INCARCERATION OF AFRICAN AMERICAN MEN AND THE IMPACTS ON WOMEN AND CHILDREN*

Sitian Liu†

August 2, 2019

Abstract

Since the early 1970s, the United States has experienced a dramatic surge in imprisonment, especially of African American men. This paper investigates the causal effects of black male incarceration on black women's marriage and labor market outcomes, as well as its effects on black children's family structure, long-run educational outcomes, and income. To establish causality, I exploit plausibly exogenous changes in sentencing policies across states and over years and construct a simulated instrumental variable for the incarceration rate, using offender-level data on the universe of prisoners admitted to and released from prisons between 1986 and 2009. The instrument characterizes how sentencing policies affect incarceration at both the extensive margin (i.e., whether to incarcerate an arrestee) and the intensive margin (i.e., how long to imprison an inmate). First, I find that high incarceration rates of black men negatively affect black women's marriage outcomes, although they increase the likelihood of employment for those with higher education levels. Second, higher black male incarceration rates hurt black children by increasing the likelihood of out-of-wedlock birth and living in a mother-only family, and decreasing the likelihood of having some college education in the long run. Third, black men at either the extensive or intensive margin of incarceration have different impacts on women and children. The results suggest the consequences of tough-on-crime policies for inequality and racial gaps, which could be taken into account when reforming sentencing policies.
JEL Codes: J12, J15, K14.

*I am grateful to my advisors, Caroline M. Hoxby, Rebecca Diamond, Petra Persson, and Luigi Pistaferri, for their guidance and support. I also thank Jaime Arellano-Bover, Yiwei Chen, John Donohue, Mark Duggan, Eleonora Freddi, Shota Ichihashi, David Alan Sklansky, Isaac Sorkin, Yichen Su, and participants at the Stanford Labor Seminar, Applied Lunch, Labor and Public Workshop, San Fransisco State University, University of Ottawa, HEC Montreal, and Queen's University. I acknowledge financial support from the John M. Olin Program in Law and Economics Research Fellowship and the B.F. Haley and E.S. Shaw Fellowship for Economics.

†Dunning Hall, Room 345. Department of Economics, Queen's University. 94 University Avenue, Kingston, ON, K7L 3N6, Canada. Email: sitianliu@econ.queens.ca. Telephone: 613-716-9480.

1 Introduction

Over the past four decades, the United States has witnessed dramatic growth in incarceration, with a 1.1 million increase in the number of adults in state or federal prisons between 1974 and 2001, up from 216,000; the phenomenon is broadly described as "mass incarceration" (Bonczar, 2003). The African American population, and in particular African American men, has been disproportionately affected by mass incarceration: 11% of black men between 20 and 39 years old were in state or federal prisons and local jails, compared with 1.7% of white men, 1% of black women, and 0.2% of white women in that age group as of 2001.[1]

This paper investigates the causal effects of the incarceration of African American men on women's marriage and labor market outcomes, as well as its effects on children's family structure, long-run educational outcomes, and income. While the increase in the number of "missing" black men has been accompanied by a decline in marriage among young black adults and an increase in out-of-wedlock births among black children, it is difficult to establish causality due to the potential endogeneity problem: Increases in the incarceration rate can be correlated with unobservable changes in economic factors, local conditions, or individual characteristics that may affect women's and children's economic outcomes independently.

To overcome endogeneity, I exploit plausibly exogenous changes in state and federal sentencing policies and build a simulated instrumental variable (IV) for the incarceration rate. The IV characterizes how sentencing policies affect incarceration at both the extensive margin (i.e., whether to incarcerate an arrestee) and the intensive margin (i.e., how long to imprison an inmate). The IV strategy essentially uses a difference-in-differences (DD) strategy to estimate the impact of sentencing policy changes. To illustrate how the simulated IV works, consider different sentences for theft due to different sentencing policies across states and over years. Suppose Person A stole a $400 pair of basketball shoes in Georgia and Person B stole similar items in Florida, but they are otherwise identical. Person A would be charged with a misdemeanor and punished with a fine. However, Person B would be charged with a felony and might have to serve time in prison. Moreover, Florida implemented truth

[1] Estimation is based on the number of inmates in state or federal prisons and local jails by gender, race, Hispanic origin, and age on June 30, 2001, from Prison and Jail Inmates at Midyear 2001 from the Bureau of Justice Statistics (Beck et al., 2002), and the July 1 resident population, by gender, race, Hispanic origin, and age, from Bridged-Race Population Estimates on the CDC Wonder website.

in sentencing in 1995, which requires that all offenders serve a substantial portion of the sentence before being eligible for release. Therefore, Person B might have to serve longer time in prison if he was sentenced after 1995.

With the simulated IV, I estimate causal effects of "missing" black men at the margins of incarceration, where the punitiveness of sentencing policies influences their probability of imprisonment. Moreover, men with some form of contact with the criminal justice system and those with longer duration of incarceration could have different impacts on women and children (e.g., Andersen, 2016; Massoglia et al., 2011; Pager, 2003). By constructing simulated IVs that exploit changes in sentencing policies at different margins separately, I disentangle the impacts of (1) "missing" black men at the *extensive* margin of incarceration (i.e., men who serve short terms of imprisonment and would not have been incarcerated at all under less harsh sentencing laws), and (2) "missing" black men at the *intensive* margin of incarceration (i.e., men who serve longer terms of imprisonment and would have been released more quickly under less harsh sentencing laws).

To construct the simulated IV, I employ offender-level data on the universe of prisoners who were admitted to or released from state or federal prisons between 1983 and 2009 from the National Corrections Reporting Program (NCRP) and arrest data from the Uniform Crime Reporting (UCR) Program. The data allow me to estimate the variables used to construct the IV: (1) probability of incarceration conditional on arrest and (2) average time served in prison by year of prison admission, state or metropolitan statistical area (MSA) where sentence was imposed, offense, race, and gender. Furthermore, I estimate the incarceration rate of adult black men by year and MSA of sentence using data from the NCRP and U.S. Census Population Data. Then I merge the incarceration rates with individual-level information on marriage, employment, education, and family structure by year and MSA between 1986 and 2009. It is noteworthy that the incarceration rate is only one measure of the fraction of individuals who are "disabled" in the marriage market due to harsh sentencing policies. Nevertheless, the results also reflect the impacts of other outcomes associated with incarceration that are driven by harsh sentencing policies, such as previous incarceration. More specifically, incarceration leaves in its wake a large population of former prisoners residing among the general population who encounter obstacles to reentering the workforce.

