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The Impact of Crack Cocaine

by

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Abstract

A wide range of social indicators turned sharply negative for Blacks in the late 1980s. We argue that crack cocaine played an important role. Empirical analysis of crack has been hindered by the absence of a good proxy for crack. We demonstrate that with the arrival of crack, outcomes that were previously weakly related to one another begin to exhibit a high degree of correlation. Based on that observation, we use factor analysis to construct a crack index. Our index reproduces many of the spatial and temporal patterns described in ethnographic and popular accounts of the crack epidemic. We find that the presence of crack is strongly associated with increased youth homicide rates and much more weakly related to adult homicide rates and other types of violent and property crime. A relationship between crack and the rate of low birth weight babies, the fraction of children in foster care, fetal death rates, and death rates of children aged one to four, and new AIDS infections is also found. No relationship between crack and unemployment rates or poverty rates is uncovered. In work that is not yet complete, we intend to reanalyze the relationship between concealed weapons laws and crime and legalized abortion and crime to determine the extent to which prior results have been spuriously driven by the failure to control for crack.

I. Introduction

Blacks in the United States have shown long term improvements on a wide range of social and economic indicators. Over the past thirty years, for instance, the black-white ratio of median earnings for male full-time workers increased from .5 to .73 (Welch 2003), the black infant mortality rate fell by two-thirds (Almond, Chay, and Greenstone 2003), the fraction of blacks between the ages of 25-29 with four-year college degrees has increased nearly 3 fold (Blank 2001), and Black academic achievement (as measured by NAEP scores) has increased 0.6 standard deviations relative to whites (Grissmer, Flanagan, and Williamson 1998). The number of black entrepreneurs has more than doubled (Boston 2001). The number of blacks in congress has increased five-fold.[1] Similar advances have been made among high-level executives, professors and administrators at elite colleges and universities, and the fraction of blacks living in middle class neighborhoods. While black-white parity on these outcomes has not been fully achieved, the 20th century proved to be one of unparalleled convergence.

Black progress, however, has not been monotonic. In particular, during the mid-1980s, some positive trends for blacks sharply reversed. Figure 1 presents aggregate U.S. time series data for Blacks and Whites for recent decades for a variety of social and economic outcomes.[2] Between the mid-1980s and the early-1990s, Black youth homicide tripled. Gun arrests rose sharply, as did the number of children under the supervision of the foster care system. The rate of low birth weight babies and fetal deaths

[1] See http://www.house.gov/ebjohnson/cbchistorymain2.htm.
[2] We describe the data sources, definitions, sample availability, and precise construction of these variables and others used in the paper in the data appendix.

also increased.[3] Substantial portions of the gains achieved by Blacks in preceding decades were lost in a period of seven years. Among Whites, the reversals in the late 1980s are more muted or completely absent.

In contrast to the patterns shown in Figure 1, other social and economic outcomes for Blacks continued to improve in the late 1980s. The homicide rate for blacks 25 and older was steadily falling. The standard measures of economic and labor market success – poverty rates, wages, and labor supply – showed little break from trend (Blank 2001). This evidence is consistent with a *cohort specific* negative shock for blacks in the mid to late 1980's that affected outcomes that are associated with Black youth. The most likely shock of this kind, we argue, is the rise of crack cocaine.[4]

Crack cocaine is a smoked version of cocaine that provides a short, but extremely intense, high. The invention of crack represented a technological innovation that dramatically widened the availability and use of cocaine in inner cities. Virtually unheard of prior to the mid-1980s, crack spread quickly across the country, particularly within Black and Hispanic community (CITE). The timing of crack's rise, as proxied by a range of indicators presented in Figure 2, corresponds closely with the patterns in other social indicators. Mentions of crack in a Lexus-Nexus search of major newspapers, the frequency of emergency room visits for smoked cocaine, and the number of arrests on cocaine-related drug charges all show tremendous increases between 1985 and the early 1990s, before leveling out or declining thereafter.

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[3] Neal (2004) provides further evidence of this downturn in black fortunes. For instance, Black educational achievement measures also fell substantially.

[4] Ferguson (2001) argues that the rise in popularity of hip-hop music is to blame for the divergence in black-white test score gaps in 1988. McWhorter (2003) makes a similar argument.

In spite of the general appreciation of the potential role that crack may have played in driving the patterns observed in the data (e.g., Bennett et al. 1996, Wilson 1990), especially with respect to the Black youth homicide spike (Cook and Laub 1998, Blumstein and Rosenfeld 1998, Levitt 2004), there has been remarkably little rigorous empirical analysis of crack's rise and its corresponding social impact. The scarcity of research appears to be due in part to the great difficulty associated with constructing reliable quantitative measures of the timing and intensity of crack's presence in local geographic areas. Cork (1999), for instance, uses cocaine-related arrests as a proxy for crack. Grogger and Willis (2000) use breaks from trend in cocaine-related emergency room visits in a sample of large cities, as well as survey responses from police chiefs in these cities to measure the timing of crack's arrival. Corman and Mocan (2000) use drug deaths, but the data do not specify which drug is responsible. While individual measures such as cocaine arrests, emergency room visits, and drug deaths are presumably correlated with crack prevalence, they are likely to be quite noisy proxies. Both measures are a function not just of crack usage, but also reflect powder cocaine. Cocaine arrests fluctuate with the degree to which law enforcement in a particular city is targeting crack use and distribution as a priority. Emergency room data are available for a limited number of hospitals in a small sample of cities and the extent to which extreme events mirror broader crack usage is unknown.

In this paper, we adopt a different strategy for constructing a crack cocaine proxy. The basic idea underlying our approach is that the presence of crack in a community causes a set of otherwise disparate social indicators to covary. Table 1 presents cross-city and cross-state correlations for a set of outcomes in the years 1977-1984 (before crack

became popular), 1985-1992 (roughly the peak years for crack), and 1993-2000. The city sample includes the 100 most populous cities in the United States in 1980. The measures we have available differ at the city and state level. Prior to crack's arrival, these measures are essentially uncorrelated. The mean off-diagonal element in the top panel of Table 1 is .02 for cities and .03 for states. For both cities and states, negative correlations are at least as common as positive correlations. In the time period widely thought to coincide with the peak of the crack era, the measures become positively correlated. For both cities and states, the mean off-diagonal element now has a value of .26 for cities and .25 for states, and at least 12 of the 15 individual elements have a positive sign. In the later part of the sample, when crack was in decline, the correlations shrink to .09 for cities and .07 for states.

We formalize the insight that a seemingly diverse set of outcomes covary in the presence of crack, using factor analysis to isolate that common component. We label that common factor "crack," recognizing that it may in practice reflect other influences beyond crack. The patterns we observe in this factor correspond closely with conventional wisdom regarding crack (e.g. the timing of its rise and fall, the concentration in central cities and among Blacks and Hispanics), strengthening our case for labeling this factor as crack. Relative to other applications of factor analysis, the setting we analyze has the important advantage that we have strong prior beliefs that crack use was virtually non-existent prior to 1985. The existence of this pre-crack period allows us to differentiate the crack factor from any prior factors that may have exerted a common influence on the outcomes in the earlier period.

Our measure captures the intensity of crack's presence in a particular place and time and can be constructed for a wide variety of geographic areas. Thus far, we have estimated our crack index annually for large cities and states over the period 1976-1999. We intend to make these data available to other researchers.[5]

We address three separate questions in this paper. First, using the crack index, we describe the patterns in cracks rise and fall. We find that crack rises sharply beginning in 1985, peaks in 1989 and slowly declines thereafter. At the end of our sample in 1999, however crack remains at roughly 60 percent of its peak level. Crack is concentrated in central cities, particularly those with large Black and Hispanic populations. Most cities exhibit a pattern that broadly mirrors the national time series; a substantial number of other cities never experience a significant crack problem. A small number of cities, most notably Minneapolis and Baltimore, see crack peaking at the end of the sample.

The second question we address is the magnitude of crack's impact on a variety of social, criminological, and economic outcomes. We find that crack's rise was associated with a doubling of the youth homicide rate in large cities (a 55 percent increase for the nation as a whole), but increased the nation's overall violent crime rate by less than six percent and raised property crime by only one percent. For a range of other variables (low birth weight babies, the percent of children in foster care, death rates of children aged one to four, fetal deaths, and new AIDS infections), we find evidence of an association with crack. We find little relationship between crack and economic outcomes such as unemployment or poverty rates.

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[5] Not yet, but as soon as we have final numbers they will soon be posted on Roland Fryer's [http://post.economics.harvard.edu/faculty/fryer/fryer.html] or Steven Levitt's [http://www.src.uchicago.edu/users/levit/recentpublications.htm] web page.

The third set of questions we intend to analyze in the paper (but haven't gotten to yet) is the extent to which the failure of previous studies to control for crack may have biased the reported findings. Ayres and Donohue (2003) conjecture that the findings of Lott and Mustard (1997) and Lott (2000) regarding the impact of concealed weapons laws are spurious, driven by the omitted variable crack cocaine. Sailer (1999) and Joyce (2004) level the same charges at Donohue and Levitt's (2001) analysis of the impact of legalized abortion on crime.

The remainder of the paper is structured as follows. Section II provides a brief history of crack and a review of the relevant literature. Section III lays out the empirical strategy used in the paper. Section IV describes the data that we use. Section V reports our basic results of our estimates of a crack index. Section VI assesses the determinants of the timing and intensity with which crack hits a city, and the extent to which crack can account for the observed fluctuations in social indicators since 1985. The (not yet completed) Section VII will reanalyze the previous findings regarding concealed weapons laws and legalized abortion, taking into account the impact of crack. Section VIII concludes. The appendix outlines the sources of data used and the precise construction of the variables.

Section II: A Brief History of Crack Cocaine

Cocaine is a powerful and addictive stimulant first extracted from the coca plant in 1862. During the 19th century, cocaine had a variety of medical uses and could be purchased over the counter, including in the original version of Coca-Cola (Bayer 2000). In the 1970s, inhaled cocaine emerged as a popular but high priced recreational drug.

The street price of pure powder cocaine was roughly $100 to $200 per gram. The high price of cocaine had two important implications: (1) cocaine use was concentrated among the affluent, and (2) retail cocaine purchases required hundreds of dollars because it is impractical to transact in fractions of grams.[6]

Crack cocaine is a variation of cocaine made by dissolving powder cocaine powder in water, adding baking soda, and heating. The cocaine and the baking powder from an airy condensate, that when dried, takes the form of hard smokeable "rocks."[7] A pebble-sized piece of crack, which contains roughly one-tenth a gram of pure cocaine, sells for $10 on the street and provides an intense high, but one that lasts only fifteen minutes. Crack is an important technological innovation in many regards. First, crack can be smoked, which is an extremely effective means of delivering the drug psychopharmologically. Second, because crack is composed primarily of air and baking soda, it is possible to sell in small units containing small fractions of a gram of pure cocaine, opening up the market to consumers wishing to spend $10 at a time. Third, because the drug is extremely addictive and the high that comes from taking the drug is so short-lived, it quickly generated a large following of users wishing to purchase at high rates of frequency. The profits associated with selling crack quickly eclipsed that of other drugs. Furthermore, unlike most other drugs, crack is often sold in open air market, high volume markets between sellers and buyers who do not know one another.

There are three primary reasons why it is believed that crack may have been so devastating to the Black community. First, street gangs, which already controlled outdoor spaces, became the logical sellers of crack (Venkatesh and Levitt 2000). Gang

[6] A gram weighs about as much as a dime.

[7] Crack differs from freebase cocaine because the creation procedure lacks the final step of removing the base from the mixture.

violence, primarily as a means of establishing and maintaining property rights, grew dramatically, and potentially accounts for the sharp rise in Black youth violence. Second, the increased returns associated with drug dealing attracted young Black males to the gang and may have reduced educational investment. Third, a large fraction of crack users were young women. Prostitution was common among female crack addicts, potentially accelerating the spread of AIDS and the unwanted birth of low birth weight "crack babies."[8] Crack addicted mothers are unlikely to provide nurturing home environments for their children (and often ended up incarcerated), leading to the relinquishing of parental rights.

Section III: A Strategy for Constructing a Crack Index

The prevalence of crack cocaine is not directly observable. Consequently, we must adopt an indirect identification strategy. To understand the intuition behind our approach, it is useful to begin by thinking about a hypothetical world in which crack is observable and influences a set of outcomes as follows:

$$Y_{ist} = \beta_i Crack_{st} + Z_{st}\Gamma_i + \varepsilon_{ist} \qquad \beta_i > 0 \ \forall_i \qquad (1)$$

where i indexes outcome variables, s corresponds to a geographic area such as a city or state, and t represents time. The variable Y stacks a wide range of outcomes that are potentially influenced by crack, e.g. youth homicide, proportion of low birth weight babies, emergency room visits for crack, newspaper mentions of crack, etc. In this simple setup, crack is assumed to have a positive and linear impact on all of these

[8]Note, however, that the consensus in the recent medical literature is that there are few long term effects of crack exposure in utero, once you control for the mother's alcohol and tobacco consumption. (Frank et. al. 2001, Zuckerman, Frank, and Mayes 2002, and

outcomes, with the coefficient on crack varying across outcomes as reflected in the subscript i on β. In addition to crack, there is a set of other covariates Z also influences the dependent variable and an error term that is uncorrelated with the other regressors. One could also include fixed effects by geography or time (as we will do in the empirical analysis), but for simplicity in exposition these are omitted for the time being.

