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# General Equilibrium Effects of Prison on Crime: Evidence from International Comparisons

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*Justin McCrary and Sarath Sanga*

**ABSTRACT**

We compare crime and incarceration rates over time for the United States, Canada, and England and Wales, as well as for a small selection of comparison countries. Shifts in U.S. punishment policy led to a five-fold increase in the incarceration rate, while nearly every other country experienced only minor increases in incarceration. The large shifts in U.S. punishment policy do not seem to have caused commensurately large improvements in public safety.

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# General Equilibrium Effects of Prison on Crime: Evidence from International Comparisons

## 1. INTRODUCTION

From 1920 through 1970, the rate of incarceration in the United States was roughly constant, hovering around 100 per 100,000. Today, the incarceration rate is five times that level. The incarceration rate in the United States is thus markedly higher today than it was historically.

The incarceration rate in the United States is also markedly higher today than it is in other countries. According to the International Centre for Prison Studies of the University of Essex, in 2008 the United States accounted for 5 percent of world population but 23 percent of worldwide prisoners (Walmsley 2009).

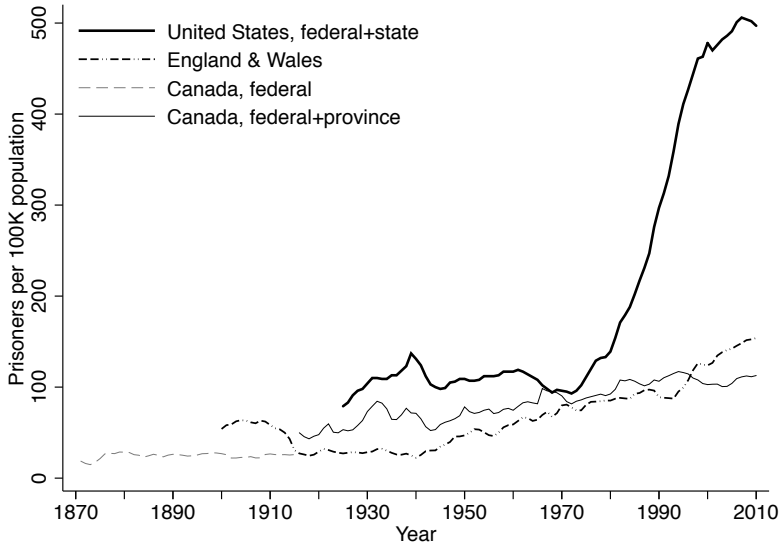
Figure 1 displays the time series of the incarceration rate for the United States as compared with that of other countries. Panel A compares the United States to Canada and England and Wales (combined) over the last century. These countries have perhaps the longest tradition of collecting data on incarceration rates and are additionally relatively comparable to one another in terms of language, economy, law, and culture. The figure indicates that already during the early part of the 20th century, the United States had higher incarceration rates than Canada and England and Wales. From 1925 through 1970, however, those countries essentially caught up to the United States. But starting in 1970, the United States made substantial investments in prison capacity, and by 2010 the U.S. incarceration rate was 3.3 times that of England and Wales and 4.4 times that of Canada. These conclusions are particularly stark; compared to other countries that are members of the Organization for Economic Cooperation and Development, England and Wales have a relatively high incarceration rate.

Panel B compares the United States to selected OECD countries over the last four decades.[1] The figure indicates that the U.S. increase

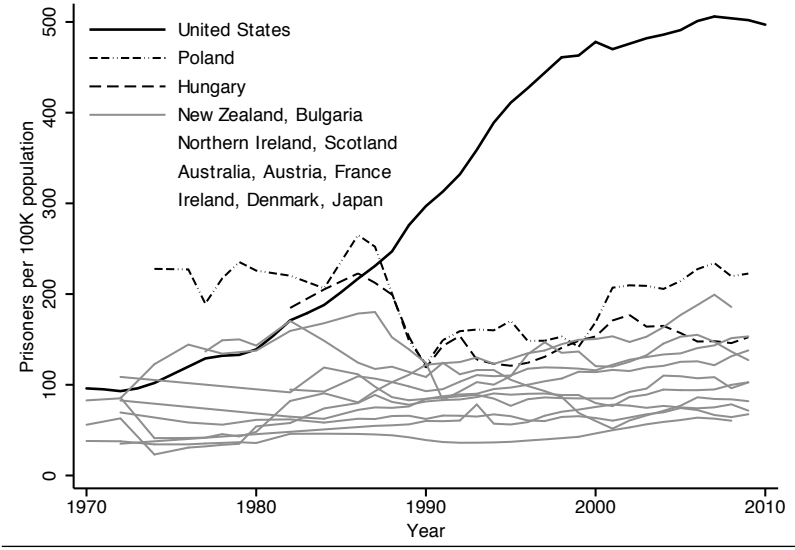
[1] Throughout this paper, countries were selected on grounds of data availability and quality.

*Figure 1*
Incarceration Rates in Perspective

*A. U.S., England & Wales, and Canada: 1870 to present*




*B. Selected Rich Countries: 1970 to present*




Source: See text, pp. 170–71, 173.

in incarceration is surprising compared to Canada and England and Wales, as well as to a broader set of countries.

In sum, from a historical and comparative perspective, the expanded use of prisons in the United States in recent decades is breathtaking. However, while the punitiveness of the current U.S. system is unusual, some people may be willing to set aside the obvious liberty concerns if they are persuaded that prison is sufficiently effective at providing for the safety of those not imprisoned. Scholars and policymakers alike note that a large prison system could reduce crime through two important channels: deterrence and incapacitation. Assessing the magnitude of these channels is an important task for research and one that is taken up in an extensive academic literature.

However, a general equilibrium policy evaluation of the increased use of imprisonment must take account of additional possible mechanisms. One such mechanism is the so-called prison reentry problem, which has been much discussed in the popular press recently and in the academic literature. Nationally, roughly 700,000 people will be released from prison (long-term incarceration) this year, and roughly 7 million people will be released from jail (short-term incarceration). It is conceivable that those released will be changed by virtue of the experience of incarceration. Such changes could be protective against crime if, for example, former prisoners decided to "go straight" to avoid any subsequent confinement. More concerning is the possibility that the changes could encourage crime if, for example, former prisoners found themselves unable to obtain legitimate work and were thereby encouraged to engage in crime, or if they were scarred by the experience and unable to cope with life on the outside.

A second such mechanism is the replacement hypothesis (Freeman 1999). In Freeman's view, criminal opportunities are limited and rivalrous—if one person is taking advantage of the opportunity, another cannot take advantage of it simultaneously—and the group of potential offenders is large relative to the number of criminal opportunities. Accordingly, if this mechanism is important, incapacitation could be entirely offset by replacement. In simple terms, one corner drug dealer is sent to prison, and another steps forward to take his place.

A third mechanism is the effect of the scope of imprisonment on deterrence via externality. Typically, deterrence is framed as an individual's decreased inclination toward crime because of a higher threatened sanction. However, the stigma associated with a criminal

record may be an important deterrent as well, for example in the labor market or in social interactions. Stigma means that in the extreme, higher threatened sanctions can be counterproductive (Rasmusen 1996). In simple terms, when punishment is rare, a punished person is more likely to be a bad seed than when punishment is prevalent.