They are likely to be "disabled" by incarceration, becoming less viable as potential marriage partners in life.

My results suggest that the surging incarceration rates of black men negatively affect black women's marriage outcomes. For example, I find that a 1 percentage point (pp) increase in the black male incarceration rate lowers the likelihood of marriage by 3 pp and lowers the likelihood of "marrying up" by 2 pp for black women between ages 18 and 34.[2] Also, more educated black women are more likely to be employed in the face of higher black male incarceration rates. Moreover, my results indicate that mass black male incarceration could hurt children by negatively affecting family structure and their long-run educational outcomes. For example, I find that for black children, a 1 pp increase in the incarceration rate of black men increases the likelihood of being born out of wedlock and living in a mother-only family by 4.3 pp and 3.5 pp, respectively; in the long run, it lowers the likelihood of obtaining at least some college education by 3.8 pp. Finally, my results suggest that harsh sentencing policies could partially explain the large intergenerational gap in income between black and white men. It is noteworthy that the two-stage least square (2SLS) results are considerably larger in magnitude than the ordinary least squares (OLS) results. This could result from omitted variable bias and attenuation bias due to measurement error. Another reason could be heterogeneous treatment effects. In particular, I find that compliers—marginal prisoners whose imprisonment is influenced by sentencing policy changes—are more marriageable, and therefore could have larger impacts on women's and children's outcomes.

My results also suggest that black men at different margins of incarceration have different impacts on women and children. I find that a 1 pp increase in the incarceration rate of black men at the *extensive* margin lowers the likelihood of marriage by 4 pp for black women with *some college* education, and the impact is small and statistically insignificant for less educated black women; a 1 pp increase in the incarceration rate of black men at the *intensive* margin lowers the likelihood of marriage by 4 pp for black women with *no college* education, and the impact is small and statistically insignificant for more educated black women. It is reasonable that the extensive (intensive) margin incarceration of black men has a starker

[2]In this paper, the incarceration rate of black men is defined as the fraction of black men between ages 20 and 54 who are in prison. "Marrying up" is defined as having a husband whose years of education are at least equal to the woman's.

effect on the marriage of relatively more (less) educated women. This is because black men at the extensive margin of incarceration are more likely to have committed less serious crimes, and therefore more likely to be considered potential marriage partners by more educated black women, and vice versa. While both cases have substantial effects on children, the impact of black men at the *intensive* margin of incarceration is notably large. This suggests that a father's longer separation from his family could be especially harmful for children.

The paper's contributions are threefold. The first contribution is identification. I exploit plausibly exogenous changes in sentencing policies across states and over years, and encapsulate policy changes efficiently in powerful instruments. The simulated IV not only increases the power of the first stage by employing a continuous measure of the effects of complicated sentencing policies, but also improves its clarity by specifying how sentencing policies fit into the prison population based on a simulation procedure of the prison population.

The second contribution is measuring the incarceration rate at the MSA level. Public-use data usually provide incarceration rates at the national or state level. However, MSAs are more suitable as geographic units for the analysis of marriage and labor markets.[3]

A concern about using changes in sentencing policies to identify causal impacts of incarceration is the existence of potential confounding factors that may be related to both the outcome and the sentencing policies, such as crime rates or racial composition. Nevertheless, I find substantial variation in incarceration rates across MSAs within states, which suggests that state-level policy changes are not likely to be driven by some common shock faced by all MSAs. Moreover, with the MSA-level measurement, I am able to construct instruments using leave-one-out means, which could eliminate the impact of local idiosyncratic shocks.[4]

Finally, my third contribution is investigating the long-run impacts of black male incarceration on children and the impact of sentencing policies on intergenerational income gaps. I also disentangle different impacts of black men at different margins of incarceration.

My results have implications for sentencing policies and other correctional programs. Although many studies have evaluated direct expenditures on corrections and the consequences

[3]MSAs are regions with a relatively high population density and close economic ties throughout the area. In particular, I combine non-metropolitan areas within each state as a unique MSA of the state.

[4]Specifically, I construct the simulated IV for MSA m in state s using the sentencing outcomes of offenders sentenced from state s, leaving out those sentenced from MSA m.

of incarceration for former inmates, the broader consequences of incarceration for black families could also have welfare implications. First, my results suggest negative impacts of black male incarceration on black children's living circumstances and long-run outcomes and black women's marriage outcomes. Second, impacts of black men at the extensive margin of incarceration suggest that there could be indirect benefits of alternative sentencing to incarceration. Third, my results suggest that black men at the intensive margin of incarceration have larger effects on less educated black women and children, which could possibly exacerbate inequality. My results also indicate that the punitiveness of sentencing policies could partially explain the black-white intergenerational gaps in income. Therefore, the potential consequences of the tough-on-crime policies on inequality and racial gaps could be taken into account for sentencing policy-making.

The rest of the paper is organized as follows. Section 2 provides a literature review and Section 3 describes the data and measurement. Section 4 provides some background information on sentencing policy changes. The empirical strategy is outlined in Section 5 and results presented in Section 6. Section 7 concludes.

2 Literature Review

This paper is related to three strands of literature. The first is the literature on sex ratios and marriage markets.[5] The seminal work of Becker (1973, 1974) suggests that a reduction in the number of men should shift gains from marriage away from women toward men. Following this, some studies use cross-sectional variation in sex ratios to estimate the relationship between the sex ratio and the marriage market or female labor supply (Chiappori et al., 2002; Cox, 1940; Easterlin, 1961; Guttentag and Secord, 1983). A big challenge in these studies is the lack of exogenous variation in sex ratios, which is later overcome by Abramitzky et al. (2011), Angrist (2002), and Lafortune (2013). I complement this literature by exploiting exogenous changes in sentencing policies that disproportionately affect black male incarceration. Incarceration shrinks the pool of marriageable black men by sending them to prisons,

[5]For a more detailed review of literature on sex ratios and marriage markets, see Abramitzky, Delavande, and Vasconcelos (2011).

and reducing their "marriageability" with criminal records and high risks of incarceration.