In practice, we do not observe the variable *Crack* and we may or may not have the full set of other covariates. Nonetheless, a shock to *Crack* will be manifested in the outcomes Y (which are observed) in two ways. First, more crack in a particular place and time will be associated with higher levels of each of the i different outcome measures of interest. Second, the more crack there is, the more highly correlated the outcome measures are likely to become, since crack acts as a common shock moving all of the outcomes in the same direction.[9]

Our identification strategy, therefore, hinges on measuring fluctuations in the outcome variables, which allows us to back out estimates of the implied movements in crack. We are aided in this endeavor by the existence of a period before which crack was virtually unknown, which we refer to as the "pre-period." In that pre-period, equation (1) simplifies to

$$Y_{ist} = Z_{st}\Gamma_i + \varepsilon_{ist} \qquad (2)$$

One could estimate equation (2) by ordinary least squares if the Z variables were observed. Since we are both uncertain about the appropriate set of covariates and not directly focusing on the coefficients of these variables, we instead adopt an alternative approach. We estimate equation (2) using factor analysis, which generates predicted

[9] A third impact of crack, as long it is not uniform across time and place, is to raise the variance of the outcome variables. Although we do not exploit this prediction in our identification strategy, empirically it is indeed true that the variance of the outcomes we examine rose sharply with the arrival of crack.

values both for a set of factors Z and a set of coefficients (also known as loadings) Γ_i.[10] Mathematically, factor analysis identifies the eigenvectors (the factors) and corresponding eigenvalues (the loadings) of the variance-covariance matrix of the Y variables. In terms of intuition, however, it is easier to think of the factors in terms of the underlying forces that they are reflecting, such as family environment, the criminal justice system, economic conditions, etc. The loadings tell us the degree to which each estimated factor influences the different outcome variables. For simplicity in exposition, we focus on the case where there is one relevant factor in the pre-crack period, although the results readily generalize and we allow for multiple factors in our empirical work.

Formally, our strategy for estimating the crack index follows a three-step process. In the first step, we use factor analysis to estimate equation (3), limiting the sample to the period prior to 1985.the pre-period factor and loadings using only the data from before crack arrives:

$$Y_{ist} = Z_{st}\Gamma_i + \varepsilon_{ist} \qquad for\ t < 1985 \qquad (3)$$

In order to identify the crack variable, one needs to impose assumptions on how the pre-existing factor Z and the loadings Γ_i change across periods. The fundamental identifying assumption that we make is to restrict the loadings Γ_i to remain constant across periods. In other words, a change in Z is restricted to affect the various outcome measures in the same relative proportions in the two periods.[11] For instance, if the pre-

[10] We follow standard practice of normalizing the various outcome measures included on the left-hand side to have mean zero and variance one whenever we do factor analysis.

[11] The coefficients in these models are identified only up to a factor of proportionality, so one of the coefficients can be normalized without loss of generality.

existing factor were to reflect differences in the severity of the criminal justice system across places, and criminal justice is more strongly related to arrests than low birth weight babies before crack, then we would assume the same relationship to be true after crack arrives. Having imposed this restriction on the loadings, we place no restrictions on the values that the pre-existing factor Z can take, allowing it to vary arbitrarily across cities and years. This step is accomplished by simply running a separate OLS regression for each city and year starting in 1985 where the dependent variable is *Y* (now normalized to have mean 0 and variance one in the period after crack arrives) and the regressor is the *loading* on the pre-crack factor. The regression coefficient obtained is the best estimate of the magnitude of the pre-crack factor for that city and year, which we denote $\hat{Z}_{st}^{Pre}$. This approach attributes as much of the variation as possible to pre-existing factors, giving us a lower-bound on the estimate of the impact of crack. To the extent that the pattern of effects of crack and the pre-period factor are similar, we will mistakenly attribute some of the impact of crack to the pre-period factor.[12]

The final step in the estimation is to use factor analysis to estimate the crack factor, having removed any possible explanatory impact of the pre-existing factor *Z*:

$$Y_{ist} - \hat{Z}_{st}\hat{\Pi}_i = \beta_i Crack_{st} + \varepsilon_{ist} \qquad (4)$$

The β coefficients represent the loadings of the crack factor on each of the outcome variables, and *Crack* is our estimate of the extent of crack in a given city and year.

[12] In practice, the factor estimated in the pre-crack period and the crack factor are almost orthogonal, so that the results are not sensitive to how we treat the pre-period factor.

A simple example

To make the intuition underlying our identification strategy as clear as possible, it is worth considering the simplest case: exactly two periods (pre-crack and crack), a single city, and only two outcome variables Y_1 and Y_2. The system of equations to estimate the pre-crack outcomes in that case is given by

$$Y_1^{pre} = \gamma_1 Z^{pre} \qquad (5)$$
$$Y_2^{pre} = \gamma_2 Z^{pre}$$

where the superscript "*pre*" denotes the period prior to crack. A one factor model perfectly fits the data since there are only two data points in the pre-crack period (one for each outcome variable) and the model has three degrees of freedom (γ_1, γ_2, and, Z^{pre}). Figure 3 presents the solution to the model graphically. The horizontal and vertical axes correspond to the two outcome variables. The point labeled "Pre-crack" represents the observed outcome pair (Y_1, Y_2). The length of the vector from the origin to that point is Z^{pre}. The slope of that vector is the ratio of γ_2/γ_1 and reflects the relative responsiveness of the two outcomes to the factor *Z*.

In the second step of our estimation we choose a value for *Z* in the crack period. The only restriction we impose is that the loadings from the pre-period continue to hold. In terms of the picture, that means that we maintain the same slope as in the pre-period (γ_2/γ_1). Subject to that restriction, we choose the vector Z^{post} which minimizes the unexplained portion of the crack-period outcomes. [13] The residual, labeled *Crack* in

[13] Because there is only one city and one period with crack in this simple example, there is only one Z^{post} to choose. In general, a separate Z^{post} would be estimated for each city and period in the crack era.

Figure 3, is the estimate of the contribution of crack from the third step in our procedure. In this simple case, we are able to perfectly fit the data in the crack period.

Note that a large change in the outcome variables with the onset of crack is not enough to ensure a big estimated impact of crack; the outcomes must also change in proportions that differ from the fluctuations induced by changes in the *Z* factor.

One final point we cannot stress enough is that, although we call the factor we identify "crack," in reality, what it captures is the set of phenomena that jointly influence our outcome measures in the period beginning in 1985 in ways that were not present in the data prior to 1985. Whether crack is truly the driving force, or just a symptom of other changes that were occurring, cannot be answered with factor analysis, which is purely descriptive. We will show that something changed radically in the mid-1980s and that change is concentrated among Blacks and Hispanics, especially in central cities, but to ultimately conclude that the cause was crack cocaine requires evidence beyond the statistical model.

Section IV: Data

We estimate the model described in the preceding section at the city-level and the state-level. The city-level analysis is carried out on the 100 cities with the highest population in 1980. These cities are of particular interest because anecdotal evidence suggests that the problems associated with crack were concentrated in large areas. In addition, a number of the variables we use are collected at the city-level, making it a natural unit of analysis. Focusing on the state-level allows us to incorporate additional proxies for crack that are not available for cities, as well as facilitating a linkage between

our work and previous empirical studies carried out using state data. In all cases, annual data are used.

We utilize a wide variety of outcome measures that may potentially be good proxies for crack.[14] At the city-level, these outcomes are crack-related emergency room visits, cocaine-related arrests, gun-related arrests, youth homicide rates, and the frequency of crack cocaine mentions in newspapers. The emergency room data is based on information from the Drug Abuse Warning Network (DAWN), which has been collected since 1978. These data initially covered 14 cities, with that number growing to 19 by the end of the sample. Arrest data are collected by city police departments and are available through the FBI's Uniform Crime Reports. Because of incomplete reporting, we follow Levitt (1998) and define our cocaine arrest measure as cocaine arrests as a fraction of total arrests in the city.[15] We include gun-related arrests as an outcome based on prior claims that illegal gun carrying rose sharply as a consequence of the crack trade (Blumstein 1995). This variable is also measured as a fraction of total arrests. We focus on aged 15-25 male homicide rates as opposed to overall homicide because the ethnographic evidence and time series patterns strongly suggest that crack-related violence was concentrated among juveniles and young adults (Cook and Laub 1998). Low birth weight babies serve as indirect measure of crack usage, as physiological evidence ties the use of crack cocaine by expectant mothers to these outcomes (Datta-Bhutada et. al 1996). Our measure of crack cocaine mentions in newspapers is the number of news articles in Lexis-Nexis with a city's name and the words "crack" and

[14] The exact data sources, definitions, and construction of each of the variables are described in greater detail in the appendix.

[15] Arrests for powder versus crack cocaine are not reported separately in the FBI data.

"cocaine," divided by the total number of articles with the city's name and the word "crime." By constructing the variable as a ratio, we avoid obvious problems associated with the fact that large cities and those with local newspapers included in Lexis-Nexis will appear much more frequently in the database.

The number of observations, means, and standard deviations for all of these city-level crack proxies are presented in the top panel of Table 2. Values are reported separately for the period prior to and after 1985 (the year when crack use is believed to have become widespread), and separately for Blacks and Whites in cases where a racial breakdown is available. Hispanics are not separately broken out in our data, with most Hispanics classified as Whites. Youth homicide and cocaine arrests are much higher after 1985 then before, especially for Blacks. Gun arrests and low birth weight babies, on the other hand are not substantially higher after 1985. Crack mentions in newspapers and emergency room visits for smoked cocaine are very low prior to 1985. Note that the number of observations available varies dramatically across measures due to differences in the cities covered by the data, as well as the years in which data are collected. The data appendix describes the statistical corrections that are done to account for missing values.

When conducting our analysis at the state level, we drop the emergency room and crack citation variables since these measures are available only for a limited number of large cities. The rest of our city-level measures are available at the state-level. In addition, some relevant variables are only available by state and thus are part of our state-level analysis, but not the city-level estimates. These additional variables are the percentage of the population in foster care (capturing the degradation of the home

environment) and the percentage of state prisoners that are female (reflecting the fact that a greater fraction of female crime is likely to be tied to crack use than for men). The number of observations, means and standard deviations for the state-level crack proxies are shown in the bottom panel of Table 2. The state-level results are generally similar to the city-level results, with the exception that youth homicide does not rise in the later period for Whites in the state data.

Section V: Estimates of the prevalence of crack across time and place

Table 3 presents our baseline estimates of the factor analysis loadings for both the pre-period factor and the crack factor. The first two columns report city-level results; the final two columns correspond to state-level data. In the baseline empirical estimation, we remove city fixed-effects from all variables as a safeguard against differences in reporting of variables across cities.

The loadings in the first column show that in the pre-crack years, gun arrests, low-birth weight babies, (and to a lesser degree) youth homicide tended to move together. Cocaine arrests, on the other hand, went in the opposite direction. Neither the crack newspaper citations nor the emergency room visits receive appreciable weight.

The loadings in the second column correspond to the crack factor in the city-level data. The crack factor has a positive loading on all of the outcomes; an increase in any of these variables raises the estimate of how much crack is present. This result is consistent with the fact that all of these variables strongly positively covary starting in 1985. The heaviest weights for the crack factor are for the newspaper citation ratio and cocaine

arrests. Youth homicides, ER visits related to crack, and low birth weight babies also receive substantial weight. Gun arrests receive the lowest weight.

Given how similar the time-series patterns are for the outcomes we examine (see Figures 1 and 2), it is perhaps unsurprising that the crack index we estimate loads in a reasonable manner on the outcomes examined. When we remove year fixed-effects from our variables prior to the estimation in columns 3 and 4, however, our identification does not come at all from the national patterns in Figures 1 and 2. Rather, only deviations in a city from these national trends are used. The loadings change substantially when this only this source of variation is used – now cocaine and gun arrests dominate the weights with homicide contributing somewhat. In spite of these different loadings, however, the aggregate time series pattern generated by columns (2) and (4) are still fairly similar, with a correlation between the mean estimates of crack by city in the two specifications of .53.