The research designs used in the literature focus on measurement of deterrence and incapacitation and are unable to capture these broader general equilibrium phenomena. In the literature, general equilibrium policy evaluation has primarily been done in the context of formal structural modeling of the potential offenders' economic and legal environment (see, for example, Burdett, Lagos, and Wright 2004). This approach has many merits, including the clear explication of mechanisms and a natural methodology for evaluating counterfactual policy experiments.

In this paper, we complement the theoretical literature with an empirical assessment of the general equilibrium effects of mass incarceration. Our approach is rooted in the observation that the magnitude of the expansion in the prison population in the United States over the last 40 years has been nearly unique internationally. Our conclusions are informed by a new data set on the use of imprisonment and the extent of crime for a large group of countries over many years. We pay particularly close attention to Canada and to England and Wales, as these are natural comparisons for the United States, and the governments of those countries have a tradition of collecting the relevant data.

The plan for the paper is as follows: Section 2 describes the data we use. Section 3 focuses on a comparative analysis of trends in the United States, Canada, and England and Wales. Section 4 introduces some simple panel data regressions to summarize the results. Section 5 concludes.

## 2. DATA

Our first analysis compares the United States to Canada. Data on crime in Canada are taken from the *Statistics Canada* website, www.statcan.gc.ca. Data on prisoners in Canada are taken from the *Statistics Canada* website for 1978 to the present. Historical data on prisoners were obtained from Tables Z173–174 (federal prisoners) and Tables Z198–208 (provincial prisoners) of *Historical Statistics of Canada* (2nd edition). Data on U.S. crime are taken from the Federal

Bureau of Investigation's *Uniform Crime Reports*. Data on U.S. prisoners are taken from the University at Albany's *Sourcebook of Criminal Justice Statistics*.

Our second analysis compares the United States to England and Wales. Data on crime for the latter are taken from two electronic files produced by the Home Office, "Recorded Crime Statistics 1898–2001/2" and "Recorded Crime Statistics 2002/3–2009/10." Data on prisoners are taken from Table 7.5 of "Offender Management Caseload Statistics 2009."

Our final analysis uses data from the *Surveys of Crime Trends and Operations of Criminal Justice Systems*. These data were collected by the Crime Prevention and Criminal Justice Division of the United Nations ("UN data") in 10 separate waves. The data collection for the first wave was conducted in 1978 and pertained to aspects of crime and the criminal justice system for the years 1970–75. Subsequent waves were collected roughly every five years; the most recent information from the survey pertains to 2006. All of the statistics reported in the survey are collected from statistical reports from the respondent countries. We have hand-checked these data using Eurostat data, which are available after 1987. We have observed some minor discrepancies between the values in the survey and those in the Eurostat data, but these seem to emerge from definitional differences.

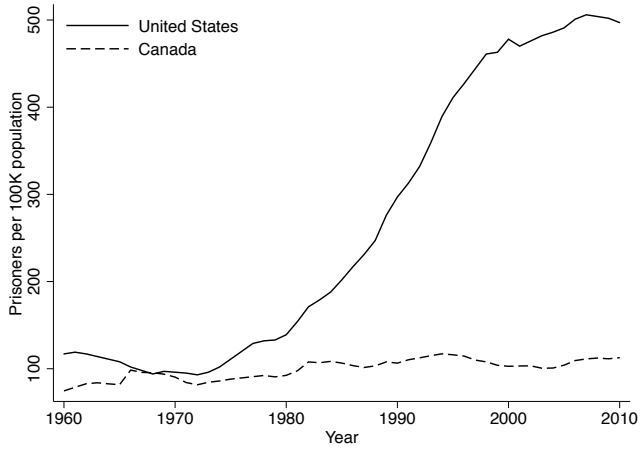
Perhaps oddly, a counterexample is the UN data set for the United States. Fortunately, high-quality data for the United States are available from several other sources, and we have replaced the U.S. values in the UN data with information from the *Sourcebook*. For other countries, our sense is that the main measurement problem in the survey emerges from nonresponse rather than incorrect values.

## 3. COMPARISON WITH CANADA AND ENGLAND AND WALES

Previous research has noted that, despite substantial similarity between the two countries on many dimensions, Canada does not imprison its citizens at nearly the rate the United States does (Doob and Webster 2006). Figure 2A displays total incarceration rates per 100,000 using publicly available data for Canada and the United States. The figure indicates that Canada did not increase its use of prisons over the

*Figure 2*
Imprisonment and Crime: United States and Canada

*A. Incarceration Rate*




*B. Homicide Rate*

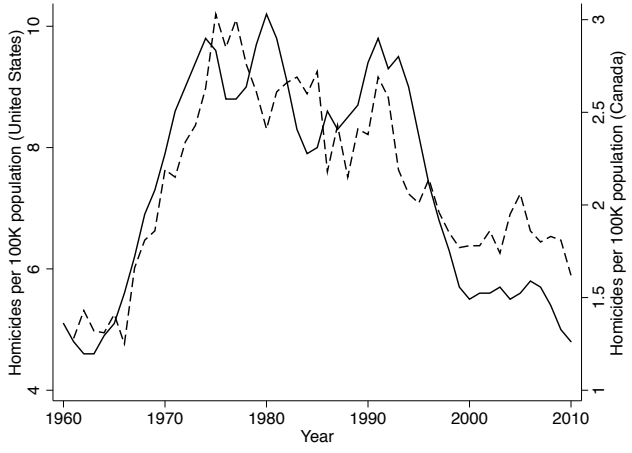
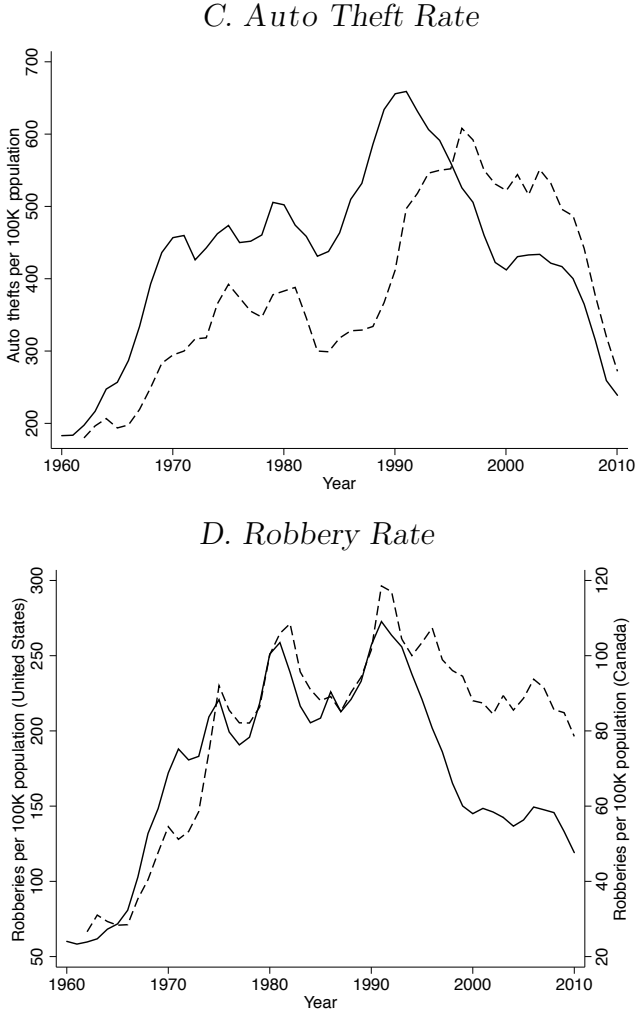


*Figure 2*
(*continued*)




Source: See text, pp. 170–71, 174.

last 30 years in the same way that the United States did. While *Statistics Canada* presently provides a series going back only to 1978, data are available going back to 1916 in *Historical Statistics of Canada*. The figure indicates that Canada has displayed little change in incarceration rates over 40 years, whereas U.S. incarceration rates have grown rapidly.