This paper is also related to the literature on the impacts of incarceration. A large body of literature focuses on the direct impact of incarceration on criminal activity and the consequences for former inmates (Aizer and Doyle Jr, 2015; Kuziemko and Levitt, 2004; Levitt, 1996; Mueller-Smith, 2015; Western and Lopoo, 2004; Western and McClanahan, 2000; Western, 2002; Wildeman and Muller, 2012).[6] Nevertheless, collateral impacts of aggregate male incarceration have been less studied. To the best of my knowledge, Charles and Luoh (2010) and Mechoulan (2011) are the first to investigate the relationship between male incarceration and female outcomes.[7] These studies use the fixed effect approach and exploit variation in male incarceration rates across states and over years. However, their results may not represent a causal relationship because of unobservable confounds. I add to these studies in three ways. First, I improve the measurement with the MSA-level incarceration rates. Second, I propose a simulated IV to address the potential endogeneity of incarceration. Third, I also estimate long-run impacts on children and intergenerational income gaps.

Lastly, this paper is related to the literature on how changes in sentencing policies affect the prison population. The construction of the simulated IV is motivated by the simulation models presented by Raphael and Stoll (2013) and Neal and Rick (2016), which aim to match the simulated prison population to the real prison population.[8] Instead, I extract exogenous components of their models that characterize the punitiveness of sentencing policies: tendency to incarcerate arrestees and time served in prison. Then I use these exogenous components to construct an IV based on a simulation procedure of the prison population.

[6]Some studies also investigate the impact of incarceration on African American communities by exploiting the geographic concentration of incarceration (Clear, 2008). Influential work by Johnson and Raphael (2009) studies the impact of male incarceration on AIDS infection. Travis et al. (2014) provide a detailed review of literature on the consequences of incarceration. They also point out the knowledge gap in drawing causal inferences about the aggregate effects of incarceration.

[7]A more detailed review of these studies is presented in Appendix A1. Caucutt et al. (2016) develop an equilibrium search model of marriage, divorce, and labor supply. They show that differences in incarceration and employment between black and white men can explain part of the black-white marriage gap.

[8]Another strand of the literature uses panel regressions to determine how a particular sentencing policy change affects the prison population (Nicholson-Crotty, 2004; Stemen et al., 2006; Stemen and Rengifo, 2011; Zhang et al., 2009). However, there is no consensus among these studies.

3 Data Description and Measurement

3.1 Arrest Data

The Uniform Crime Reporting Program (UCR) collects data on crime and arrests through reporting by participating law enforcement agencies, since 1930. I use yearly summary data on the number adult arrests by state, year, offense, and race (or gender).[9]

3.2 Prisoner Data

I use data on prisoners from four sources. First, the National Prisoner Statistics Program (NPS) provides an enumeration of inmates in state and federal prisons since 1926. In 1999, it was expanded to include inmates held in local facilities. In particular, I use data on jurisdiction population at year end by year, state, race, and gender between 1983 and 2009.

The main data on prisoners are from the National Corrections Reporting Program (NCRP), which has collected offender-level administrative data annually since 1983. It consists of data for the universe of prisoners who were admitted to prison (Admissions Data) or released from prison (Releases Data) from 1983 to 2009. In 2004, 22 states also began to collect data on stocks of prisoners in custody at year end (Yearend Population Data). The NCRP data provide demographic information, including date of birth, gender, race, Hispanic origin, and education attainment. The data also provide sentencing information, including date of admission to prison, date of release from prison (in Releases Data only), conviction offense(s), length of the longest sentence, location where sentence was served, state of custody, and county (and MSA)[10] where sentence was imposed. A more detailed description of the NCRP data can be found in Appendix A2.1.

Third, the Survey of Inmates in State Correctional Facilities (SISCF) (1986, 1991, 1997, and 2004) selects nationally representative samples of inmates in state prisons, and collects detailed demographic characteristics of prison inmates. In particular, the SISCF data provide marital status and employment status 1 month before arrest. Unfortunately, the samples are

[9]The data do not provide the number of arrests jointly by race and gender.

[10]The NCRP provides the county where sentence was imposed. I match counties to MSAs based on the 2000 delineation of the Office of Management and Budget.

not annual, and only provide the census region (not state) where an inmate was interviewed.

Fourth, I use data from the American Community Survey (ACS) (2006-2009) on the institutionalized to complement the SISCF data. Unfortunately, the ACS data do not distinguish among different types of institutions. Nevertheless, when the sample is restricted to young black men in institutions, their characteristics are comparable to the characteristics of young black male inmates in the SISCF.[11]

Table 1 provides summary statistics for newly admitted black male prisoners from the NCRP (Columns 1-2), black male inmates in state prisons from the SISCF (Columns 3-4), black men in institutions from the ACS (Columns 5-6), and general black male population from the household data described in the next subsection (Columns 7-8). Compared with the general black male population, black male inmates are younger, more likely to be single, and less likely to have higher levels of education. Interestingly, however, the employment rates of black male inmates before arrest are comparable to that of the general population.

3.3 Household Data

For the dependent variables and individual characteristics of women and children, I use repeated cross-sectional data from the Current Population Survey Annual Social and Economic Supplement (CPS-ASEC) 1986-2009, the American Community Survey (ACS) 2006-2009, and the U.S. Census 5% samples for 1990 and 2000 from the Integrated Public Use Microdata Series (IPUMS). The data provide demographic information, such as age, gender, race, marital status, and family interrelationship, and socioeconomic information, such as educational attainment, employment status, and income. The geographic information includes current state, MSA, and county of residence.[12] The U.S. Census 5% samples and the ACS data also provide state of birth.

[11] The ACS data do not distinguish among different types of institutions, including correctional institutions, mental institutions, and institutions for the elderly, handicapped, or poor. Charles and Luoh (2010) treat institutionalized young men in the 1990 and 2000 censuses as being incarcerated. They argue that young men are most likely to be in mental institutions if not incarcerated, but the number of people in mental institutions has plummeted since the 20th century. They also show that the patterns of incarceration based on their definitions are consistent with information on incarceration from the Bureau of Justice Statistics.

[12] The CPS-ASEC provides information on MSA since 1962. The number of MSAs identified increased over time, from 15 beginning in 1962 to over 200 beginning in 1986. Therefore, I focus on years between 1986 and 2009. The CPS-ASEC provides information on county since 1996. I do not use CPS Basic Monthly data because they started to provide information on MSA in 1994 and on county in 1995.