The state-level estimates share many similarities with the city-level estimates. In the pre-period, cocaine arrests move in the opposite direction of gun arrests. Low birth weight babies and youth homicide have small loadings. All of the outcomes receive positive loadings in the state-level crack factor, just as was the case with the city-level estimates. Cocaine arrests are once again among the strongest indicators of crack. Gun arrests also receive a heavy loading, mirroring the city-level estimates when year dummies are included. The two variables available only at the state level (foster care and the female fraction of prisoners) receive the lowest weights, but are nonetheless statistically different than zero. Removing year-fixed effects in the state-level sample reduces the importance of low birth weight babies and the female share of the prison population, but otherwise yields similar loadings.

Figure 4 presents our estimate of how a population-weighted aggregate crack index varies over time for the city-level and state-level analysis. The crack index is identified only up to a scale of proportionality, so the absolute units of the crack measure are not directly interpretable, nor can they be directly compared across the two figures.[16] The top panel of the figure shows results for the city-level analysis. The estimated crack prevalence rises slightly in 1985, and then quickly ascends to a peak in 1989.[17] After 1989, the crack index is generally falling. By the end of our sample in 1999, the index is about 40 percent below its peak. The state-level picture follows a similar pattern, except that the rise is slower, the peak comes four years later in 1993, and the ensuing decline is steeper. The patterns in Figure 4 fit well with anecdotal descriptions of the timing of crack. The most surprising aspect of the picture is that our crack index remains so high in 1999, a time in which many casual observers had declared the crack epidemic to have faded.[18]

If the factor we are estimating is indeed closely related to crack, then one would expect the impact on Blacks to be much stronger than on Whites. Because a number of our city-level and state-level indicators are not available separately by race, we are forced to take an indirect approach to identifying a race-specific crack index. Under the assumption that the loadings on the crack factor are the same for Blacks and Whites,

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[16] Although it should be noted that the District of Columbia is included in both our city and state analyses, which provides an indirect means of comparing the scales of the two pictures in Figure 2. The mean estimate for crack in District of Columbia is 2.57 in the city analysis and 3.60 in the state analysis, suggesting that the city-level crack measure should be inflated 40 percent to make the units equivalent to the state crack measure.

[17] Further evidence that crack is essentially non-existent prior to 1985 comes from specifications in which we use 1982 as the cut-off between the pre-crack and crack periods. For the years prior to 1985, the crack factor is uniformly low (lower than 1985) and shows almost no year-to-year variation.

[18] If we adjust our pre-period to end in 1982 so that we get estimates of the crack factor in the years 1983 and 1984, crack is estimated to be very close to zero in those years, providing further evidence that the rise in crack does not begin until 1985.

using the available data we can estimate a model in which the impact of crack varies by race. The overall per capita impact of crack in a city (or state) and year can be decomposed into

$$Crack_s = \lambda^{Black} P_s^{Black} + \lambda^{Hispanic} P_s^{Hispanic} + \lambda^{White} P_s^{White}$$

where the P variables represent population shares by race and the λ coefficients are race- and city-specific crack estimates. λ captures how our crack index varies across cities at a given point of time as a function of the racial composition of the city; λ is the value the crack index would take in a hypothetical city all of whose residents were of the race in question. That coefficient does not necessarily directly reflect the relative rates of crack usage across individuals of different races if, for example, the presence of more Blacks in a city is associated with higher crack use by Whites. To estimate the relative impact of crack by race, we run a separate cross-sectional regression for each year with the crack index as the left-hand-side variable and race proportions as the right-hand-side variables, omitting a constant.

The results of this estimation are reported in Figure 5. For the city-level analyses, crack among Blacks rises until 1994, before falling roughly 25 percent by the end of the sample. At its peak, the estimate for Blacks is about five times higher than for Whites. For Hispanics, crack peaks earlier and falls more from the peak. The overall level for Blacks and Hispanics in central cities is similar. The state-level estimates reveal a substantially different picture, with Blacks rising much higher than Hispanics. The ratio of Black to White crack is also higher in this sample.

One explanation for the difference between the city and state results in Figure X is that crack is primarily an urban problem, with neither Blacks nor Whites in rural areas

being greatly affected. To test this hypothesis, we redo the state-level estimates, but allow for the impact of crack to vary not only by race, but also by whether one lives in one of the 100 largest cities in 1980. These results are presented in the top panel of Figure 6. Crack rose most quickly among urban Hispanics, peaking in 1989, whereas for urban Blacks the peak is not until 1993. Non-central city Blacks are associated with moderate levels of crack that has remained steady throughout the period. All Whites and non-central city Hispanics have dramatically lower crack levels.

Figures 7 and 8 present crack estimates by region and size of central city respectively. In Figure 7, the Northeast and the South experienced the greatest crack problem. The West kept pace with those regions initially, but reached a much lower peak. The Midwest shows little evidence of crack. In Figure 8, the time series pattern for crack in cities above and below 350,000 residents is quite similar, except that the crack levels are roughly twice as high in the larger cites.

The estimates in Figures 5-8 may be misleading if race, region, and city size are correlated, since the figures examine these variables independently of one another. Figure 9, therefore, presents estimates from regressions which allow for the impact of crack to vary by race, by whether one lives in a city with a population greater than 350,000 controlling for the other factors. The results in Figure 9 differ from the earlier figures in that they the time-series patterns are now plotted relative to the omitted category in each group (namely, Whites, the Midwest, and cities under 350,000 in population). The difference between Blacks and Hispanics becomes greater, and the West emerges as having a bigger crack problem than the South when controlling for other factors. Otherwise, the results appear similar.

Table 4 reports the cities and states in our sample with the highest and lowest estimated average crack prevalence over the period 1985-1999.[19] The set of cities with the greatest crack problem is largely as one would expect. Oakland leads the list, followed by Philadelphia, Newark, San Francisco, and New Orleans. Other cities thought to have had serious crack problems, like Baltimore, District of Columbia, and Los Angeles also make the list. The omission of Chicago, which ranks 38 among our cities, is the most surprising result. Among states, District of Columbia, Maryland, Georgia, New York, and California head the list. The cities with the least evidence of crack tend to be smaller, geographically isolated cities with low Black populations. The states with low crack tend to have large rural populations and few minorities.

Figure 10 presents year-by-year estimates of the crack index for a subset of cities that exhibit different time-series patterns.[20] Los Angeles has a particularly early crack experience, falling to less than half the peak level by 1999. New York City's pattern is similar to Los Angeles, except the rise is slower, as is the decline. Chicago mirrors New York, except the levels are roughly 40 percent lower throughout the period. Baltimore is unusual in that the crack starts slowly and peaks very late (1996) and shows little decline thereafter.

Sensitivity of the results to alternative assumptions

Our baseline estimates necessarily rely on a number of assumptions regarding the sample of cities included, the sources of variation that we utilize, the outcome variables

[19] Results for the full set of cities and states in the sample, for the years 1985, 1989, 1993, 1997, and 2000 (??) are reported in the appendix.

[20] For those who are interested in using the crack index in their own research, or simply want to explore our estimates in greater detail, the full data are available at XXXX. We have also created a graphing tool in Microsoft Excel that allows one to easily graph the crack index over time for an arbitrary set of cities.

included, and the way that we remove the influence of pre-period factors during the crack era. Table 5 explores the sensitivity of our city-level results to a variety of these assumptions. The first six columns report the loadings on each of our outcome measures. The last three columns summarize the results, providing the estimated year in which crack peaks, how far crack declines from the peak to 1999, and the cross-city correlation between the mean city-level crack estimates obtained in our baseline specification and each of the alternatives. The top row presents our baseline results from Table 3; the remaining rows each reflect alternative specifications.

The top panel presents results for different samples of cities. Restricting the sample to only the thirty largest cities or cities with a large Black population have little impact on the estimates, nor does expanding the sample to include all cities with 100,000 population in 2000, as opposed to the 100 largest cities in 1980 which is our baseline sample. The loadings do not change greatly, nor does the timing of crack's peak, the decline from the peak, or the ordering of which cities have serious crack problems and which do not.

The second panel of the table shows results using a different set of outcome measures. If, instead using outcomes for all city residents, we use per capita rates for Blacks only for the measures we have by race, the loadings change somewhat (gun arrests and emergency room visits turn negative), but the city rankings are not greatly affected. Including additional outcomes that we had initially conjectured might be proxies for crack (the fetal death rate, the death rate of children aged 1 to 4, and the percentage of arrestees testing positive for cocaine), but that empirically did not prove highly correlated with the other measures, does not change our results significantly.

Treating newspaper citations and emergency room visits for smoked cocaine as missing in the pre-period, both of which have extremely low mean values prior to 1985, leads to a later estimate for the peak of crack, but does not otherwise greatly affect the results.

The results are somewhat sensitive to allowing for two pre-period factors. With two pre-period factors, cocaine and gun arrests have the freedom to move in arbitrary directions with respect to the other measures, allowing the pre-period factor to absorb a greater amount of the variation in the post-period. Not including any pre-period factor, however, has little impact. The reason for this is that the most important pre-crack factor and the crack factor are essentially orthogonal empirically. Our results are also robust to changing the cutoff date between the pre-crack and crack periods.

The final six rows of Table 5(a) show the results that would be obtained if we were to separately use each of our individual outcomes, instead of combining all the measures together. The individual measures predict a range of peak years for crack from 1989-1993, and a range of declines in crack from peak to the end of the sample from 2 percent to 54 percent. The correlations with our baseline estimates range from .02 (gun arrests) up to .71(emergency room visits for smoked cocaine).

Table 5(b) reports the same set of sensitivity analyses for the state-level results. Like the city-level results, the state-level estimates appear quite robust to most of the changes in specification that are explored. In contrast to the city-level estimates, the state estimates are most sensitive to not including any pre-period factor, but are almost unaffected by allowing for two pre-period factors. When the individual outcome measures are examined one at a time, cocaine arrests yield the results most similar to our baseline state-level index (a correlation of .755, although the peak year for crack moves

four years earlier). Despite receiving a heavy loading in the analysis, gun arrests yield a very different ordering of states (correlation of only .178) than the baseline.

Section VI: How important was crack in explaining the socio-economic and crime patterns since 1985?

The ultimate goal of constructing a crack index is to use it to quantifying the impact that crack had on society. In this section, we present some preliminary attempts to address that question. Our approach is simply to regress outcome measures on our estimated crack index, city/state fixed effects, and year dummies. We then estimate how large an impact the rise and fall of crack had on each of these outcomes, under the (tenuous) assumption that the coefficient on crack has a causal interpretation. Tables 6(a) and 6(b) present the results. For each of the outcome variables we consider, we report the regression coefficient on crack in column 1, along with clustered standard errors. Column 2 shows the mean of the variable in 1982, before crack. Columns 3 has the percent change in the variable attributable to crack between 1982 and the peak of crack, under the assumption that the OLS regression coefficient has a causal effect on the measure of interest. Column 4 is the actual percent change in the variable over that same time period. The remaining columns of the table repeat the exercise, but for the period beginning with the peak of crack and going to the end of the sample in 1999.

The top panel of Table 6(a) looks at the variables we used as proxies for crack in the city-level data. Because our crack index was constructed using these variables, it is likely that we will have over-fit the data, exaggerating the true impact of crack on these

outcomes.[21] The rise of crack is associated with an increase of 113 percent in youth homicide, indeed an increase almost twice as large as observed in the actual data. The decline of crack is estimated to have reduced youth homicide by almost 28 percent, which is about the amount that youth homicide actually fell. Crack also accounts for most of the enormous increase in cocaine arrests to the peak, as well as the modest decline since then. By our estimates, crack raised weapons arrests by 7 percent and the number of low birth weight babies by 15 percent (an increase of about 1 percentage point) at its peak. The bottom panel of Table 6(a) looks at outcomes not included in the construction of the index. We find that deaths of children aged one to four and fetal deaths are elevated somewhat by crack. The implied link between crack and AIDS is so strong as to suggest that the relationship is largely spurious. Our crack index is strongly correlated with AIDS, but it is hard to imagine that crack is the primary causal story for the rise of AIDS, although it is consistent with the somewhat puzzling fact that over two-thirds of new AIDS diagnoses are among Blacks and Hispanics (Centers for Disease Control 2004).

Table 6(b) provides a parallel analysis using the state-level data. Because we estimate the peak of crack to be 1993 in this sample, we use that date as the cutoff point in our analysis. The rise in youth homicide is largely explained by crack in these data, although the subsequent fall in crack accounts for less than half of the observed decline in that variable since 1993. Crack can explain two-thirds of the rise in cocaine arrests and more than accounts for the rise in weapons arrests. The estimate impact of low birth weight babies is small in the state data, in contrast to the large implied effects in the city

[21] We are in the process of re-estimating the crack index excluding each of the outcomes one at a time. We could then potentially use those modified crack indexes as instruments for the baseline crack index in making these calculations.

data. When we examine crime outcomes that were not involved in the construction of the index, we find a substantial relationship between crack and homicide rates of older males, but it is much weaker than for young males, as would be expected. The fall of crack explains less than one-third of the homicide declines among older males since 1993. The impact on crimes other than homicide are much more muted. We estimate that overall violent crime was possibly increased by 7 percent, and that property crime was only 1 percent higher due to crack. As was the case in the city-level data, we find a non-trivial relationship between the death rates of children aged one to four and fetal deaths, and a very strong relationship to AIDS. In contrast, we see almost no link between crack and the unemployment rate or the poverty rate.