One explanation for the low Canadian incarceration rates observed in Figure 2A is a low rate of crime: a country with a low rate of crime has little need for imprisonment. However, this is not a good explanation for the stark differences in trend observed in Figure 2A because Canadian and U.S. crime rates exhibit rather similar trends. Panels B, C, and D provide time series for the rates of homicide, auto theft, and robbery, respectively, in the two countries. These are the three crime series believed to be measured most accurately in aggregate police statistics, upon which both series are based.

Despite their differences in scale, with the U.S. homicide rate generally three to four times higher than in Canada, homicide rates in the two countries exhibit remarkably similar trends (correlation coefficient of 0.86). Auto theft is more similar in its level, but somewhat less similar in its trend. In Canada, the peak auto theft rate comes about five years after the peak rate in the United States. Panel D displays the robbery rate for the two countries. The similarity in the series is remarkable; the most prominent difference in the series is that the post-1990 decline in crime is more marked in the U.S. data. An important question is whether the faster decline in crime in the United States can be attributed to the prison expansion.

These comparisons are suggestive but largely anecdotal. Nonetheless, drawing a contrast between the United States and Canada clarifies two simple points. First, despite a variety of similarities between the two countries, the increased use of imprisonment in the United States saw little parallel in Canada. Second, the effect on crime of the large investment in prisons is hard to discern with the naked eye. The United States and Canada seem to have generally similar crime trends that may or may not be related to changes in punishment policy.

Before attempting to draw any more conclusions from these data, we pause to note a conceptual difficulty with inferring the effect of punishment policy on crime using natural variation in incarceration rates. Imprisonment is an equilibrium phenomenon that reflects both changes in punitiveness as well as changes in crime, and im-

prisonment both causes and is affected by crime. McCrary (2009) emphasizes the cohort decomposition of those in prison as a means of clarifying these points. Let $Q_t$ denote the fraction of the population in prison, $G_t$ the fraction of those not in prison who engage in crime, $p_t$ the fraction of offenders arrested, and $H_t(s) \equiv P_t\,(S_t \geq s)$ the fraction of arrestees obtaining a sentence of at least $s$ periods, where $s$ is an integer. Since those in prison were either free last period and committed an offense for which they were sentenced to at least one period in prison, or were free two periods ago and committed an offense for which they were sentenced to at least two periods, and so on, we have

$$Q_t = \sum_{s=1}^{\infty}(1 - Q_{t-s})\, G_{t-s} p_{t-s} P(S_{t-s} \geq s) \tag{1}$$

In the steady state, where $G_t$, $p_t$, and $H_t(\cdot)$ have been constant for sufficiently long that $Q_t$ is constant, we have

$$\begin{aligned} Q &= (1 - Q)\, Gp \sum_{s=1}^{\infty} H(s) \\ &\leftrightarrow Q = \frac{Gp\mathbb{E}[S]}{1 + Gp\mathbb{E}[S]} \leftrightarrow 1 - Q = \frac{1}{1 + Gp\mathbb{E}[S]} \end{aligned} \tag{2}$$

where we make use of the fact that the sum of the survivor function is equal to the mean, or $\sum_{s=1}^{\infty} H(s) = \mathbb{E}[S]$. Some calculus shows that

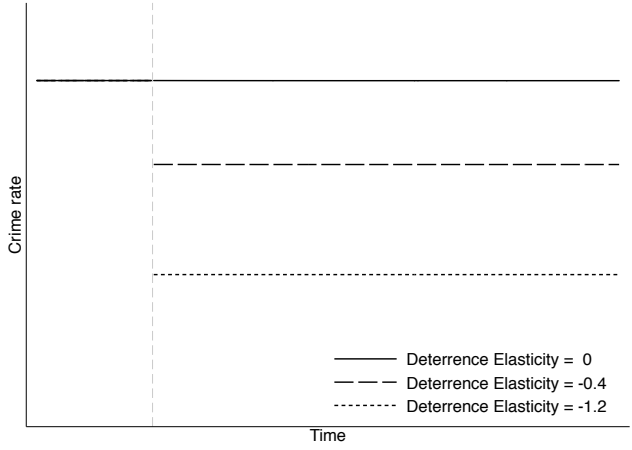
$$\frac{\partial \ln Q}{\partial \ln \mathbb{E}[S]} = (1 - Q)\,(1 + \varepsilon) < 1 \tag{3}$$

where $\varepsilon = \partial \ln G / \partial \ln \mathbb{E}[S]$ is the elasticity of crime on the part of the free with respect to expected sentence lengths. This equation says that a 1 percent increase in the punishment schedule confronting offenders exerts less than a 1 percent increase in the incarceration rate. A standard empirical policy evaluation exercise would relate the growth rate in crime to the growth rate in imprisonment. That is, it would measure empirically the quantity $\Delta \ln C / \Delta \ln Q$, perhaps using a regression. Equation (3) shows that this approach will tend to exaggerate the effect of imprisonment on crime because the denominator is functionally related to the numerator. We will try to quantify this effect momentarily.

Outside of the steady state, we can use equation (1) to understand the dynamic effects on incarceration of a change in punishment policy. Figure 3 demonstrates the effect of an immediate shift and a slow shift in the distribution of sentence lengths on the incarceration rate with no, modest, and large deterrence effects of expected

*Figure 3*
Hypothetical Changes to Crime and Incarceration Rates Associated with Increases in Sentence Lengths

