raphael (2007) estimate that the average inmate incarcerated between 1979 and 2002 reduced index crimes reported to the police by approximately 3.5 (the effect on overall crime is closer to 10 given underreporting). Because reported crimes are likely to generate police actions leading to an arrest and conviction, one estimate of the likelihood of incarceration is to estimate the likelihood that such an average prisoner would be caught and convicted again if released. With an average admissions-crime ratio of approximately 0.019, the likelihood of being caught and incarcerated for committing four index crimes in one year is approximately 0.074 (calculated as $1 - (1 - 0.019)^4$). Certainly, the marginal offender drawn into crime is not likely to engage in criminal activity with the intensity of the average prison inmate. Thus our slightly more modest choice of 0.06 seems justified.

    A further alternative is to make use of the stylized fact presented by Levitt and Venkatesh (2001) that roughly one-third of the sixteen heads of the Chicago drug gang that they studied were in prison at any given time. Since all sixteen men can be accurately described as full-time criminals (that is, $c = 1$), the incarceration equation 2.1 for this group can be written as $0.33 = p / (p + \theta)$. With an estimate of the release probability, one could back out the an-

nual risk of incarceration for these full-time criminals. The release probability for all inmates in 2000 was slightly less than 0.50, corresponding to an expected time served of two years. It seems reasonable to assume that the leaders of a violent drug gang are likely to be serving somewhat longer sentences than the average inmate. If we assume a release probability for this group of 0.33 (corresponding to an expected time served of three years), then the annual incarceration risk would be equal to 0.16. Thus, our estimated risk of 0.06 implies that the incarceration risk for a marginal offender is roughly 40 percent the incarceration risk for a full-time criminal. While these are clearly speculations, this seems like a reasonable approximation.

23. Juhn's 2003 published study does not include estimates of adjusted changes in hourly log wages for those with some college education but no degree. However, the author provided us with these additional tabulations.
24. Grogger and Willis (2000) use data from the Drug Awareness Warning System (DAWN) on cocaine-related emergency-room visits as well as a survey of police chiefs in large cities to date the onset of the crack epidemic for different urban areas. Roland G. Fryer and colleagues (2005) use data from the DAWN, data on Drug Enforcement Administration (DEA) cocaine seizures, newspaper citations on crack-related stories, cocaine arrests, and cocaine deaths to construct a single index. Both date the beginning of the crack epidemic to between 1984 and 1985.
25. Crack cocaine in its powder form is derived by dissolving cocaine in water, mixing it with baking soda, and boiling (Grogger and Willis 2000). The resulting "rocks" are smoked, concentrating cocaine in the bloodstream and brain at a particularly fast rate. This causes a short intense high followed by an intense depression and possibly desperation caused by the rapid decline in cocaine levels (Johnson, Golub, and Dunlap 2000).

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