Section VII: The role of crack as an omitted variable in prior research

The estimates of the preceding section suggest that crack has had an important influence on a wide range of social indicators over the last two decades. Prior research has typically not controlled in effective ways for crack. In this section, we explore the impact of controlling for crack on the conclusions drawn in earlier work on concealed weapons laws and the link between legalized abortion and crime.

…NOT YET WRITTEN…

Section VII: Conclusion

A number of social, criminological, and economic variables experienced negative shocks in the lat 1980s and early 1990s, particularly among Blacks. Many observers

have suggested that crack cocaine may have played a causal role, but the absence of good quantitative measures of crack have hampered scholarly study of the issue. In this paper, building on the insight that a set of otherwise disparate outcomes will covary in the presence of crack, we use factor analysis to construct a crack index. This crack index reproduces many of patterns described in journalistic and ethnographic accounts including the timing of the crack epidemic and the disproportionate impact on Blacks and Hispanics. The crack index is robust to a wide range of sensitivity checks and yields generally similar results even when the national time series variation is not used in the identification.

While much of this paper has been devoted to estimating the crack index and evaluating the plausibility of the index, the greatest ultimate payoff, we believe, will come from applying the index to substantive problems with two goals in mind: (1) understanding the impact that crack itself may have had on a range of social and economic outcomes, and (2) providing an important control variable when measuring the impact of other variables or social programs on outcomes of interest.

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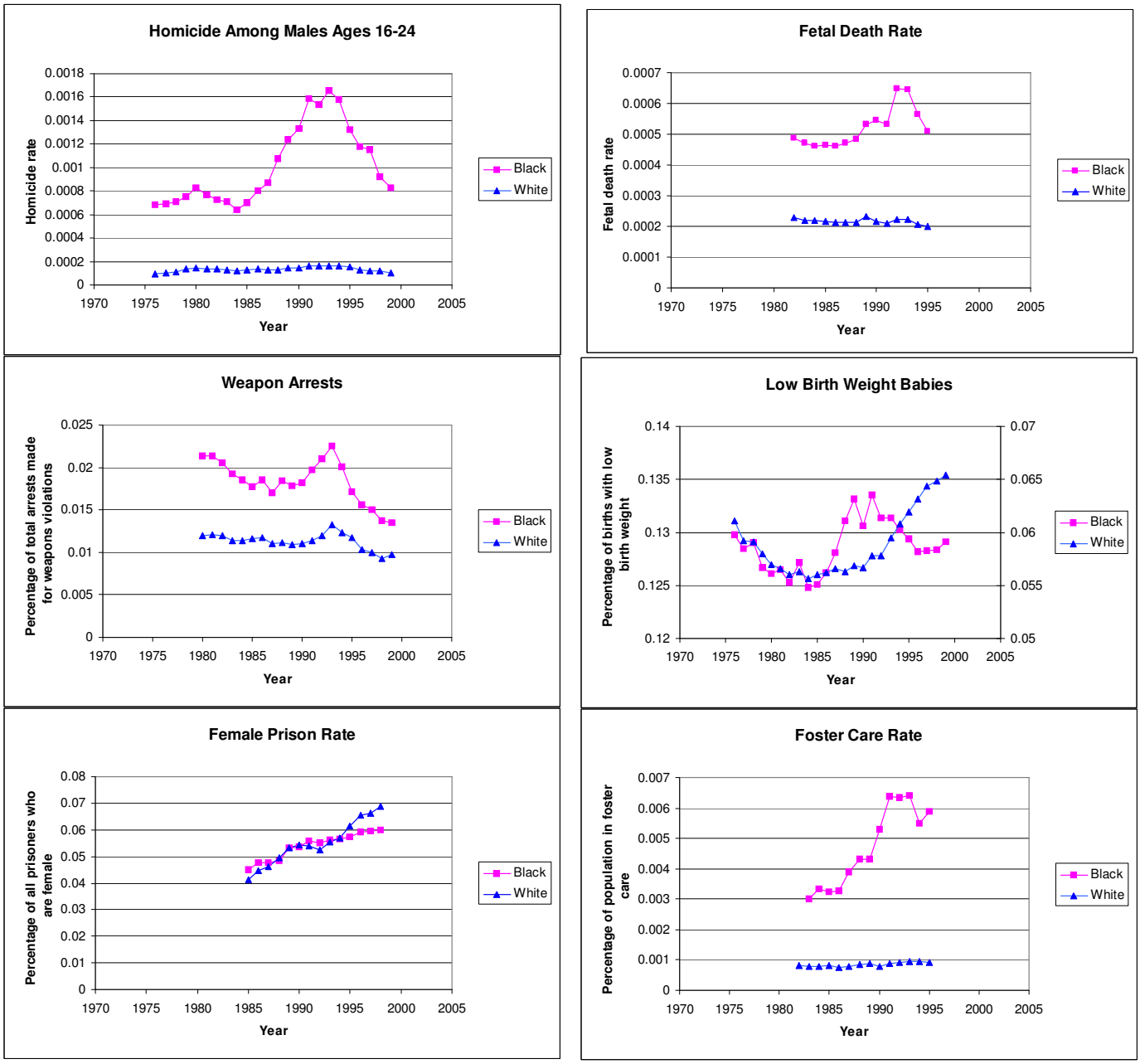
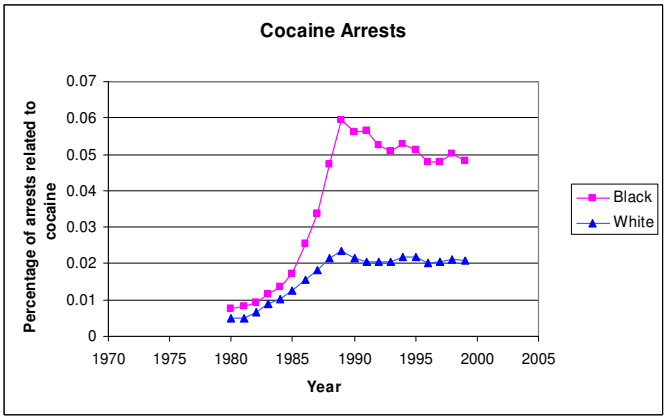
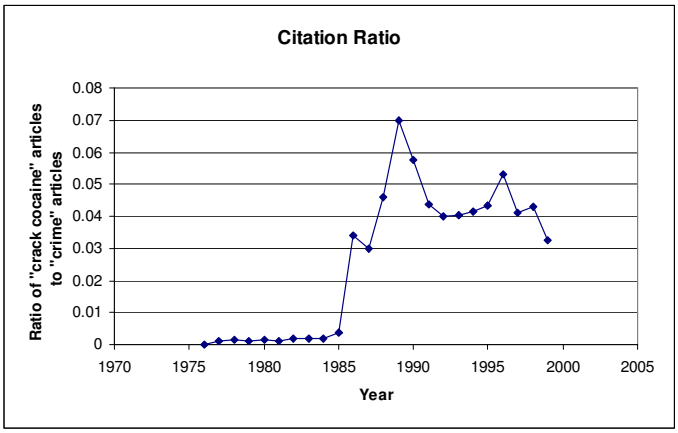
Figure 1: Trends in Selected Social and Economic Outcomes for Blacks and Whites

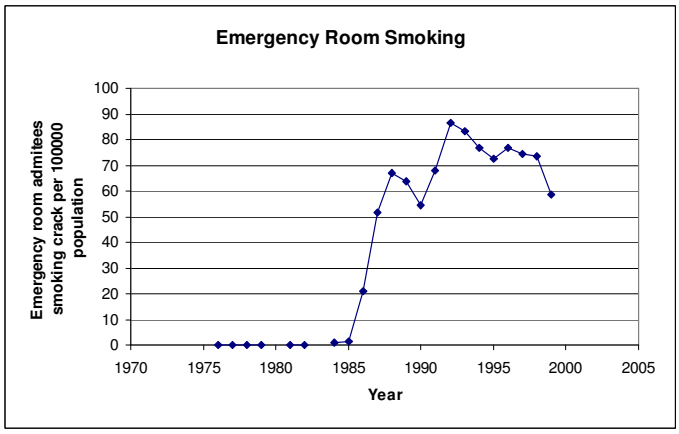


Notes: See the data appendix for a full description of data sources and definitions. Values reported are population-weighted national averages.

Figure 2: Trends in Potential Proxies for Crack Cocaine







Notes: See the data appendix for a full description of data sources and definitions Values reported are population-weighted national averages.

Table 1(a): Raw Correlations Between Outcome Variables, by Time Period

City-Level Data

1976-1984 Correlations

	Homicide	Cocaine	Weapon	Birth Weight	Citations	ER visits
Youth Homicide	1.000					
Cocaine Arrests	0.109	1.000				
Weapon Arrests	-0.045	-0.299	1.000			
Low Birth Weight Babies	0.297	0.002	-0.111	1.000		
Newspaper Crack Citations	-0.038	0.102	-0.003	-0.156	1.000	
ER smoked cocaine visits	0.352	0.203	-0.189	0.135	0.000	1.000

Average off-diagonal element: 0.024

1985-1992 Correlations

	Homicide	Cocaine	Weapon	Birth Weight	Citations	ER visits
Youth Homicide	1.000					
Cocaine Arrests	0.424	1.000				
Weapon Arrests	0.218	0.018	1.000			
Low Birth Weight Babies	0.359	0.432	-0.071	1.000		
Newspaper Crack Citations	0.232	0.367	-0.012	0.181	1.000	
ER smoked cocaine visits	0.440	0.557	-0.081	0.479	0.350	1.000

Average off-diagonal element: 0.260

Post-1992 Correlations

	Homicide	Cocaine	Weapon	Birth Weight	Citations	ER visits
Youth Homicide	1.000					
Cocaine Arrests	0.147	1.000				
Weapon Arrests	0.354	0.071	1.000			
Low Birth Weight Babies	0.172	0.166	-0.033	1.000		
Newspaper Crack Citations	0.115	-0.026	0.036	-0.084	1.000	
ER smoked cocaine visits	0.040	0.302	0.034	-0.045	0.148	1.000

Average off-diagonal element: 0.093

Table 1(b): Raw Correlations Between Outcome Variables, by Time Period

State-Level Data

1976-1984 Correlations

	Homicide	Cocaine	Weapon	Birth Weight
Youth Homicide	1.000			
Cocaine Arrests	0.269	1.000		
Weapon Arrests	-0.002	-0.156	1.000	
Low Birth Weight Babies	0.144	-0.021	-0.085	1.000

Average off-diagonal element:	0.025

1985-1992 Correlations

	Homicide	Cocaine	Weapon	Birth Weight	Foster Care	Prison
Youth Homicide	1.000					
Cocaine Arrests	0.439	1.000				
Weapon Arrests	0.116	-0.019	1.000			
Low Birth Weight Babies	0.381	0.392	-0.035	1.000		
% of Kids in Foster Care	0.371	0.276	0.236	0.356	1.000	
% Female Prisoners	0.343	0.361	0.006	0.233	0.259	1.000

Average off-diagonal element:	0.248

1985-1992 Correlations

	Homicide	Cocaine	Weapon	Birth Weight	Foster Care	Prison
Homicide	1.000					
Cocaine Arrests	-0.022	1.000				
Weapon Arrests	0.281	-0.115	1.000			
Low Birth Weight Babies	-0.042	0.124	-0.367	1.000		
% of Kids in Foster Care	0.470	0.142	0.207	0.044	1.000	
% Female Prison	-0.055	0.041	-0.329	0.370	0.233	1.000
Average off-diagonal element:	0.066					

Notes: See data appendix for precise definitions and data sources. Each entry in the table represents a pairwise correlation between the two variables in the time period named. State-fixed effects for the entire period 1976-1999 were removed from all data series prior to calculating the correlations. Not all measures are available for all states and years. If crack cocaine is a common omitted factor influencing all of these outcomes, we expect the correlations reported in the table to be higher when crack is prevalent.