*A. Instantaneous Shift: Crime Effect*




*B. Gradual Shift: Crime Effect*

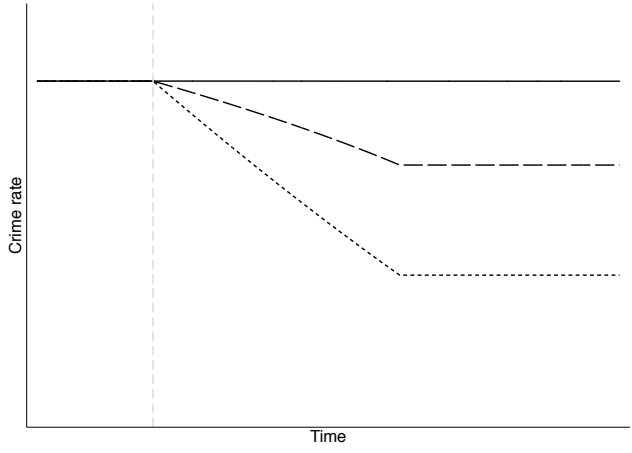
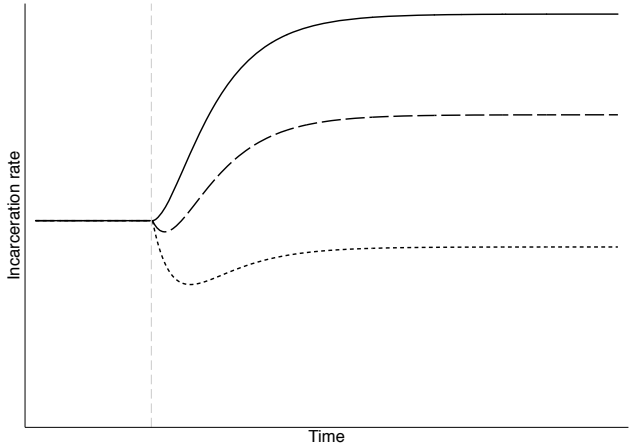
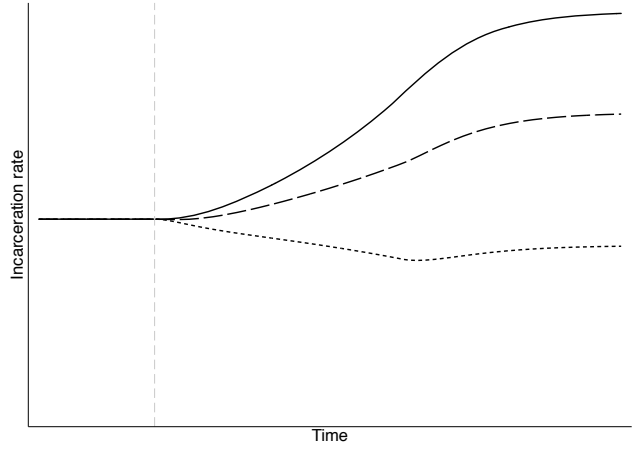


*Figure 3*
(*continued*)

*C. Instantaneous Shift: Incarceration Effect*




*D. Gradual Shift: Incarceration Effect*



sentence lengths on crime.[2] Panel A shows the effect on the overall crime rate of an instantaneous and large shift to the right in the distribution of sentence lengths. The solid line shows the crime rate assuming no deterrence; the long dashed line shows the crime rate assuming a deterrence elasticity of −0.4; and the short dashed line shows the crime rate assuming a deterrence elasticity of −1.2. The solid line imperceptibly declines after the policy reform (indicated by a vertical dashed line) because of the incapacitation effect of prison. Both dashed lines show dramatic and immediate declines because of the deterrence effect.

Panel C shows the effect of this policy reform on incarceration. The solid line increases rapidly, but at a decreasing rate, converging to the new steady-state value after 300 months and to 90 percent of the steady-state value after 120 months. Prison populations evolve very slowly, like the temperature in the ocean. Empirical evidence consistent with this fact is that while crime began dropping precipitously in 1990, the U.S. prison population continued to increase for another 19 years, until 2009. The dashed line initially declines because of deterrence effects, but after 24 months the incarceration rate rises above its initial level and continues to climb to its new steady-state value. While fewer individuals cross the threshold of the prison because of deterrence, those who do must stay longer. Interestingly, computing $\Delta \ln C / \Delta \ln Q$ yields −0.67, or about 1.68 times the deterrence elasticity of −0.4. In this example, the incapacitation effect is small enough that −0.4 is also the overall effect of a sentence enhancement on crime.

Panel B shows the effect on the overall crime rate of a more plausible policy shift, which is a linear increase in the expected sentence length facing a potential offender. The solid line is essentially unchanged (the incapacitation effect is now even less perceptible), but the dashed line declines nearly linearly in time as sentence lengths increase. Panel D

[2] The example uses a geometric distribution for sentence lengths on 0, 1, 2,... so that $P(S_t \geq s) = \gamma_t^s$, where $1 - \gamma_t$ is the per-period release probability for a prisoner. We peg the steady-state values for the key variables $C_t$, $Q_t$, $G_t$ and $p_t$ to roughly match empirical values for the United States in recent years. The hypothetical values for $G_t$ are then constructed using a log linear approximation to the relationship between the crime rate of the free and the mean sentence length, i.e., we adjust the crime rate as $G' = \exp(\ln G + \varepsilon \Delta \ln \mathbb{E}[S])$, where $\varepsilon$ is the elasticity of crime with respect to the mean sentence length and $\Delta \ln \mathbb{E}[S]$ is the percent change in the mean sentence length associated with the example. Hypothetical values for $Q_t$ are generated directly from equation (1) and the hypothetical values for $C_t$ are generated according to the identity $C_t = (1 - Q_t)G_t$.

shows the effects of this shift on incarceration. As before, incarceration declines at first because all the prisoners are incumbents and hence the prison exit rate is unaffected, yet the prison entry rate is lower because of deterrence. The effect is hard to detect visually but lasts for about 24 months. Eventually, the exit rate from prison is reduced because enough prisoners entered after the reform in punishment policy, and incarceration climbs rapidly thereafter.

This discussion highlights the hazards of using natural variation in incarceration rates to draw inferences about the effect of prison on crime. As panel C emphasizes visually, in the short run, one sees a positive association between incarceration and crime. This follows for two reasons. First, a spike in punitiveness reduces crime faster than it increases incarceration. Second, the immediate reduction in crime that occurs reduces the flow rate into prison enough to shrink the incarceration rate, even though the long-run consequences are for higher incarceration rates. After a decade, however, we are in a long-run scenario where there is a negative association between incarceration and crime. Nonetheless, the magnitude of the association is exaggerated because of the functional relationship between incarceration and crime. Roughly speaking, the association at long-run frequencies should be discounted by roughly $1 \div 1.67$, or about 0.6. However, if the magnitude of the elasticity of crime with respect to expected sentence lengths is sufficiently large, one will observe a positive association with incarceration and crime even in the long run.

Perhaps the most important takeaway from panel C is this: holding fixed the probability of apprehension, long-run secular increases in the incarceration rate will be observed under only two conditions. First, sentence lengths have to increase. Second, the deterrence elasticity of sentence lengths cannot be too great. Were it to be substantial, the flow rate into prison would be reduced by too much for the prison population to be able to grow. Finally, note that if deterrence effects were appreciable yet inelastic, then we should observe oscillation in the prison population, with short-run prisoner-reducing effects of policy reforms on the prison population being offset by medium- and long-run prisoner-increasing effects.