3.4 Measurement

In this subsection, I describe how I measure the prison population and the incarceration rate at the MSA level. Public-use data on prisoners provide the number of prisoners at the national and state level in general.[13] However, there is substantial variation in incarceration rates across areas within states.[14] Therefore, it is important to measure the incarceration rate at the MSA level. And last, I discuss how the incarceration rate should be interpreted.

3.4.1 Prison Population at the MSA Level

The NCRP data did not provide information on stocks of prisoners in custody until 2004. Therefore, I use the *perpetual inventory method* to estimate the year-end prison population by year, MSA of sentence, race, and gender between 1983 and 2009. First, I use the NCRP data on stocks of prisoners in custody between 2004 and 2009 to estimate the year-end prison population between 2004 and 2009, by year, MSA of sentence, race, and gender. Second, I use the NCRP data on admissions and releases between 1983 and 2009 to estimate yearly changes in prison population—namely the number of admission minus the number of releases within each year.[15] Last, I back out the year-end prison population before 2004. Since only 22 states provide data on year-end prison population, I can only estimate MSA-level prison population for the 22 states. In Appendix A2.2, I discuss the availability and reliability of the NCRP data across states and how I clean the data. In Appendix A2.3, I show mathematically how I employ the perpetual inventory method.

It is noteworthy that the geographic unit is the MSA where sentence was imposed (rather than the location of custody). This is important for three reasons. First, the MSA of sentence

[13] The Vera Institute of Justice recently publishes data on the county-level prison and jail population by race or by gender (but not by both race and gender) (https://www.vera.org/projects/incarceration-trends).

[14] For instance, in California, 2000, while on average 9.4% of black men ages 20-54 were in prison, less than 2% of black men from the MSA of San Luis Obispo County were in prison, and more than 20% of black men from the MSA of Shasta County were in prison. For another instance, in Texas, 2000, the average incarceration rate was 9.2%. The minimum was less than 0.4% in the MSA of Webb county, and the maximum was more than 16% in the MSA of Ector County and Midland County.

[15] I assume that prisoners will return to the MSA where they were sentenced after they are released. The assumption is reasonable, because their social networks (including family and friends) are likely to remain where they used to live. Visher et al. (2008) show that most former prisoners search for a job through family or friends, and family or friends are also the most common source of income for formerly incarcerated people two months after release.

is most likely to be the place where an offender committed a crime. It is also more likely to be the marriage market where the person is "missing," since offenders generally commit crimes near their residence.[16] Second, the number of prisoners in custody within a MSA can be different from the number of prisoners sentenced from the MSA, and the latter could introduce less measurement error.[17] Finally, using the MSA of sentence, transfers of prisoners between different locations do not affect the estimation.[18]

After the estimation, I check whether the estimated MSA-level year-end prison population is reliable in two ways. First, I compare the year-end MSA prison population 2004-2008 estimated directly from NCRP Yearend Population Data (Figure 1 x-axes) with the MSA prison population backed out using the perpetual inventory method (Figure 1 y-axes). This checks whether data on stocks of prisoners are consistent with data on admissions and releases in the NCRP. Figure 1 shows that the two estimates are almost the same.

Second, I aggregate the estimated MSA prison population to the state level, and compare this with the state prison population reported from the NPS. These two data series should not match exactly.[19] Nevertheless, large deviations in the trend between estimates from two data sources can cause concern. Figure 2 shows that for several large states, NCRP estimates are mostly comparable with NPS estimates. I also calculate the correlation of the two estimates for each state in my sample, and the average is 0.935.

[16] Ackerman and Rossmo (2015) show that the average residence-to-crime distance is 6.3 miles.

[17] The location of custody can be different from where an offender was sentenced. For federal prisoners, they can be held in another state rather than the state where they committed the crime. For state prisoners, the prison assignment depends on many factors, such as risk level and capacity of institutions, so the location of custody can be far away from the place where the crime was committed. Moreover, state prisoners could also be held in another state since states can lease their prison space. For instance, in 1999, 1,468 prisoners sentenced in the District of Columbia were sent to Virginia, representing 17% of the total number of prisoners under the jurisdiction of the District of Columbia at the end of 1999.

[18] For instance, suppose a person was sentenced in MSA s, admitted to a prison in MSA a, and later transferred to another prison in MSA b. The transfer does not affect the estimation, since the offender is only considered to be a person missing from MSA s.

[19] The NCRP and the NPS differ in several respects. First, the NCRP data include prisoners sentenced to state or federal prisons. The NPS data included prisoners in federal and state prisons before 1999, then was expanded to include inmates housed in local jails. Second, before 1999, the NPS separated race and Hispanic origin. Since then, it combined race and Hispanic origin into a single item, including white (not of Hispanic origin), black (not of Hispanic origin), Hispanic or Latino, and other race categories. To be consistent, I only consider races without distinguishing Hispanic origin in the NCRP.

3.4.2 Incarceration Rate

The incarceration rate of black men in year t and MSA m is

$$\text{Fraction of black men in prison}_{mt} = \frac{\text{\# of black men in prison in year } t \text{ sentenced from MSA } m}{\text{residential population of black men ages 20-54 in year } t \text{ MSA } m}. \quad (1)$$

The numerator is estimated as described in the previous subsection, and the denominator is estimated using U.S. Census Intercensal County Population Data. I restrict the age range, because more than 90% of black male inmates were between 20 and 54 years old.[20] For robustness checks, I also estimate the incarceration rate of *single* black men, because black male inmates tend to be single, and single black men should be more related to the marriage market. More details can be found in Appendix A3.1.

3.4.3 Interpretation of the Incarceration Rate

The black male incarceration rate is used to measure the share of black men who are not "marriageable" in the marriage market, because of relatively better availability of data on prisoners than other data on corrections. However, higher incarceration rates of black men are associated with a variety of other forms of contact with the criminal justice system, such as probation, jail, or parole, which might also affect black men's marriageability in the marriage market. Moreover, higher incarceration rates also result in a larger *stock* of former prisoners residing in the general population who face health problems, difficulty finding employment, and social stigma. Therefore, incarceration not only removes people from the marriage market for a typically short period of time, but also potentially "disables" them by making them less viable as potential marriage partners in life. As a result, when interpreting the incarceration rate, it is important to consider all outcomes associated with incarceration.