Table 2(a): Summary Statistics for Outcome Measures

City-Level Data

Black and White Combined

	Before 1985					1985 and After				
Measure	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**
Youth Homicide	864	0.0004	0.0003	0.0000	0.0021	1521	0.0008	0.0008	0.0000	0.0056
Cocaine Arrests	375	0.0103	0.0128	0.0000	0.0903	1297	0.0438	0.0360	0.0002	0.1752
Weapon Arrests	434	0.0177	0.0084	0.0001	0.0552	1407	0.0167	0.0086	0.0000	0.0978
Low Birth Weight Babies	468	0.0827	0.0168	0.0516	0.1259	805	0.0855	0.0199	0.0504	0.1479
Newspaper Crack Citations	361	0.0019	0.0052	0.0000	0.0323	1635	0.0389	0.0355	0.0000	0.6119
ER Smoked Cocaine Visits	81	0.2357	0.6990	0.0000	0.6980	270	41.5660	40.4082	0.0000	205.0760

Black Only

	Before 1985					1985 and After				
Measure	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**
Youth Homicide	864	0.0008	0.0007	0.0000	0.0065	1521	0.0015	0.0013	0.0000	0.0088
Cocaine Arrests	383	0.0112	0.0139	0.0000	0.0918	1325	0.0561	0.0410	0.0001	0.1895
Weapon Arrests	436	0.0213	0.0100	0.0000	0.0600	1419	0.0192	0.0103	0.0000	0.1221
Low Birth Weight Babies	468	0.1316	0.0134	0.0720	0.1756	806	0.1324	0.0161	0.0595	0.1946

White Only

	Before 1985					1985 and After				
Measure	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**
Youth Homicide	864	0.0002	0.0003	0.0000	0.0021	1521	0.0003	0.0004	0.0000	0.0026
Cocaine Arrests	417	0.0089	0.0115	0.0000	0.0895	1337	0.0315	0.0317	0.0000	0.1734
Weapon Arrests	447	0.0155	0.0075	0.0017	0.0554	1448	0.0139	0.0075	0.0019	0.1179
Low Birth Weight Babies	468	0.0636	0.0083	0.0392	0.0959	812	0.0648	0.0102	0.0000	0.1144

Notes: See data appendix for precise definitions and data sources. The number of observations varies across measures due to different availability of time periods and incomplete coverage of cities. Newspaper citations and emergency room visits are not available separately by race.

Table 2(b): Summary Statistics for Outcome Measures

State-Level Data

Black and White Combined

	Before 1985					1985 and After				
Measure	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**
Youth Homicide	457	0.0002	0.0001	0.0000	0.0009	833	0.0002	0.0005	0.0000	0.0053
Cocaine Arrests	243	0.0063	0.0093	0.0003	0.0666	807	0.0202	0.0188	0.0000	0.1220
Weapon Arrests	243	0.0130	0.0062	0.0024	0.0445	807	0.0116	0.0057	0.0000	0.0444
Low Birth Weight Babies	459	0.0654	0.0125	0.0433	0.1218	765	0.0680	0.0139	0.0418	0.1375
% Kids in Foster Care	--	--	--	--	--	305	0.0013	0.0005	0.0002	0.0035
% Female Prisoners	--	--	--	--	--	704	0.0555	0.0156	0.0154	0.1364

Black Only

	Before 1985					1985 and After				
Measure	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**
Youth Homicide	458	0.0005	0.0005	0.0000	0.0050	833	0.0009	0.0009	0.0000	0.0087
Cocaine Arrests	243	0.0083	0.0110	0.0000	0.0690	807	0.0357	0.0286	0.0000	0.1515
Weapon Arrests	243	0.0187	0.0073	0.0000	0.0411	807	0.0156	0.0076	0.0000	0.0459
Low Birth Weight Babies	459	0.1234	0.0353	0.0000	0.5000	765	0.1222	0.0244	0.0000	0.2632
% Kids in Foster Care	--	--	--	--	--	305	0.0046	0.0033	0.0000	0.0160
% Female Prisoners	--	--	--	--	--	704	0.0587	0.0244	0.0000	0.2143

White Only

	Before 1985					1985 and After				
Measure	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**
Youth Homicide	458	0.0001	0.0001	0.0000	0.0004	837	0.0001	0.0001	0.0000	0.0005
Cocaine Arrests	250	0.0054	0.0068	0.0000	0.0473	820	0.0134	0.0128	0.0000	0.0692
Weapon Arrests	250	0.0112	0.0062	0.0002	0.0463	820	0.0099	0.0052	0.0000	0.0458
Low Birth Weight Babies	459	0.0581	0.0073	0.0427	0.0880	765	0.0602	0.0081	0.0388	0.0863
% Kids in Foster Care	--	--	--	--	--	306	0.0009	0.0004	0.0002	0.0023
% Female Prisoners	--	--	--	--	--	712	0.0566	0.0204	0.0145	0.2105

Notes: See data appendix for precise definitions and data sources. The number of observations varies across measures due to different availability of time periods and incomplete coverage of cities. Newspaper citations and emergency room visits are not available separately by race.

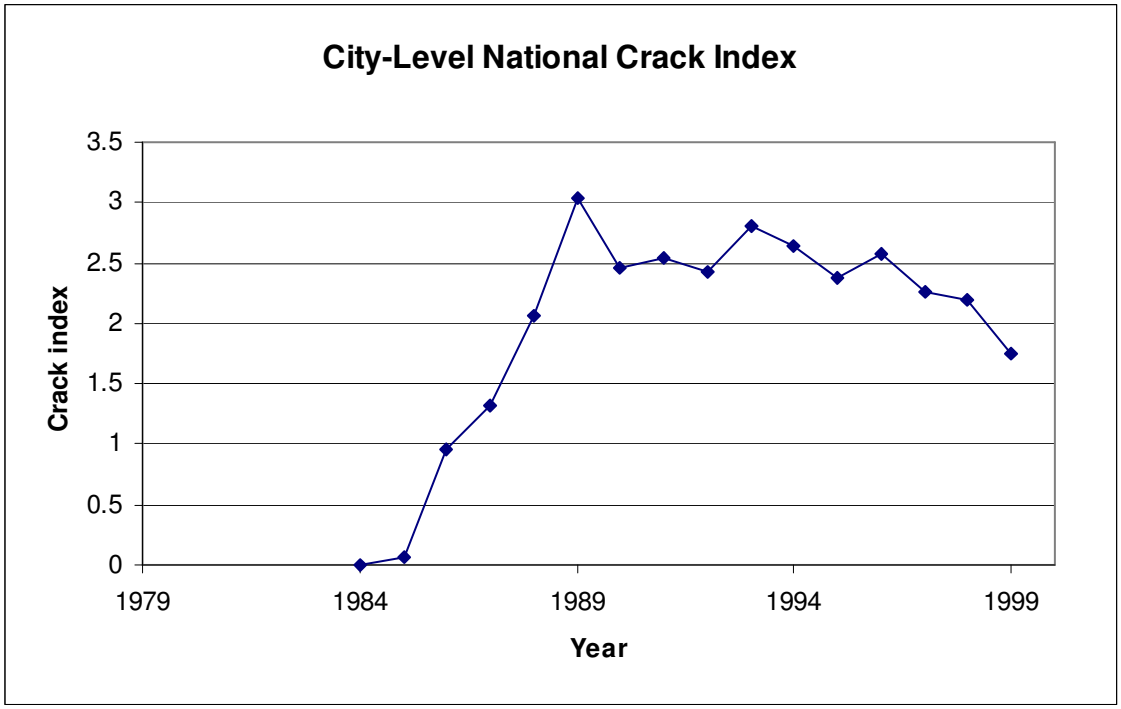
Table 3: Estimated Loadings from Factor Analysis

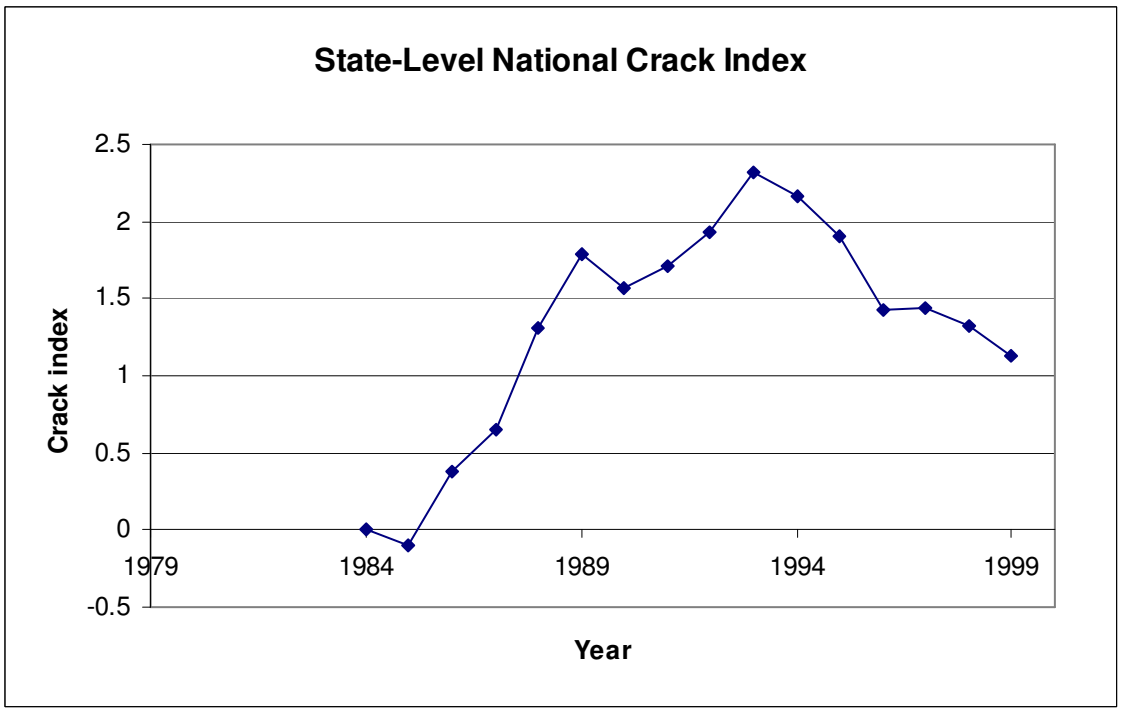
Outcome	City-Level Analysis Pre-1985 Factor Loading	City-Level Analysis Crack Factor Loading	City-Level Analysis Pre-1985 Factor Loading	City-Level Analysis Crack Factor Loading	State-Level Analysis Pre-1985 Factor Loading	State-Level Analysis Crack Factor Loading	State-Level Analysis Pre-1985 Factor Loading	State-Level Analysis Crack Factor Loading
Youth Homicide	0.345	0.415	0.188	0.209	-0.033	0.293	0.000	0.271
Cocaine arrests	-0.598	0.527	-0.718	0.729	-0.708	0.630	-0.708	0.633
Weapon arrests	0.620	0.100	0.611	0.643	0.702	0.597	0.704	0.627
Low birth weight babies	0.368	0.297	0.263	0.087	0.072	0.302	0.061	0.009
Newspaper Crack Citations	0.004	0.584	0.001	0.003	.	.	.	.
ER Smoked Cocaine Visits	-0.066	0.332	0.083	0.056	.	.	.	.
% Kids in Foster Care	.	.	.	.	.	0.230	.	0.363
% Female prisoners	.	.	.	.	.	0.127	.	0.025
No. Obs.	2700		2700		1377		1377	
Remove year fixed	No		Yes		No		Yes	

effects				

Notes: See data appendix for description of variables and normalizations imposed on the estimation. Each column presents factor loadings from a different factor analysis. The pre-1985 factor loadings are based only on data prior to 1985 when crack is thought to have started becoming prevalent. The crack factor is estimated on data 1985-1999, after removing as much variation as possible from the data imposing the pre-1985 loadings and allowing the magnitude of the pre-1985 factor to vary arbitrarily. Some variables are available only at the city or the state level, or only in the post-1985 period. City-fixed or state-fixed effects were removed prior to estimation. Year fixed effects were removed where noted. Bootstrapped standard errors in parentheses.