Returning to the data from the United States and Canada, we now present an analysis of the long-run differences in the data. Table 1 presents growth rates in crime and incarceration rates for Canada and the United States for 1960, 1970, 1980, 1990, 2000, and 2010. Table 2

*Table 1*
Log Differences in Crime and Incarceration Rates

| | Canada | | | | United States | | | |
|---|---|---|---|---|---|---|---|---|
| | Murder | Auto Theft | Robbery | Prison | Murder | Auto Theft | Robbery | Prison |
| ***One decade*** | | | | | | | | |
| 1970–1960 | 0.9 | 115 | 28 | 16 | 2.8 | 274 | 112 | −21 |
| 1980–1970 | 0.2 | 88 | 46 | 2 | 2.3 | 45 | 79 | 43 |
| 1990–1980 | 0.0 | 29 | 1 | 14 | −0.8 | 154 | 6 | 158 |
| 2000–1990 | −0.6 | 110 | −13 | −4 | −3.9 | −244 | −112 | 181 |
| 2010–2000 | −0.2 | −250 | −9 | 10 | −0.7 | −173 | −26 | 19 |
| ***Two decades*** | | | | | | | | |
| 1980–1960 | 1.1 | 203 | 74 | 18 | 5.1 | 319 | 191 | 22 |
| 1990–1970 | 0.2 | 117 | 47 | 16 | 1.5 | 199 | 85 | 201 |
| 2000–1980 | −0.6 | 139 | −12 | 10 | −4.7 | −90 | −106 | 339 |
| 2010–1990 | −0.8 | −140 | −23 | 6 | −4.6 | −417 | −138 | 200 |
| ***Three decades*** | | | | | | | | |
| 1990–1960 | 1.1 | 232 | 75 | 32 | 4.3 | 473 | 197 | 180 |
| 2000–1970 | −0.4 | 227 | 33 | 12 | −2.4 | −45 | −27 | 382 |
| 2010–1980 | −0.8 | −111 | −22 | 20 | −5.4 | −263 | −132 | 358 |
| ***Four decades*** | | | | | | | | |
| 2000–1960 | 0.5 | 342 | 61 | 28 | 0.4 | 229 | 85 | 361 |
| 2010–1970 | −0.6 | −23 | 24 | 22 | −3.1 | −218 | −53 | 401 |
| ***Five decades*** | | | | | | | | |
| 2010–1960 | 0.3 | 92 | 52 | 38 | −0.3 | 56 | 59 | 380 |

*Table 2*
Estimated Effect of Prison on Crime:
U.S.-Canadian Comparisons

| | Naive | | | Adjusted | | |
|---|---|---|---|---|---|---|
| | Murder | Auto Theft | Robbery | Murder | Auto Theft | Robbery |
| ***One decade*** | | | | | | |
| 1970–1960 | −0.05 | −4.32 | −2.28 | −0.03 | −2.59 | −1.37 |
| 1980–1970 | 0.05 | −1.05 | 0.81 | 0.03 | −0.63 | 0.49 |
| 1990–1980 | −0.01 | 0.87 | 0.03 | 0.00 | 0.52 | 0.02 |
| 2000–1990 | −0.02 | −1.92 | −0.53 | −0.01 | −1.15 | −0.32 |
| 2010–2000 | −0.06 | 8.43 | −1.81 | −0.04 | 5.06 | −1.08 |
| ***Two decades*** | | | | | | |
| 1980–1960 | 0.96 | 27.98 | 28.28 | 0.57 | 16.79 | 16.79 |
| 1990–1970 | 0.01 | 0.44 | 0.21 | 0.00 | 0.26 | 0.12 |
| 2000–1980 | −0.01 | −0.70 | −0.29 | −0.01 | −0.42 | −0.17 |
| 2010–1990 | −0.02 | −1.43 | −0.59 | −0.01 | −0.86 | −0.36 |
| ***Three decades*** | | | | | | |
| 1990–1960 | 0.02 | 1.62 | 0.82 | 0.01 | 0.97 | 0.49 |
| 2000–1970 | −0.01 | −0.74 | −0.16 | 0.00 | −0.44 | −0.10 |
| 2010–1980 | −0.01 | −0.45 | −0.33 | −0.01 | −0.27 | −0.20 |
| ***Four decades*** | | | | | | |
| 2000–1960 | 0.00 | −0.34 | 0.07 | 0.00 | −0.20 | 0.04 |
| 2010–1970 | −0.01 | −0.52 | −0.20 | 0.00 | −0.31 | −0.12 |
| ***Five decades*** | | | | | | |
| 2010–1960 | 0.00 | −0.11 | 0.02 | 0.00 | −0.06 | 0.01 |

presents naive and adjusted estimates of the effect of punishment on crime. The naive estimates are the difference-in-difference for the given crime rate (i.e., the U.S.-Canadian difference in the temporal growth rate) relative to the difference-in-difference for the incarceration rate. The adjusted estimates are discounted by 0.6, reflecting the conceptual discussion above.

These estimates indicate that there are often quite violent swings in crime rates that have little to do with changes in penal policy. This is consistent with a potential identification problem, which is that in the medium run, changes in incarceration rates may be a response to changes in crime. Our preferred difference is the longest difference in the data. We are persuaded that the U.S.-Canadian difference in response to crime between 1960 and 2010 has less to do with crime than it has to do with politics and culture. Even if the dramatic run-up in incarceration rates in the United States were reflective of a response to crime, it was plausibly a response to the crime wave of the 1960s and 1970s, and not to current conditions.

Our preferred 2010–1960 difference indicates very small effects of prison on crime. These are consistent with zero and are generally small in magnitude. However, the 2010–1970 difference is essentially as credible on a priori grounds to us and is more consistent with the idea that prison is protective against crime. Plainly, more data are needed to triangulate.

We turn now to the data from England and Wales. Figure 4 is structured analogously to Figure 2, and Tables 3 and 4 are structured analogously to Tables 1 and 2. The results for England and Wales depend less on the base year. The estimates for both 2010–1960 and 2010–1970 indicate that prison may indeed be protective against crime.

## 4. PANEL DATA REGRESSIONS

We estimate

$$C_{ct} = \alpha_c + \delta_t + \gamma Q_{ct} + \epsilon_{ct} \tag{4}$$

where $C$ is either robbery, homicide, or auto theft. These results are in Table 5. Table 6 lists the number of observations each country contributes to these regressions. The results are quite sensitive to specification, with the seemingly innocuous change from levels to logs changing the sign of the robbery estimate.