Figure 3 shows the fractions of black males age 20 or older who were on probation, on parole, in jail, in state or federal prison, as well as of those who had ever been incarcerated

[20] Estimation is based on data from Prison and Jail Inmates at Midyear 2000-2009. For robustness checks, I also estimate the incarceration rate by replacing the denominator with the population of black men ages 20-39, since young black men are more likely to be incarcerated and related to the marriage market. On average, 70% of black male inmates in state or federal prisons and local jails were between ages 20 and 39.

in state or federal prison at year end.[21] The incarceration rate increased from 3% to 6% between 1986 and 2001. This is associated with an increasing share of black men who were having some contact with the criminal justice system, from 9% to 19%, and an increasing share of black men who had ever been incarcerated, from 11% to 18%. In summary, every 1% of black men in prison was on average associated with 5.6% of former black male prisoners or black men having contact with the criminal justice system.

4 Background of Sentencing Policy Changes

The explosive growth of the U.S. prison population since the mid-1970s has been associated with notable changes in sentencing regimes from the 1970s to the 1990s. This section provides a brief review of the changes in sentencing policies, how they differ across states, how they could contribute to the growth in incarceration, and how they are translated into the simulated instrument. Table 2 compares the policy changes across states.

Determinate Sentencing Between the late 1970s and the 1990s, some states adopted determinate sentencing by abolishing or curtailing the discretionary power of parole boards, to ensure that time served by offenders would be determined by the length of the sentence.[22] Determinate sentencing may have contributed to the growth of the prison population through longer time served in prison, by eliminating the possibility that parole boards could adjust prison populations through selective release (Raphael and Stoll, 2013).

Sentencing Guidelines In the 1970s, states started to adopt various forms of sentencing guidelines for consideration in judicial sentencing decisions (Stemen et al., 2006). Among states with sentencing guidelines, there is substantial variation. For instance, while in some states guidelines are legally binding, in other states guidelines are voluntary.[23] Sentencing

[21] The estimates of the correctional populations are from Correctional Populations in the United States 1986, 1991, and 1997, Probation and Parole in the United States 2001, Prison and Jail Inmates at Midyear 2002, and Prisoners in 2001 from the Bureau of Justice Statistics. The population of black males age 20 or older is from the intercensal estimates of population from the United States Census Bureau. Bonczar (2003) provides the number of black male adults who had ever been incarcerated in state or federal prison.

[22] Throughout the early 1970s, indeterminate sentencing was implemented in all states in which parole boards maintained their authority to release inmates at their discretion.

[23] For a detailed review of state sentencing guidelines, see Frase (2005).

guidelines may have contributed to the growth of incarceration because they include many mandatory minimum sentences, which curtail judges' discretion to impose alternatives to incarceration and can lead to longer sentences (Raphael and Stoll, 2013).[24]

Truth-in-sentencing Laws From 1984 through the late 1990s, many policy changes made sentences more stringent (Tonry, 2013). Some states sought to ensure that offenders serve a substantial portion of their sentences through truth-in-sentencing laws.[25] The requirements of the laws vary considerably across states, in terms of the type of offenders covered under the laws and the proportion of sentences to be served.[26] Such laws may have contributed to the growth of incarceration through longer time served in prison (Ditton and Wilson, 1999).

Three-strikes Laws Since 1994, some states have adopted three-strikes laws, which impose more severe mandatory sentences for repeat offenders. States vary in terms of the number and type of convictions to trigger the laws and the sentences imposed under them (Clark et al., 1997; Stemen et al., 2006).[27] Such laws may have contributed to the growth of incarceration through a higher tendency to incarcerate arrestees and longer sentences.

The War on Drugs The Anti-Drug Abuse Acts of 1986 and 1988 were major federal laws that paid special attention to crack cocaine. For instance, a minimum sentence of 5 years without parole was mandated for possession of 5 grams of crack cocaine, while the same sentence was mandated for a possession of 500 grams of powder cocaine. It has been argued that some provisions of the acts targeted black drug offenders (Alexander, 2012).

[24] For instance, after federal sentencing guidelines were implemented in 1987, the share of convicted federal offenders to whom probation could be applied at the discretion of judges dropped from more than 60% to less than 15% (Champion, 2008).

[25] In 1994, the federal government established the Truth-in-Sentencing Incentive Grants Program, which provided grants for prison construction and expansion to states that adopted policies requiring some offenders to serve large portions of their sentences.

[26] For instance, although most truth-in-sentencing states require that some offenders serve 85% of the prison sentence, some states have a 50% requirement or a 100% requirement. In addition, while most states apply the requirements to violent offenders or certain other offenders, some states apply the requirements to all sentenced offenders (Ditton and Wilson, 1999; Sabol et al., 2002).

[27] For instance, in California, a "second striker" (i.e., someone with a prior violent offense convicted of a second felony) receives a sentence equal to twice the sentence for the second offense and a "third striker" receives an indeterminate sentence of 25 years to life. Pennsylvania's three-strikes law is triggered only when an offender of two prior felonies is convicted of one of eight specified offenses, and the judge has the discretion to increase the sentence by up to 25 years (Raphael and Stoll, 2013).

Summary There is large variation in sentencing policies across states in terms of the policies implemented, timing of the policy changes, and the requirements. The variation in and complexity of these sentencing policies provides supporting evidence of the exogeneity of the law changes to some extent, but in the meantime makes it difficult to identify the effect of a particular law change.[28] Despite the complexity, the discussion in this section indicates that sentencing policy changes are likely to have contributed to the growth of the prison population through two channels: (1) a higher tendency to incarcerate arrestees and (2) longer time served in prison. The effects can differ across states depending on both the types of sentencing policies implemented and the requirements of the policies. Therefore, in order to exploit these complicated policy changes, I encapsulate them in a simulated IV, which serves as a sufficient statistic that embodies these two channels.[29]

5 Empirical Strategy

In this section I describe the identification strategy. First, I set up the baseline specification and discuss the endogeneity problem. Second, I provide some intuition, using an analogy with the simulated IV of taxation. Third, I formally construct the simulated IV. Fourth, I discuss IV validity and provide supporting evidence. Lastly, I show how I estimate the variables used to construct the instrument.

5.1 Setup

For a black woman or child i living in MSA m in year t, I consider a model that relates the woman's outcome, such as an indicator of being married or employed, or the child's outcome, such as an indicator of being born out of wedlock or living in a mother-only family, y_{imt}, to the incarceration rate of black men, i.e., the fraction of black men missing from MSA m in

[28] It it difficult to implement a DD approach to estimate the impact of sentencing policy changes, because many policies were implemented simultaneously, different states had different requirements for similar laws, and different states used different names for laws with similar effects. Mixed results among studies that estimate the effect of each sentencing policy change also suggest the complexity of the sentencing policies.