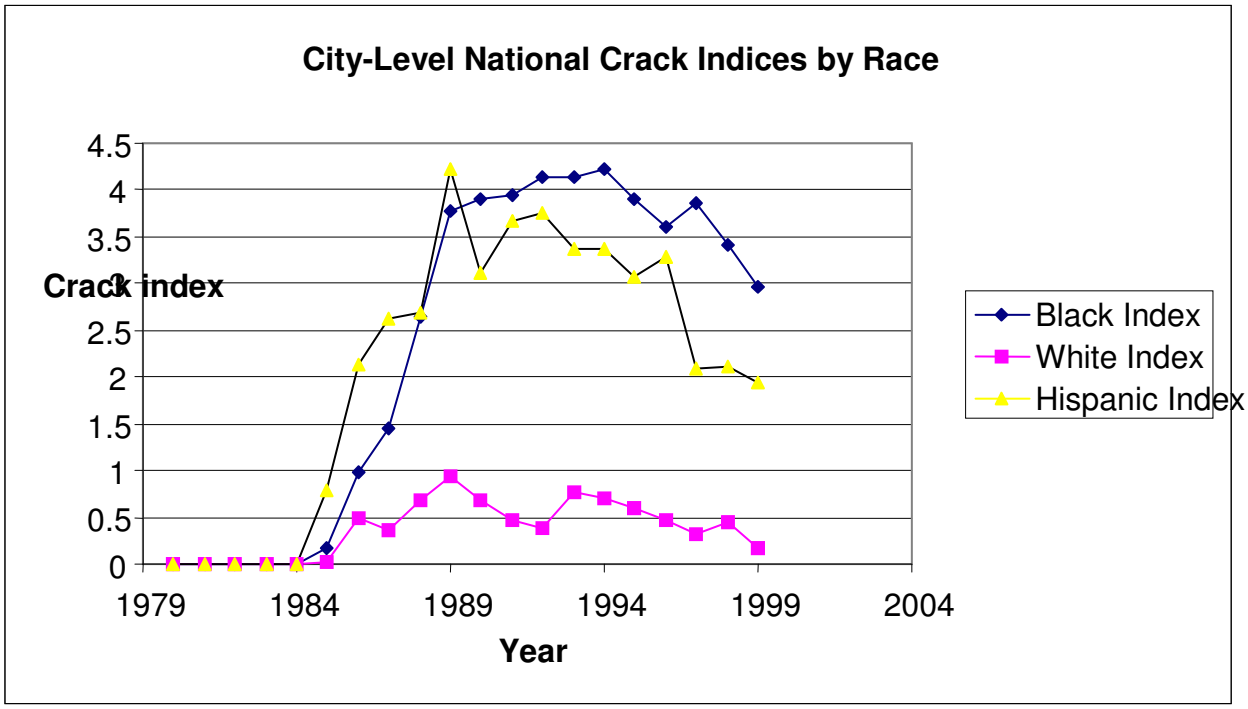
Figure 4: Estimated National Crack Indices





Notes: The reported indices are population weighted aggregates of the estimated crack indices for individual cities and states.