*Figure 4*
Imprisonment and Crime: United States and England and Wales

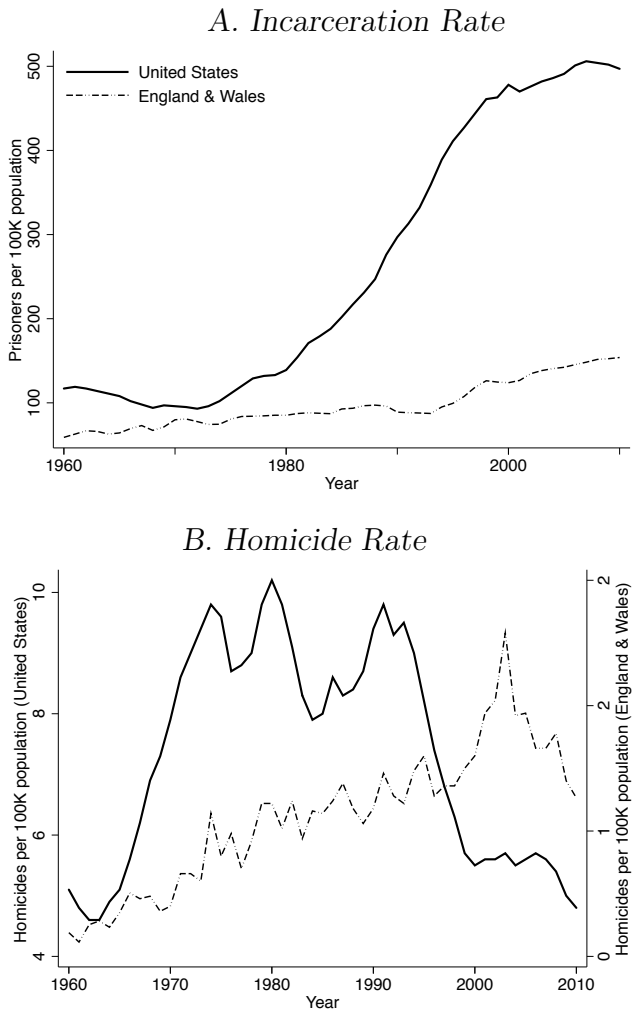
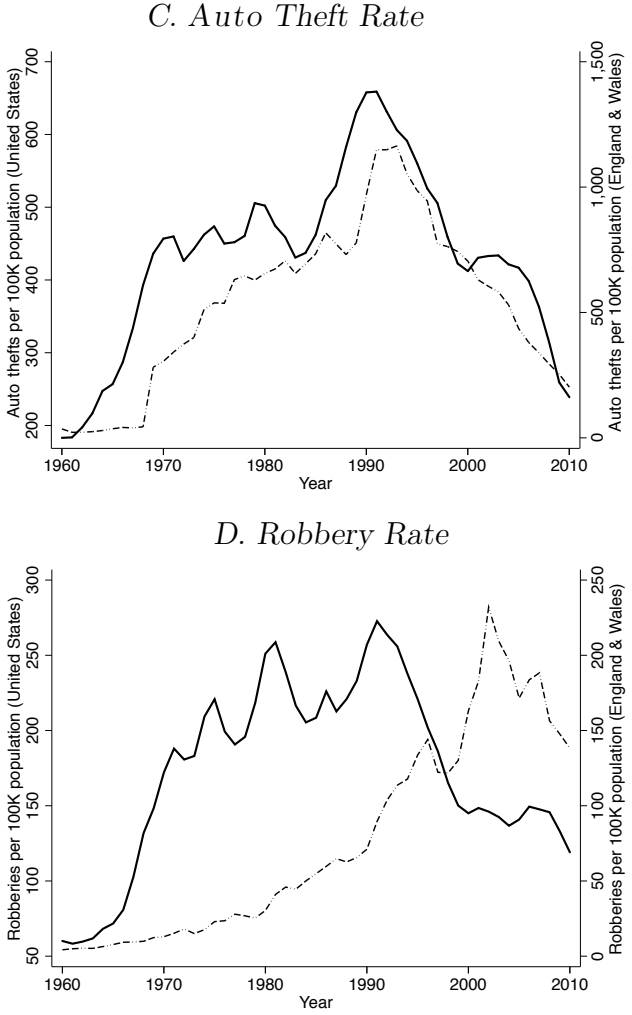


*Figure 4*
(*continued*)




Source: See text, pp. 170–71.

*Table 3*
Log Differences in Crime and Incarceration Rates

| | England and Wales | | | | United States | | | |
|---|---|---|---|---|---|---|---|---|
| | Murder | Auto Theft | Robbery | Prison | Murder | Auto Theft | Robbery | Prison |
| ***One decade*** | | | | | | | | |
| 1970–1960 | 0.11 | 269.33 | 8.71 | 20.92 | 2.8 | 273.8 | 112.0 | −21 |
| 1980–1970 | 0.41 | 350.95 | 17.39 | 5.32 | 2.3 | 45.4 | 79.0 | 43 |
| 1990–1980 | −0.02 | 314.81 | 40.75 | 3.75 | −0.8 | 155.6 | 5.9 | 158 |
| 2000–1990 | 0.21 | −265.92 | 91.95 | 34.95 | −3.9 | −245.6 | −112.0 | 181 |
| 2010–2000 | −0.17 | −502.55 | −24.80 | 29.97 | −0.7 | −173.4 | −25.9 | 19 |
| ***Two decades*** | | | | | | | | |
| 1980–1960 | 0.52 | 620.28 | 26.09 | 26.24 | 5.1 | 319.2 | 191.0 | 22 |
| 1990–1970 | 0.39 | 665.76 | 58.13 | 9.07 | 1.5 | 201.0 | 84.9 | 201 |
| 2000–1980 | 0.19 | 48.89 | 132.70 | 38.70 | −4.7 | −90.0 | −106.1 | 339 |
| 2010–1990 | 0.04 | −768.47 | 67.15 | 64.92 | −4.6 | −419.0 | −137.9 | 200 |
| ***Three decades*** | | | | | | | | |
| 1990–1960 | 0.50 | 935.10 | 66.84 | 29.99 | 4.3 | 474.8 | 196.9 | 180 |
| 2000–1970 | 0.60 | 399.84 | 150.08 | 44.02 | −2.4 | −44.6 | −27.1 | 382 |
| 2010–1980 | 0.02 | −453.66 | 107.90 | 68.67 | −5.4 | −263.4 | −132.0 | 358 |
| ***Four decades*** | | | | | | | | |
| 2000–1960 | 0.71 | 669.18 | 158.79 | 64.94 | 0.4 | 229.2 | 84.9 | 361 |
| 2010–1970 | 0.43 | −102.71 | 125.28 | 73.99 | −3.1 | −218.0 | −53.0 | 401 |
| ***Five decades*** | | | | | | | | |
| 2010–1960 | 0.54 | 166.63 | 133.99 | 94.91 | −0.3 | 55.8 | 59.0 | 380 |