[29] As examples, in Section 5.4, I study several states in which policy changes were enacted in a relatively discrete way. I show that the simulated IV grows after some sentencing policy is implemented, which provides evidence that harsher sentencing policies contributed to the growth of the prison population through the above two channels.

year t due to incarceration, IR_{mt}:

$$y_{imt} = \beta_0 + \beta_1 IR_{mt} + X_{imt}\delta + \gamma_m + \xi_t + \epsilon_{imt}, \tag{2}$$

where X_{imt} is a vector of control variables, including age, age-squared, and years of education for women, and age and gender dummy for children. γ_m denotes MSA fixed effects and ξ_t denotes year fixed effects. ϵ_{imt} is the error term. β_1 is the parameter of interest.[30]

I consider a similar model to estimate the long-term impact of black male incarceration on children's education:

$$y_{imt} = \beta_0 + \beta_1 \overline{IR}^{child}_{(i)m} + \gamma_m + \xi_t + \epsilon_{imt}, \tag{3}$$

where y_{imt} is an indicator that a young black adult i living in MSA m had at least 1 year of college education in year t. $\overline{IR}^{child}_{(i)m}$ is the average incarceration rate of black men in MSA m when individual i was in his or her childhood. The model is estimated for young black men and young black women separately.

The OLS estimates of β_1 are likely to be biased because of omitted variables and measurement error. To understand the potential sources of endogeneity, it is useful to think about how the incarceration rate is determined. Specifically, at the extensive margin, the probability of being in prison is influenced by the probability of being *admitted* to prison:

$$\Pr(\text{admission}) = \Pr(\text{admission} \mid \text{arrest}) \cdot \Pr(\text{arrest}).$$

At the intensive margin, the probability of being in prison is influenced by the amount of time spent in prison:

$$\text{time in prison} = \text{sentence length} \cdot \text{proportion served}.$$

[30] To interpret β_1, it is helpful to consider the timing of marriage (and similarly of employment). This is because the current marital status of a woman depends on all her past decisions regarding whether to remain single, marry, or divorce. These decisions were made by weighing gains from and costs of marriage, which could differ across ages under the same marriage market condition (characterized by the male incarceration rate). Therefore, given the male incarceration rate, the probability of being married for women is not uniform across ages. Although I focus on women of prime marriageable ages, increasing male incarceration rates could still play different roles for the marriage decisions of women of different ages. As a result, β_1 should be understood as a weighted average impact of the black male incarceration rate on the likelihood of being married for women of different marriage ages who are on the margin of opting into or out of marriage.

In Section 4, I argue that many sentencing policy changes are likely to lead to higher probabilities of prison admission conditional on arrest, longer sentences, and larger proportions of sentences served. (Additional supporting evidence is presented in Section 5.4.) In contrast, the arrest rate, Pr(arrest), is likely to be endogenous because it is likely to be influenced by criminal and police behaviors.

Potential omitted variables could bias OLS estimates in both ways. One example is higher prevalence of illicit drugs, which may increase the fraction of men addicted to drugs and therefore increase their chances of being arrested and imprisoned.[31] In the meantime, black women may be less likely to marry because they may not want to marry men addicted to drugs. This omitted variable may lead to upward bias (in magnitude) in OLS estimates.[32]

Omitted variables may also bias OLS estimates in the other direction. One example is economic profit from crime (Becker, 1968). On the one hand, higher returns to some criminal activity can lead to higher crime rates, and therefore higher incarceration rates. On the other hand, the higher returns may also make some men involved in the related criminal activity more attractive in the marriage market if they had not been incarcerated.[33] This omitted variable may lead to downward bias (in magnitude) in the OLS estimates.

Finally, measurement error can also lead to OLS estimates biased toward zero. This is because I do not observe the incarceration rate that a woman perceives. For instance, she could be disproportionately influenced by the incarceration rate in her neighborhood, but I do not observe that. The incarceration rate that I measure only provides a proxy for it.

The identification strategy is to construct a simulated IV for the incarceration rate (IR), which embodies plausibly exogenous sentencing policy changes that made sentences more stringent. This is essentially using a DD strategy to estimate black women and children's responses to a group of sentencing policy changes, which affect them through male incarceration rates. The identifying assumption is that there were no other contemporaneous shocks that affected women and children to the states that introduced the policies. Nevertheless,

[31] Men are more likely to use illicit drugs than women for all races (Abuse, 2014).

[32] Another example is police discrimination, which could lead to higher chances of arrest and imprisonment for black men (Donohue III and Levitt, 2001). It may also affect black women's marriage decisions independently, because they may not want to marry men facing discrimination. This may also lead to upward bias (in magnitude) in OLS estimates.

[33] Clear (2008) shows that earnings from criminal activity such as drug sales contribute to the welfare of the family.

it is not feasible to implement such a DD strategy directly because sentencing policies are very complex, with very different requirements for similar laws across states. Therefore, in order to exploit the impact of complicated sentencing policies on the incarceration rate, I build a simulation model of the prison population and, based on the model, I construct a simulated IV using two sufficient statistics on the punitiveness of sentencing policies: (i) the probability of incarceration conditional on arrest and (ii) the length of sentence served in prison, for each type of crime and MSA, estimated using leave-one-out means.

Using the simulated IV has three main benefits. First, it increases the power of the first stage by employing a continuous measure of the effect of various sentencing policies. Since sentencing policies are complicated, with substantial variation in their requirements across states, using a dummy variable for having a specific policy is not sufficient to capture the effect. Second, it improves the clarity by specifying how sentencing policies fit into the prison population based on a simulation model of the prison population. Since the incarceration rate is not only determined by the current prison admission, but also affected by the accumulation of all past flows into and out of prisons, sentencing policy changes in the past can have a relatively long-run impact before the prison population reaches a new steady state. The simulated IV characterizes this process. Third, comparing with the traditional DD strategy, the simulated IV restricts other possibilities through which sentencing law changes could affect women's outcomes. This is because I construct the simulated IV using sufficient statistics based on a simulation model of the prison population, instead of using dummy variables for law changes. Therefore, it is less likely that other contemporaneous shocks, rather than sentencing law changes, affect the outcomes of interest.