Figure 5: Estimated National Crack Indices by Race



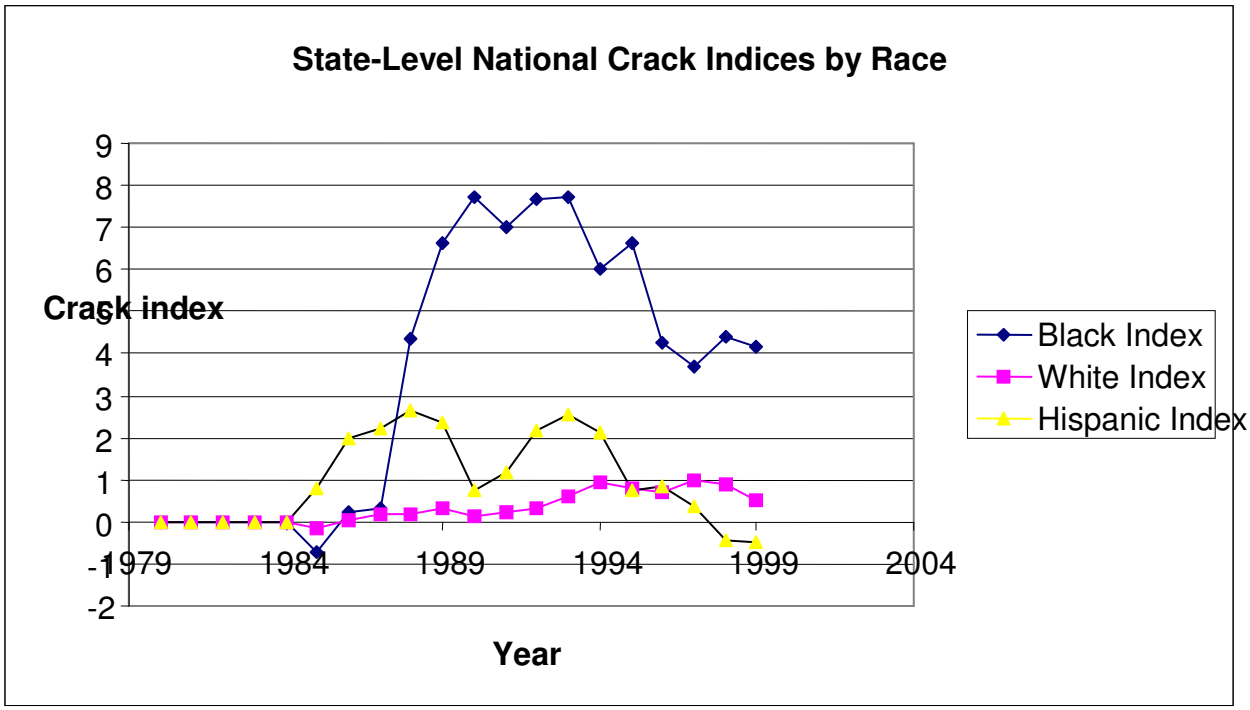


Figure 6: Estimated National Crack Indices by Race and Urban Type

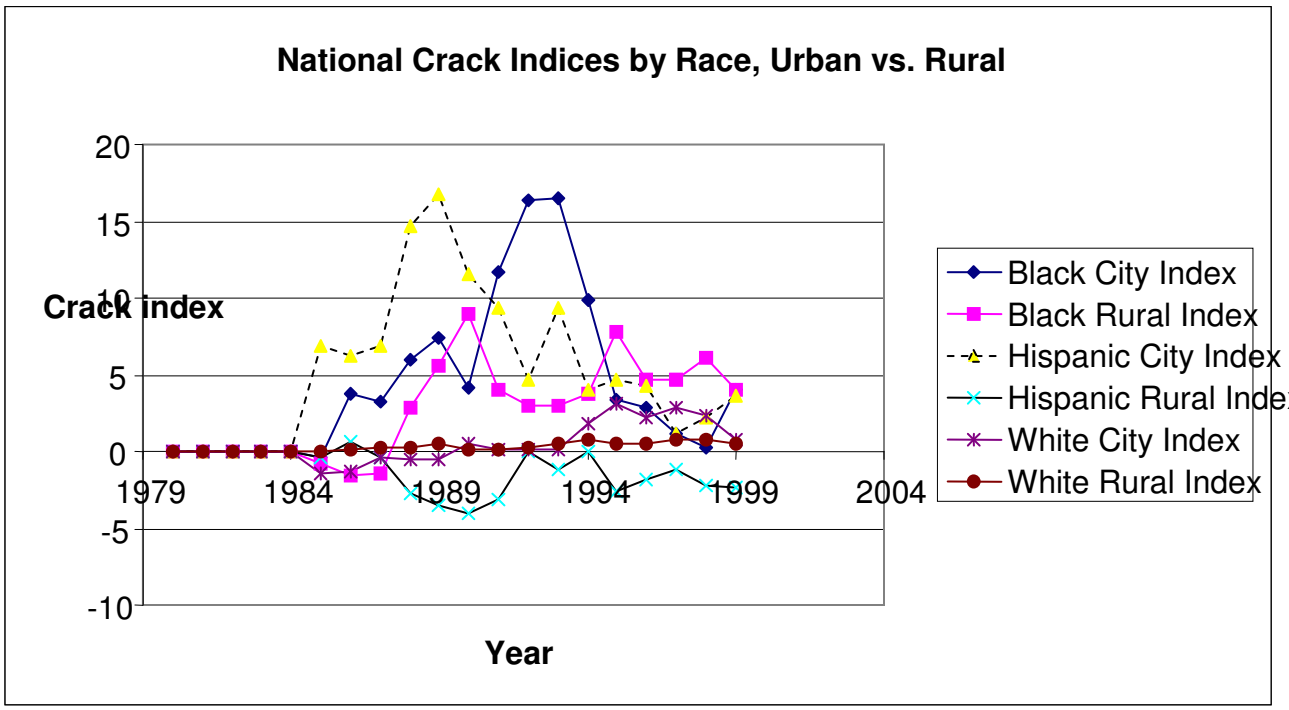


Figure 7: Estimated Crack Indices by Region

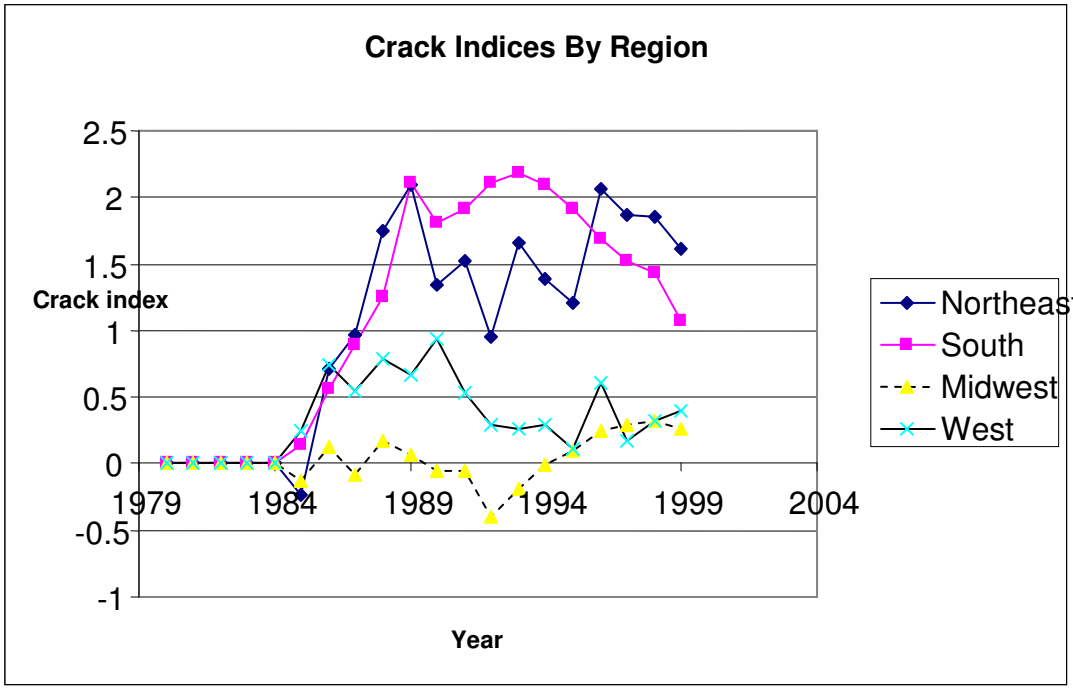


Figure 8: Estimated Crack Indices by City Population

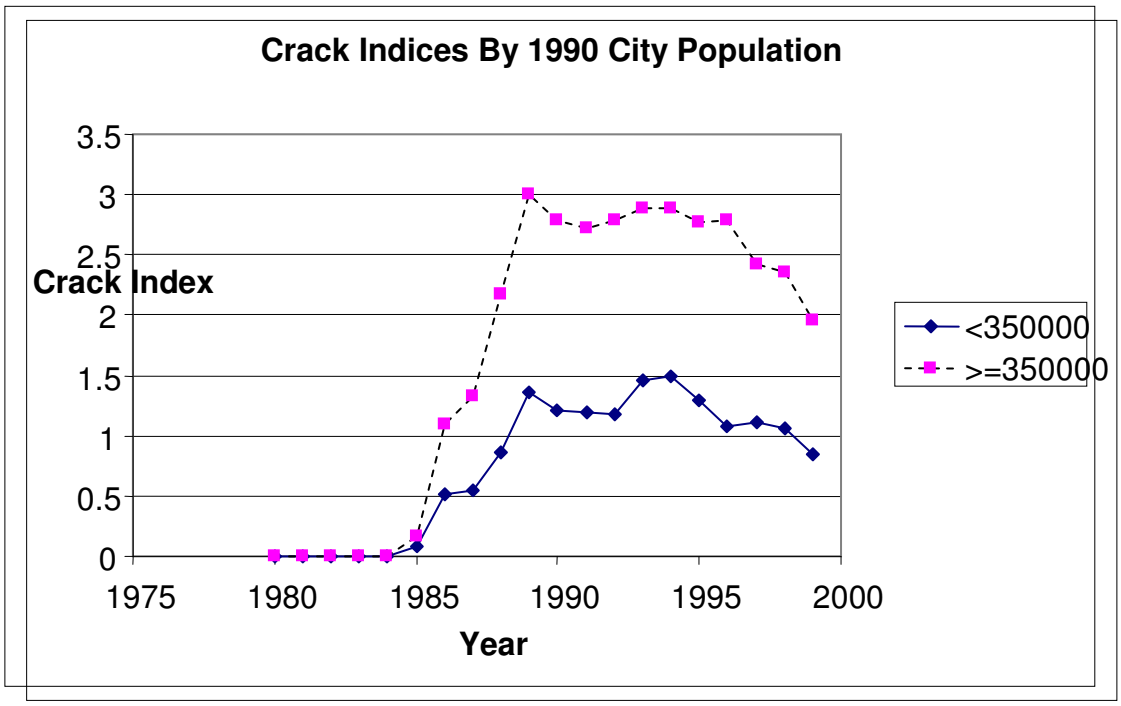
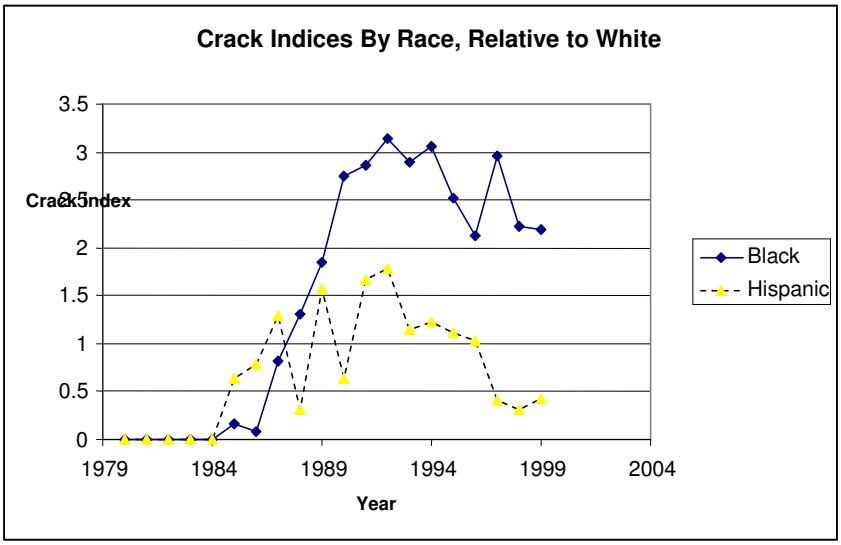
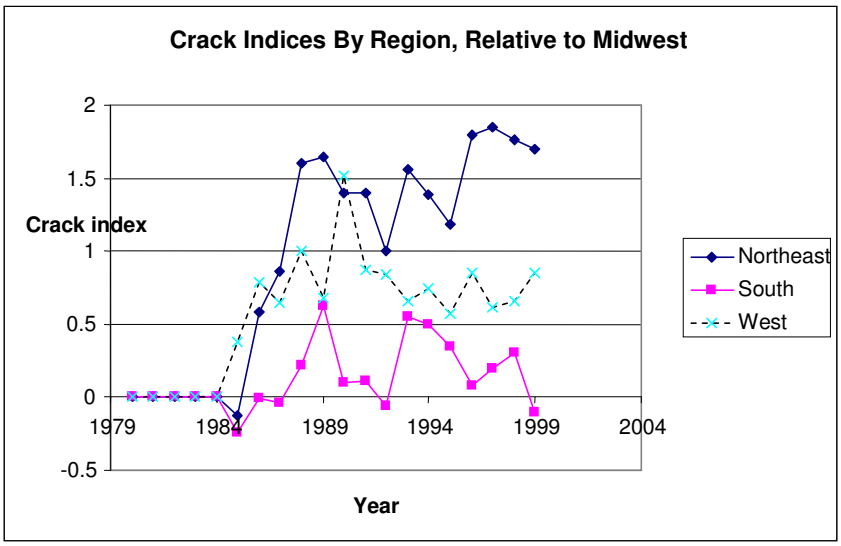


Figure 9: Estimated Crack Indices Controlling for Race, Region, and City Size





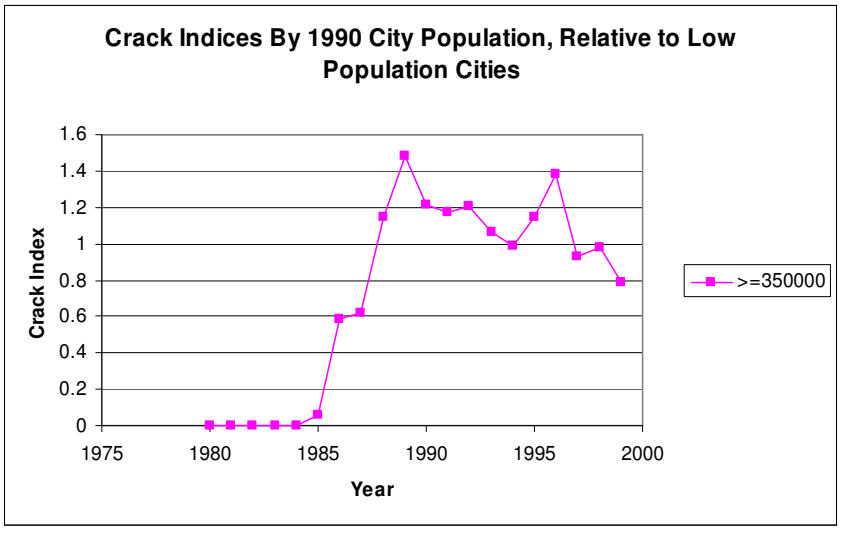


Table 4: Highest and Lowest Mean Crack Levels by City and State, 1985-1999

Cities--Highest Crack

Rank	City	Average Crack
1	Oakland	4.26
2	Philadelphia	3.57
3	Newark	3.42
4	San Francisco	3.31
5	New Orleans	3.27
6	Buffalo	3.24
7	Atlanta	3.07
8	Baltimore	2.88
9	Detroit	2.85
10	New York	2.74
11	Washington	2.57
12	Boston	2.54
13	Los Angeles	2.52
14	Cleveland	2.41
15	Columbus Oh	2.38

States—Highest Crack

Rank	State	Average Crack
1	District Of Columbia	3.41
2	Maryland	2.81
3	Georgia	2.67
4	New York	2.43
5	California	2.27
6	Massachusetts	2.20
7	North Carolina	2.12
8	Oregon	2.12
9	Pennsylvania	1.94
10	New Jersey	1.93
11	Virginia	1.61
12	South Carolina	1.44
13	Connecticut	1.41
14	Tennessee	1.39
15	Ohio	1.27

Table 4: Highest and Lowest Mean Crack Levels by City and State, 1985-1999

Cities--Lowest Crack

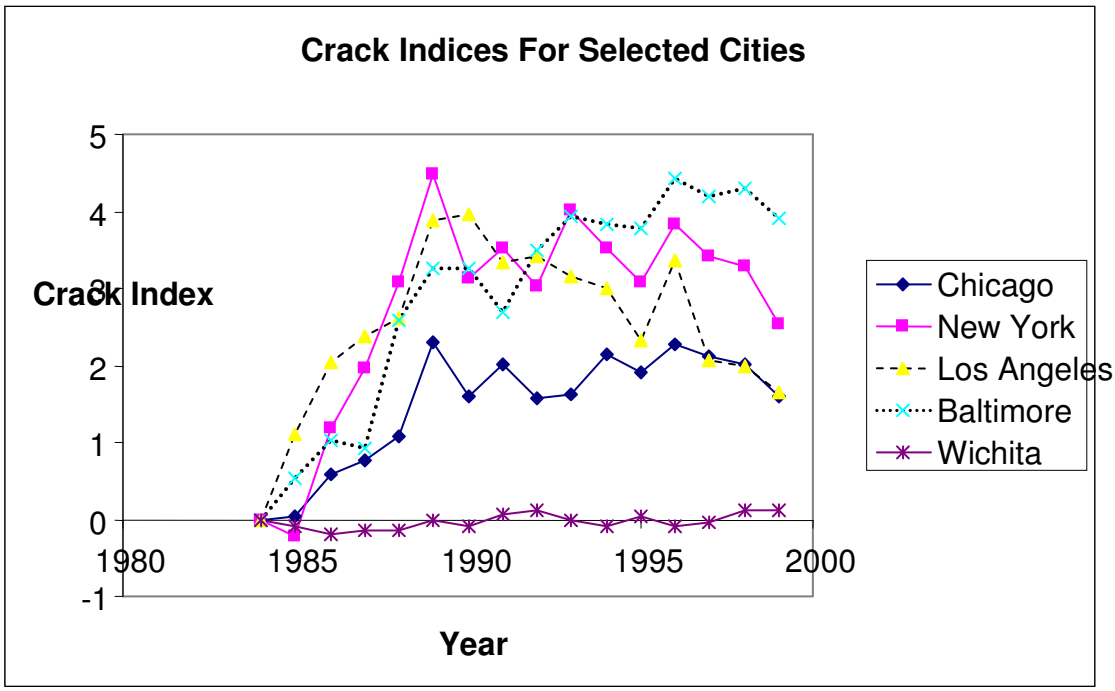
Rank	City	Average Crack
1	Corpus Christi	-0.10
2	Wichita	-0.03
3	Anchorage	0.01
4	Springfield Mo	0.02
5	Virginia Beach	0.07
6	Akron	0.10
7	Colorado Springs	0.12
8	Lubbock	0.16
9	Warren	0.26
10	Huntington Beach	0.28
11	Aurora Co	0.29
12	Kansas City Mo	0.29
13	Columbus Ga	0.37
14	Tulsa	0.39
15	Jackson	0.40

States—Lowest Crack

Rank	State	Average Crack
1	West Virginia	-1.23
2	Hawaii	-0.69
3	Wyoming	-0.58
4	Alaska	-0.28
5	Iowa	-0.23
6	Vermont	-0.17
7	Colorado	-0.01
8	Montana	0.06
9	Mississippi	0.10
10	Alabama	0.12
11	New Mexico	0.13
12	New Hampshire	0.15
13	Nebraska	0.26
14	Kansas	0.27
15	Wisconsin	0.38

Notes: City and state rankings are based on the average estimated crack factor over the period 1985-1999 using our baseline specifications in columns 2 and 5 of Table 3. The city sample includes the 100 most populous cities in the United States in 1980. The unit of measurement for crack is not directly comparable across cities and states.