*Table 4*
Estimated Effect of Prison on Crime: U.S.–England and Wales Comparisons

| | Naive | | | Adjusted | | |
|---|---|---|---|---|---|---|
| | **Murder** | **Auto Theft** | **Robbery** | **Murder** | **Auto Theft** | **Robbery** |
| ***One decade*** | | | | | | |
| 1970–1960 | −0.06 | −0.11 | −2.46 | −0.04 | −0.06 | −1.48 |
| 1980–1970 | 0.05 | −8.11 | 1.64 | 0.03 | −4.87 | 0.98 |
| 1990–1980 | −0.01 | −1.03 | −0.23 | 0.00 | −0.62 | −0.14 |
| 2000–1990 | −0.03 | 0.14 | −1.40 | −0.02 | 0.08 | −0.84 |
| 2010–2000 | 0.05 | −30.00 | 0.10 | 0.03 | −18.00 | 0.06 |
| ***Two decades*** | | | | | | |
| 1980–1960 | −1.08 | 71.02 | −38.90 | −0.65 | 42.61 | −23.34 |
| 1990–1970 | 0.01 | −2.42 | 0.14 | 0.00 | −1.45 | 0.08 |
| 2000–1980 | −0.02 | −0.46 | −0.80 | −0.01 | −0.28 | −0.48 |
| 2010–1990 | −0.03 | 2.59 | −1.52 | −0.02 | 1.55 | −0.91 |
| ***Three decades*** | | | | | | |
| 1990–1960 | 0.03 | −3.07 | 0.87 | 0.02 | −1.84 | 0.52 |
| 2000–1970 | −0.01 | −1.31 | −0.52 | −0.01 | −0.79 | −0.31 |
| 2010–1980 | −0.02 | 0.66 | −0.83 | −0.01 | 39.00 | −0.50 |
| ***Four decades*** | | | | | | |
| 2000–1960 | 0.00 | −1.49 | −0.25 | 0.00 | −0.89 | −0.15 |
| 2010–1970 | −0.01 | −0.35 | −0.55 | −0.01 | −0.21 | −0.33 |
| ***Five decades*** | | | | | | |
| 2010–1960 | 0.00 | −0.39 | −0.26 | 0.00 | −0.23 | −0.16 |

*Table 5*
Estimated Effect of Prison on Crime, World Panel

| | *Dependent variable is crime per 100,000 population* | | | | | |
|---|---|---|---|---|---|---|
| | **Robbery** | **Homicide** | **Auto Theft** | ***ln* (Robbery)** | ***ln* (Homicide)** | ***ln* (auto theft)** |
| Incarceration rate | 0.028 | −0.010 | −0.336 | | | |
| | (0.028) | (0.002) | (0.102) | | | |
| *ln* (Incarceration rate) | | | | 0.312 | −0.333 | −0.232 |
| | | | | (0.078) | (0.043) | (0.077) |
| Adjusted $R^2$ | −0.054 | −0.015 | −0.044 | −0.028 | 0.043 | −0.048 |
| Observations | 649 | 591 | 529 | 649 | 591 | 529 |

Note: Standard errors in parentheses.

We also estimate the log difference regression

$$C_{ct} - C_{ct-s} = \beta(Q_{ct} - Q_{ct-s}) + \mu_{ct} \quad (5)$$

as a function of the lag length, $s$. These results are in Figure 5, with the solid lines representing point estimates and the dashed lines the 95 percent confidence intervals. Table 7 lists the number of observations each country contributes to the regressions.

On a priori grounds, we prefer these results to those of Table 5 because they focus on long-run differences, which are less affected by the mechanical relationship between incarceration and crime. However, the results of this empirical exercise are difficult to interpret because of the differing composition of countries. Nonetheless, bracketing the issue on composition, some conclusions may be drawn. First, for homicide and auto theft, the short-run estimates tend to be more positive than those 5 to 10 years out. This is somewhat consistent with a deterrence hypothesis, with the short-run estimates contaminated by the short-run reduction in the flow rate into prison. As discussed above, this effect exerts a positive bias on the estimated coefficients. However, the same tendency is not present for robbery, warning against strong interpretation. Second, after 20 years, according to the data, incarceration tends to have much smaller negative effects—and possibly large and positive effects—on

*Table 6*
Distribution of Country Observations for Regressions of Table 5

| Country | Dependent Variable | | | First Year of Data |
|---|---|---|---|---|
| | Robbery | Homicide | Auto Theft | |
| United States | 41 | 41 | 41 | 1970 |
| Canada | 39 | 39 | 15 | 1970 |
| England & Wales | 41 | 41 | 41 | 1970 |
| Australia | 24 | 17 | 15 | 1982 |
| Austria | 13 | 16 | 15 | 1994 |
| Belgium | 10 | 10 | 10 | 2000 |
| Bulgaria | 27 | 32 | 15 | 1970 |
| Croatia | 11 | 11 | 10 | 1994 |
| Czech Republic | 17 | 1 | 17 | 1993 |
| Denmark | 17 | 17 | 17 | 1993 |
| Estonia | 14 | 16 | 17 | 1993 |
| Finland | 23 | 17 | 17 | 1987 |
| France | 13 | 16 | 16 | 1994 |
| Greece | 15 | 15 | 12 | 1993 |
| Hungary | 26 | 17 | 17 | 1982 |
| Ireland | 10 | 16 | 17 | 1993 |
| Italy | 17 | 17 | 17 | 1993 |
| Japan | 26 | 15 | 13 | 1980 |
| Latvia | 15 | 15 | 15 | 1995 |
| Lithuania | 17 | 17 | 17 | 1993 |
| Macedonia | 13 | 9 | 9 | 1990 |
| Netherlands | 21 | 16 | 17 | 1987 |
| New Zealand | 15 | 15 | 15 | 1994 |
| Northern Ireland | 17 | 16 | 17 | 1993 |
| Norway | 17 | 17 | 17 | 1993 |

*(continued)*

*Table 6*
*(continued)*

| Country | Dependent Variable | | | First Year of Data |
|---|---|---|---|---|
| | Robbery | Homicide | Auto Theft | |
| Poland | 17 | 17 | 17 | 1993 |
| Russia | 12 | 12 | 9 | 1994 |
| Scotland | 26 | 17 | 17 | 1982 |
| Serbia | 8 | 8 | 8 | 2002 |
| Slovenia | 17 | 15 | 16 | 1993 |
| South Africa | 14 | 14 | 14 | 1994 |
| Sweden | 23 | 17 | 17 | 1987 |
| Switzerland | 17 | 16 | 1 | 1993 |
| Turkey | 16 | 16 | 16 | 1993 |
| Total observations | 649 | 591 | 529 | |

Source: See text, p. 171.

*Figure 5*
World Panel Log Difference Regressions

*A. Homicide Rate*

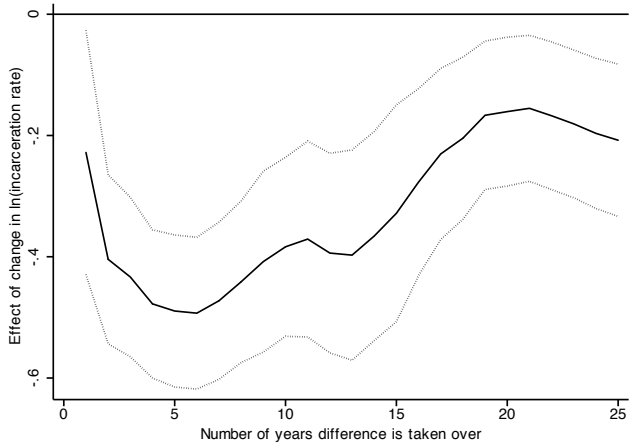
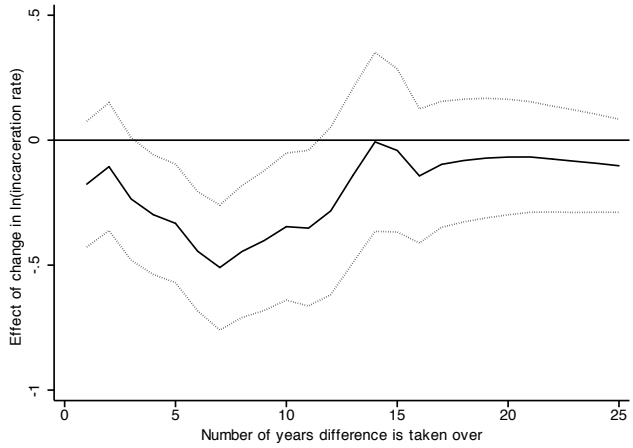