5.2 Tax Analogy of the Simulated Instrumental Variable

In this section, I compare the simulated IV with the classical simulated IVs of taxation to provide some intuition. Gruber and Saez (2002), for example, investigate the impact of changes in the tax schedule on income. The threat to identification is potentially endogenous earning behavior. To hold earning behavior constant, the authors use individuals' *before-law-change* earnings to compute the before-law-change and after-law-change tax rates for each individual, using the TAXSIM calculator. Then they use these *behavior-constant* tax

rates as simulated IVs for the *real* tax rates faced by each individual.

The TAXSIM calculator includes numerous complicated federal and state tax laws. Nevertheless, in order to obtain the simulated IVs, it is not necessary to understand the detailed tax law changes. Instead, the simulated IVs serve as sufficient statistics. They embody complicated tax law changes, by the construction of the TAXSIM, but not endogenous behavior, by inputting before-law-change earnings into the TAXSIM.

In this paper, the purpose is to construct a *behavior-constant* incarceration rate that embodies changes in sentencing policies, but not potentially endogenous behaviors. In the case of incarceration, endogenous behaviors are likely to be associated with *prior-arrest* behaviors, including (a) criminal behavior and (b) police behavior, based the discussion of potential omitted variables in the previous subsection. Given that these behaviors occur prior to arrest—$\Pr(\text{arrest}) = \Pr(\text{criminality}) \cdot \Pr(\text{arrest} \mid \text{criminality})$—the behavior-constant incarceration rate can be constructed by examining variation in sentencing outcomes for a fixed population of arrestees. Ideally, there exists an incarceration calculator, like the TAXSIM, so that I can feed the calculator a fixed population of arrests and the calculator gives me their sentencing outcomes, in different states and years (i.e., under different sentencing laws).

However, such an incarceration calculator does not exist. Therefore, I exploit variation in the incarceration rate *conditional on arrest*. This assumes that *post-arrest* outcomes are not affected by criminal and police behaviors. Based on a simulation model of the prison population, I show that incarceration rate conditional on arrest can be estimated with two sufficient statistics: (i) the probability of incarceration conditional on arrest and (ii) the amount of time served in prison. Admittedly, these variables could be affected by the sentencing harshness of local prosecutors and judges or severity of the crime, in addition to sentencing laws. I use sentencing outcomes for each type of crime that occurred in the state, outside of the own MSA, to construct the simulated IV. This could address the concern about the endogeneity of the local population, but still reflect the impact of state-level sentencing laws (Currie and Gruber, 1996). Finally, constructing behavior-constant incarceration rates is more complicated than constructing behavior-constant tax rates, because the current incarceration rate involves the flow into prison (admissions) and the flow out of prison (releases). This dynamic process is reflected in the simulation model of the prison population.

5.3 Construction of the Simulated Instrumental Variable

In this section, I formally describe how I construct the simulated IV. Let C^c_{mt} denote the population of criminals for crime c ($c = 1, ..., N$) in MSA m and year t. Let α^c_{mt} be the probability of arrest conditional on engagement in crime c, γ^c_{mt} be the probability of prison admission conditional on arrest for crime c, and $\bar{S}^c_{mt}$ be the average length of sentence (in years) served in prison for offenders sentenced for crime c from MSA m in year t.

For simplicity, assume that the prison population was zero in year $t = 0$, so that there will not be prisoners released from $t = 0$. Let I_{mt} be the year-end prison population of year t sentenced from MSA m and I^c_{mt} be that of crime c. Let A^c_{mt} be the number of newly admitted prisoners. Then the prison population at year end 1 from MSA m is equal to the number of newly admitted prisoners during the year:

$$I_{m1} = \sum_{c=1}^{N} I^c_{m1} = \sum_{c=1}^{N} A^c_{m1} = \sum_{c=1}^{N} C^c_{m1}\alpha^c_{m1}\gamma^c_{m1}.$$

The prison population at year end 2 from MSA m is:

$$\begin{aligned} I_{m2} &= \sum_{c=1}^{N} A^c_{m2} + \sum_{c=1}^{N} A^c_{m1}\mathbb{1}\{\bar{S}^c_{m1} > 1\} \\ &= \sum_{c=1}^{N} C^c_{m2}\alpha^c_{m2}\gamma^c_{m2} + \sum_{c=1}^{N} C^c_{m1}\alpha^c_{m1}\gamma^c_{m1}\mathbb{1}\{\bar{S}^c_{m1} > 1\}, \end{aligned}$$

where $\mathbb{1}\{\bar{S}^c_{m1} > 1\}$ is an indicator that the average time served in prison for prisoners of crime m admitted to prison in year 1 is greater than 1 year. In other words, the number of prisoners in custody at year end 2 consists of the number of newly admitted prisoners during year 2 and those from year 1 who were not released during year 2. In general, the prison population at year end t from MSA m is:

$$\begin{aligned} I_{mt} &= \sum_{c=1}^{N} A^c_{mt} + \sum_{c=1}^{N}\sum_{j=1}^{t-1} A^c_{mj}\mathbb{1}\{\bar{S}^c_{mj} > t - j\} \\ &= \underbrace{\sum_{c=1}^{N} C^c_{mt}\alpha^c_{mt}\gamma^c_{mt}}_{(1)} + \underbrace{\sum_{c=1}^{N}\sum_{j=1}^{t-1} C^c_{mj}\alpha^c_{mj}\gamma^c_{mj}\mathbb{1}\{\bar{S}^c_{mj} > t - j\}}_{(2)}. \end{aligned} \tag{4}$$

The equation reflects that the year-end prison population depends on (1) the number of newly

admitted prisoners during the current year and (2) the accumulation of past flows in and out of prison. The number of current admissions can be influenced by the prevalence of crime (C^c_{mt}), police effectiveness (α^c_{mt}), or the punitiveness of sentencing decisions to incarcerate (γ^c_{mt}). The past flows of prisoners furthermore depend on the time served in prison ($\bar{S}^c_{mt}$).