Figure 10: Estimated Crack Indices for Selected Cities and States



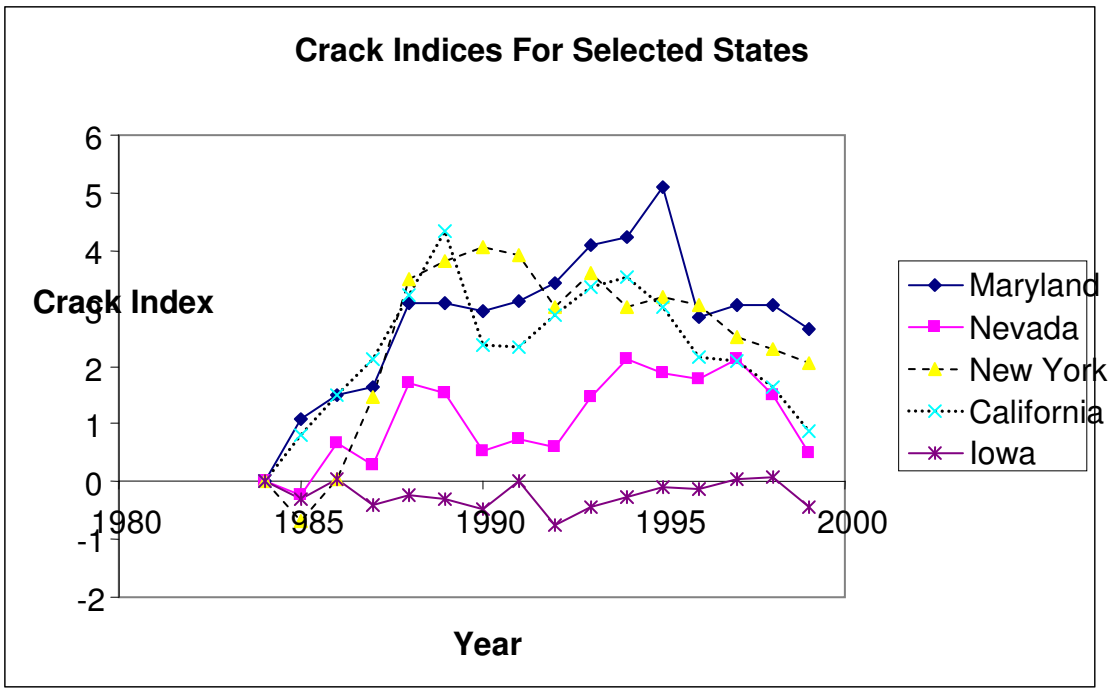


Table 5(a): Sensitivity Analysis of Baseline Estimates

City-Level Data

Variation	Loadings for Crack Factor: Youth Homicide	Cocaine Arrests	Gun Arrests	Low Birth Weight Babies	Newspaper Crack Citations	ER Smoked Cocaine Visits	Peak Year for Crack	% Decline from Peak to 1999	Correlation W/Baseline Specification
Baseline specification	0.409	0.526	0.111	0.295	0.588	0.334	1989	42.38%	1.000
	(0.042)	(0.005)	(0.024)	(0.004)	(0.006)	(0.009)			
Changing the sample									
Thirty largest cities	0.511	0.613	0.031	0.409	0.002	0.442	1993	42.05%	0.871
	(0.009)	(0.018)	(0.054)	(0.015)	(0.013)	(0.012)			
Cities with over 75000 Blacks	0.389	0.490	0.049	0.308	0.581	0.416	1989	40.49%	0.991
	(0.005)	(0.009)	(0.026)	(0.004)	(0.006)	(0.006)			
Add Cities with population over 100,000 in 2000, but less than 100,000 in 1980	0.381	0.585	0.006	0.281	0.576	0.319	1989	39.41%	0.988
	(0.009)	(0.013)	(0.009)	(0.010)	(0.057)	(0.006)			
Changing the measures									
Black-specific and non-race specific measures only	0.338	0.635	-0.091	0.098	0.666	-0.143	1989	51.83%	0.894
	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)	(0.033)			
Add fetal death rate, arrestee positive rate, and child mortality rate	0.406	0.515	-0.014	0.329	0.590	0.292	1989	40.65%	0.984
	(0.043)	(0.010)	(0.032)	(0.006)	(0.042)	(0.008)			
Citations and emergency room smoking in the post period only	0.526	0.701	0.181	0.430	0.078	0.092	1993	49.45%	0.853
	(0.013)	(0.003)	(0.039)	(0.006)	(0.008)	(0.002)			
Handling the pre-period factor differently									
Two pre-period factors	0.415	0.404	0.384	0.366	0.495	-0.372	1989	48.38%	0.585
	(0.149)	(0.198)	(0.224)	(0.109)	(0.190)	(0.177)			
No pre-period factor	0.339	0.575	-0.084	0.263	0.593	0.357	1989	37.51%	0.981
	(0.005)	(0.015)	(0.010)	(0.010)	(0.059)	(0.007)			
Changing the cutoff year									
Pre-period goes through 1986	0.429	0.536	0.106	0.328	0.524	0.368	1989	43.25%	0.968
	(0.057)	(0.145)	(0.150)	(0.057)	(0.075)	(0.106)			
Pre-period goes through 1982	0.324	0.635	-0.257	-0.134	0.599	0.222	1990	40.67%	0.892
	(0.064)	(0.158)	(0.084)	(0.065)	(0.084)	(0.144)			

Table 5(a): Sensitivity Analysis of Baseline Estimates

Using single measures	Youth Homicide	Cocaine Arrests	Gun Arrests	Low Birth Weight Babies	Newspaper Crack Citations	ER Smoked Cocaine Visits	Peak Year for Crack	% Decline from Peak to 1999	Correlation W/Baseline Specification
Youth homicide	1.000	0.000	0.000	0.000	0.000	0.000	1993	45.54%	0.536
Cocaine arrests	0.000	1.000	0.000	0.000	0.000	0.000	1989	17.47%	0.614
Gun arrests	0.000	0.000	1.000	0.000	0.000	0.000	1993	35.81%	0.021
Low birth weight babies	0.000	0.000	0.000	1.000	0.000	0.000	1993	2.25%	0.443
Newspaper crack citations	0.000	0.000	0.000	0.000	1.000	0.000	1989	54.30%	0.259
ER smoked cocaine visits	0.000	0.000	0.000	0.000	0.000	1.000	1992	31.97%	0.711

Notes: Each row represents estimates of the crack factor loadings from a different specification. The baseline estimates from column 2 of Table 3 are presented in the top row. Subsequent rows vary the sample of cities, outcome measures, method of treating the pre-period factor, or cutoff for the beginning of the period that the crack factor is estimated over. The last six rows present results for each outcome individually, i.e. under the assumption that outcome alone was the proxy for crack. The final column of the table reports the city-level correlation between the estimates of crack over the period 1985-1999 in our baseline sample and in the alternative specification. Standard errors for the estimated loadings are reported in parenthesis.

Table 5(b): Sensitivity Analysis of Baseline Estimates

State-Level Data

Variation	Loadings for Crack Factor: Youth Homicide	Cocaine Arrests	Weapon Arrests	Low Birth Weight Babies	Foster Care	Percent Female Prisoners	Peak Year for Crack	% Decine from Peak to 1999	Corr. W/Baseline
Baseline specification	0.293	0.630	0.597	0.302	0.230	0.127	1993	51.51%	1.000
	(0.020)	(0.006)	(0.005)	(0.007)	(0.012)	(0.004)			
Changing the measures									
Black-specific and non-race specific measures only	0.362	0.637	0.645	0.164	0.140	-0.005	1993	77.39%	0.808
	(0.022)	(0.005)	(0.013)	(0.022)	(0.008)	(0.003)			
Add fetal death rate and child mortality rate	0.151	0.489	0.489	0.324	0.151	0.131	1993	63.10%	0.934
	(0.039)	(0.096)	(0.096)	(0.064)	(0.309)	(0.022)			
Handling the pre-period factor differently									
Two pre-period factors	0.330	0.608	0.653	0.193	0.230	0.071	1993	46.13%	0.998
	(0.180)	(0.164)	(0.165)	(0.166)	(0.193)	(0.059)			
No pre-period factor	0.288	0.717	-0.235	0.429	0.336	0.225	1998	13.58%	0.718
	(0.022)	(0.008)	(0.011)	(0.007)	(0.024)	(0.005)			
Changing the cutoff year									
Pre-period goes through 1986	0.291	0.651	0.583	0.369	0.100	0.071	1993	43.79%	0.981
	(0.020)	(0.007)	(0.006)	(0.008)	(0.005)	(0.004)			
Pre-period goes through 1982	0.292	0.627	0.609	0.242	0.283	0.111	1993	59.06%	0.972
	(0.016)	(0.003)	(0.127)	(0.042)	(0.013)	(0.012)			
Using single measures									
Youth homicide	1.000	0.000	0.000	0.000	0.000	0.000	1993	46.12%	0.499
Cocaine arrests	0.000	1.000	0.000	0.000	0.000	0.000	1989	14.47%	0.755
Gun arrests	0.000	0.000	1.000	0.000	0.000	0.000	1993	35.32%	0.178
Low birth weight babies	0.000	0.000	0.000	1.000	0.000	0.000	1999	0.00%	0.399
% in foster care	0.000	0.000	0.000	0.000	1.000	0.000	1993	N/A	0.368
% female prisoners	0.000	0.000	0.000	0.000	0.000	1.000	1998	N/A	0.124

Notes: Each row represents estimates of the crack factor loadings from a different specification. The baseline estimates from column 2 of Table 3 are presented in the top row. Subsequent rows vary the sample of cities, outcome measures, method of treating the pre-period factor, or cutoff for the beginning of the period that the crack factor is estimated over. The last six rows present results for each outcome individually, i.e. under the assumption that outcome alone was the proxy for crack. The final column of the table reports the city-level correlation between the estimates of crack over the period 1985-1999 in our baseline sample and in the alternative specification. Standard errors for the estimated loadings are reported in parenthesis.

Table 6(a): The Correlation Between Crack and a Wider Range of Outcomes

City-Level Analysis

Measure	Crack Coef.	Mean 1982	%Δ in Mean Relative to 1982 Due to Crack, 1982-1989	Actual %Δ in Mean Relative to 1982, 1982-1989	Mean 1989	%Δ in Mean Relative to 1989 Due to Crack, 1989-End	Actual %Δ in Mean Relative to 1989, 1989-End	End Year
Original Measures								
Youth homicide rate	0.000175* (7.23E-5)	0.000478	113	65.3	0.000789	-27.7	-21.2	1999
Cocaine arrest rate	0.0124** (0.00115)	0.0155	258	334	0.0673	-23.4	-15.9	1999
Weapons arrest rate	0.0004 (0.000304)	0.0172	7.43	-12.8	0.015	-3.47	-13.9	1999
Rate low birth weight	0.0037** (0.000979)	0.0848	14.8	6.07	0.09	-5.97	-1.61	1999
Newspaper Crack Citations	0.00885** (0.00257)	0.00162	1660	4200	0.0699	-16.2	-53.3	1999
ER smoked cocaine visits	19.7** (2.73)	0.216	36600	29300	63.7	-49.9	-7.8	1999
Additional Measures								
Child mortality rate age 1-4	2.709E-5** (5.318E-6)	0.000483	17	-12.7	0.000421	-5.36	-23.7	1998
Fetal death rate	2.743E-6 (2.501E-6)	0.000121	5.8	-7.2	0.000112	-1.02	-22.7	1995
AIDS rate	6.796E-5* (2.756E-5)	1.044E-5	2150	1180	0.000134	-69.8	51.7	1999
Arrestee positive rate	-0.684 (0.628)	--	--	--	28.7	4.04	31.8	1999

Notes: Each row corresponds to a different dependent variable as named in the left-hand column. Column 1 reports the point estimate and standard error from a regression of the named measure on the estimated crack index, state-fixed effects, and year-fixed effects. Standard errors, in parentheses, are clustered to account for correlation within states over time. The second column reports the mean of the dependent variable in 1982. The third column reports the percent change in the dependent variable attributable to crack, computed as the coefficient on crack times the mean change in crack between the years in question. We choose 1989 as the dividing point in the sample because that is the peak year of crack according to our estimates. The crack measure is the baseline city-level crack index from column 6 of Table 3.

Table 6(b): The Correlation Between Crack and a Wider Range of Outcomes

State-Level Analysis

Measure	Crack Coef.	Mean 1982	%Δ in Mean Relative to 1982 Due to Crack, 1982-1993	Actual %Δ in Mean Relative to 1982, 1982-1993	Mean 1993	%Δ in Mean Relative to 1993 Due to Crack, 1993-End	Actual %Δ in Mean Relative to 1993, 1993-End	End Year
Original Measures								
Youth homicide rate	6.819E-5** (2.288E-5)	0.000222	68.7	75.2	0.000388	-20.4	-46.1	1999
Cocaine arrest rate	0.00656** (0.00093)	0.00722	206	327	0.0308	-25.6	-3.85	1999
Weapons arrest rate	0.00208** (0.000425)	0.0144	32.8	14.8	0.0165	-15.1	-35.3	1999
Rate low birth weight	0.000515* (0.000258)	0.0648	1.77	6.25	0.0689	-0.918	7.3	1999
% Kids in foster care	0.000181** (3.952E-5)	--	--	--	0.0018	-5.06	-6.7	1995
% female prisoners	0.000653 (0.000769)	--	--	--	0.0555	-1.21	21.8	1998
Homicide Measures								
Male ages 26-35	3.398E-5** (1.027E-5)	0.000264	28.7	16.5	0.000308	-9.26	-28.3	1997
Male ages 36-45	1.451E-5** (5.32E-6)	0.000187	17.3	-4.65	0.000178	-6.83	-27.7	1997
Crime Measures								
Overall violent crime rate	17.2* (8.02)	534	7.19	39.2	743	-2.11	-18	1997
Rape	-1.79* (0.847)	32.1	-12.4	26.9	40.7	4	-11.5	1997
Robbery	8.85	224	8.81	13.5	254	-3.18	-27.1	1997

	(4.6)							
Aggravated assault	6.69	270	5.52	62.7	439	-1.39	-13.1	1997
	(7.71)							
Overall property crime rate	24.3	4800	1.13	-1.57	4720	-0.468	-8.77	1997
	(83.3)							
Burglary	-9.6	1410	-1.51	-22.3	1100	0.798	-16.2	1997
	(34.2)							
Larceny	0.562	2950	0.0423	2.43	3030	-0.0169	-4.61	1997
	(52.7)							
Auto theft	32.4**	434	16.6	38.3	600	-4.92	-16.3	1997
	(10.9)							
Additional Measures								
Unemployment rate	0.00127	0.092	3.06	-23	0.0708	-2.2	-39.6	1999
	(0.00116)							
Poverty rate	0.000427	0.15	0.632	0.729	0.151	-0.346	-21.8	1999
	(0.00122)							
Child mortality rate	1.529E-5**	0.000516	6.6	-29.7	0.000362	-4.32	-22.6	1998
	(5.921E-6)							
Fetal death rate	2.118E-5*	0.000267	18	5.89	0.000282	-3.33	-13.8	1995
	(9.133E-6)							
AIDS rate	2.087E-5*	5.149E-6	902	8050	0.000419	-6.11	-58.6	1999
	(1.017E-5)							

Notes: Each row corresponds to a different dependent variable as named in the left-hand column. Column 1 reports the point estimate and standard error from a regression of the named measure on the estimated crack index, state-fixed effects, and year-fixed effects. Standard errors, in parentheses, are clustered to account for correlation within states over time. The second column reports the mean of the dependent variable in 1982. The third column reports the percent change in the dependent variable attributable to crack, computed as the coefficient on crack times the mean change in crack between the years in question. We choose 1993 as the dividing point in the sample because that is the peak year of crack according to our estimates. The crack measure is the baseline city-level crack index from column 6 of Table 3.