*Figure 5*
(*continued*)

*B. Auto Theft Rate*




*C. Robbery Rate*

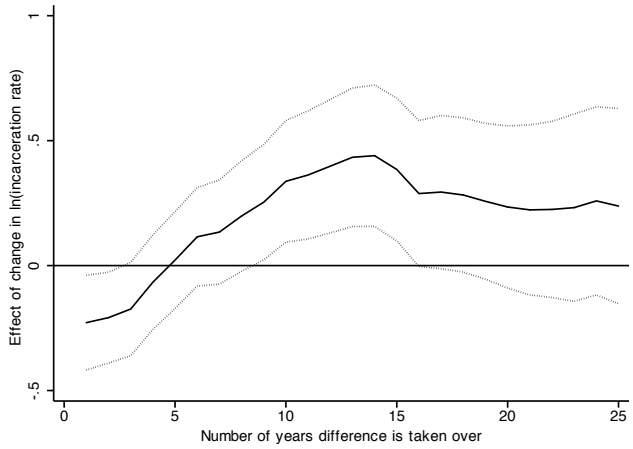


*Table 7*
Distribution of Country Observations for Regressions of Figure 5

| | *Dependent variable and number of years over which difference is taken* | | | | | |
|---|---|---|---|---|---|---|
| | **Robbery** | | **Homicide** | | **Auto Theft** | |
| **Country** | **1 year** | **10 years** | **1 year** | **10 years** | **1 year** | **10 years** |
| United States | 40 | 31 | 40 | 31 | 40 | 31 |
| Canada | 37 | 29 | 37 | 29 | 0 | 0 |
| England & Wales | 40 | 31 | 40 | 31 | 40 | 31 |
| Australia | 20 | 13 | 16 | 7 | 14 | 5 |
| Austria | 12 | 3 | 15 | 6 | 6 | 5 |
| Belgium | 9 | 0 | 9 | 0 | 9 | 0 |
| Bulgaria | 23 | 17 | 23 | 22 | 14 | 5 |
| Croatia | 9 | 1 | 9 | 1 | 9 | 0 |
| Czech Republic | 16 | 7 | 0 | 0 | 0 | 7 |
| Denmark | 16 | 7 | 16 | 7 | 16 | 7 |
| Estonia | 12 | 5 | 15 | 6 | 16 | 7 |
| Finland | 22 | 13 | 16 | 7 | 16 | 7 |
| France | 12 | 3 | 15 | 6 | 15 | 5 |
| Greece | 14 | 5 | 14 | 5 | 5 | 2 |
| Hungary | 23 | 16 | 16 | 7 | 16 | 7 |
| Ireland | 9 | 0 | 15 | 6 | 6 | 7 |
| Italy | 16 | 7 | 16 | 7 | 16 | 7 |
| Japan | 22 | 16 | 14 | 5 | 12 | 3 |
| Latvia | 14 | 5 | 14 | 5 | 5 | 5 |
| Lithuania | 16 | 7 | 16 | 7 | 16 | 7 |
| Macedonia | 10 | 3 | 8 | 0 | 8 | 0 |
| Netherlands | 19 | 11 | 15 | 6 | 16 | 7 |
| New Zealand | 14 | 5 | 14 | 5 | 14 | 6 |
| Northern Ireland | 16 | 7 | 15 | 6 | 16 | 7 |
| Norway | 16 | 7 | 16 | 7 | 16 | 7 |
| Poland | 16 | 7 | 16 | 7 | 16 | 7 |
| Russia | 11 | 2 | 11 | 2 | 2 | 0 |
| Scotland | 23 | 16 | 16 | 7 | 16 | 7 |
| Serbia | 7 | 0 | 7 | 0 | 7 | 0 |
| Slovenia | 16 | 7 | 14 | 5 | 15 | 6 |
| South Africa | 13 | 4 | 13 | 4 | 4 | 4 |
| Sweden | 22 | 13 | 16 | 7 | 16 | 7 |
| Switzerland | 16 | 7 | 15 | 6 | 6 | 0 |
| Turkey | 15 | 6 | 15 | 6 | 15 | 6 |
| Total observations | 596 | 311 | 547 | 263 | 496 | 212 |

Source: See text, p. 171.

crime. For homicide, the long-run estimate is approximately −0.20. For auto theft, it is close to −0.10, and for robbery it is roughly 0.25. This is potentially consistent with short-run deterrence effects that are negative and general equilibrium effects that are positive. Overall, however, we caution against strong interpretation based on the regression estimates.

## 5. CONCLUSION

Since the data are not definitive, a natural question is whether there is evidence against a stark prior. An example of such a stark prior is one that posits no general equilibrium effects and large deterrence effects of punishment. We see three key problems with such an interpretation of the data. First, while in the 1990–2010 period incarceration was generally on the rise in the United States and crime was on the decline, incarceration was rising faster in the 1970–1990 period and no decline in crime was evident. Indeed, crime was rising. Of course, the increase in crime may well have been the impetus for the increased sentences that led to higher incarceration rates.

Second, however, U.S. fluctuations in crime rates are not without peer. Figure 2 indicates that Canadian crime, particularly homicide and robbery, has turning points similar to the U.S. series. This is despite the fact that Canadian incarceration rates are essentially flat over the last 40 years. While Canadian auto theft's turning point is roughly five to seven years after that of the United States, the turning point for England and Wales is essentially the same. However, homicide and robbery in England and Wales turn 10–12 years after they do in the United States. In all three countries, crime is on the decline for all three of these crime types in recent years. This indicates that it is not necessary to have an explosive expansion in prison capacity to see major crime declines, since neither Canada nor England and Wales expanded their prison capacity, yet they eventually saw crime declines.

Third, the timing of the story works poorly. As noted above, an increase in sentence lengths takes some time to work its way through to increases in prison population. Using an example in which we calibrate to U.S. data in 1970, we show that the "python" is not done "swallowing the pig" even after a decade: sentence lengths affect prison populations with a long lag. This implies that the increase in prison population between 1990 and 2000, say, was likely the result

of changes to sentencing policy put in place in 1980–85. However, the data contain little evidence of this timing.

Overall, we can hardly doubt that, ceteris paribus, an increase today in the sentence length confronting a potential offender does not have a positive influence on the probability that a nonincarcerated person will commit a crime. This channel would weakly reduce crime. We certainly do not doubt that the same increase in the sentence length would lead to increases in prison stays for those who do elect to commit crime. However, we are not persuaded that these are the only two relevant effects of a shift in punishment policy on the aggregate crime rate. Future work should focus on research designs capable of teasing out these important, but elusive, mechanisms.

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