According to the discussion of potential omitted variables, criminal and police behaviors are likely to be endogenous.[34] Therefore, in order to construct a simulated IV that embodies changes in sentencing policies, but not endogenous behaviors, I hold criminal and police behaviors (i.e., C^c_{mt} and α^c_{mt}) constant and only exploit variation in sentencing outcomes conditional on arrest. Specifically, I let $C^c_{mt}\alpha^c_{mt} = C\alpha$ and obtain:

$$\sum_{c=1}^{N} C\alpha\gamma^c_{mt} + \sum_{c=1}^{N}\sum_{j=1}^{t-1} C\alpha\gamma^c_{mj}\mathbb{1}\{\bar{S}^c_{mj} > t-j\}.$$

It is noteworthy that letting $C^c_{mt}\alpha^c_{mt} = C\alpha$ is a specific normalization to ensure that variation in the simulated prison population is not driven by potentially endogenous criminal and police behaviors. The way of normalization (or the *level* of the simulated prison population) is not important, because the purpose is to construct a simulated IV that is not affected by endogenous behaviors, instead of accurately predicting the real prison population.

Moreover, let $\bar{S}^c_{-mt}$ be the average length of sentence served for offenders of crime c sentenced in year t from the state that contains MSA m, leaving out MSA m itself. I substitute $\bar{S}^c_{-mt}$ for $\bar{S}^c_{mt}$ to construct the simulated IV, because leave-one-out means can exclude the impact of idiosyncratic shocks, such as local criminal activity, behaviors of local judges, and behaviors of individual prisoners. Because of the data limitations discussed in Section 5.5, the likelihood of incarceration conditional on arrest will be estimated at the state level, denoted by $\gamma^c_{s(m)t}$. Therefore,

$$I^*_{mt} = \sum_{c=1}^{N} C\alpha\gamma^c_{s(m)t} + \sum_{c=1}^{N}\sum_{j=1}^{t-1} C\alpha\gamma^c_{s(m)j}\mathbb{1}\{\bar{S}^c_{-mj} > t-j\} \tag{5}$$

[34] C^c_{mt} and α^c_{mt} could also be affected by harsher sentencing policies due to deterrence. At the extensive margin, it is possible that fewer people commit crimes due to harsher sentencing policies (Levitt, 2004). The simulated IV does not characterize this variation. Although the IV may loss some power, this is not a threat to identification. At the intensive margin, it is possible that people commit less serious crimes for a given type of offense due to harsher sentencing policies. This is not likely to be a concern because if this were the case, the estimate of the first-stage regression would go in the other direction.

is the simulated *behavior-constant* prison population (subject to a normalization). It embodies *changes in sentencing policies*, and specifies how sentencing policies fit into the prison population. I refer to I^*_{mt} as the simulated prison population later for simplicity. Nevertheless, it is noteworthy that I^*_{mt} does not necessarily match the real prison population, because I^*_{mt} holds endogenous behaviors constant and only reflects the contribution of harsher sentencing policies to the prison population, whereas the real prison population is furthermore influenced by other factors, including the prevalence of crime and police effectiveness.

Let P_{mt} be the residential population of MSA m and year t. The IV for the incarceration rate of MSA m in year t is

$$SI_{mt} = \frac{I^*_{mt}}{P_{mt}} = \frac{\sum_{c=1}^{N} C\alpha\gamma^c_{s(m)t} + \sum_{c=1}^{N}\sum_{j=1}^{t-1} C\alpha\gamma^c_{s(m)j}\mathbb{1}\{\bar{S}^c_{-mj} > t-j\}}{P_{mt}}. \tag{6}$$

5.4 Instrument Validity

The exclusion restriction is that the likelihood of entering prison conditional on arrest ($\gamma^c_{s(m)t}$) and the average time served in prison ($\bar{S}^c_{-mt}$) reflect changes in sentencing policies, which affect women and children's outcomes only through the incarceration rate. Although I cannot directly test the exclusion restriction, I can provide some supporting evidence.

To begin, I show that changes in the simulated IV are likely to be driven by changes in sentencing policies. Specifically, I take two states as examples—Arkansas and Colorado—where sentencing policy changes were enacted in a relatively discrete way. Figure 4 shows simulated prison population I^*_{mt} (aggregated to the state level) in SD over time for these two states.[35] The figure shows little evidence of pre-policy-change trends in the simulated prison population. After policy changes are enacted in 1994 and 1995, the simulated prison population responds and continues to increase for around 5 years, and becomes relatively stable afterward. In particular, the simulated prison population grows gradually instead of jumping immediately after the policy changes. This is reasonable for two reasons. First, after a policy is enacted, the new law only applies to the relevant offenders sentenced after some specific date. The stock of the prison population is built up gradually as more and more prisoners

[35] I aggregate the simulated prison population by MSA and year (I^*_{mt} in equation (5)) to the state level, and standardize the aggregate simulated prison population by state and year, so that the mean is 0 and the SD is 1.

sentenced under the new laws are admitted to prison. The prison population is likely to reach a new steady state when all the admitted and released prisoners are sentenced under the same laws. Second, it also takes time for harsher sentences to be fully reflected in a larger prison population. For instance, suppose that the average time served for some offense was 3 years before a law change and increased to 5 years afterwards. Then it would take 3 years for the relevant offenders who were just sentenced after the law change to contribute to the growth of the prison population. Given these features, it is less likely that other shocks, rather than the newly enacted sentencing policies, affected the sentencing outcomes and the simulated prison population in exactly the same way during the post-policy-change years.

In the rest of the section, I discuss potential threats to identification and provide evidence to show that they are not major concerns.

Criminal Activity One concern regarding the simulated IV is that it can be driven by changes in the severity of criminal activity. This is because severer sentencing outcomes can be driven by some unobserved upward trend in the severity of crime. I provide four pieces of evidence to show that this is not likely to be a major concern.

First, I use $\bar{S}^c_{-mt}$ instead of $\bar{S}^c_{mt}$ when constructing the IV. On the one hand, $\bar{S}^c_{-mt}$ eliminates the impact of idiosyncratic shocks, such as changes in local crime composition, local judge behaviors, or individual prisoner behaviors, which may affect women and children's outcomes independently. On the other hand, $\bar{S}^c_{-mt}$ should still capture the effects of sentencing policy changes, which were implemented at the state level.

Second, I show that arrest rates of all types of crimes for black adults declined in or before the 1990s and have remained stable since the mid-2000s (Figure 7).[36] This provides evidence that the population has not become more criminally prone, which indirectly suggests that it is not likely that people tend to commit more serious crimes over time, and therefore tend to be given more stringent sentences.

Third, I show that sentencing outcomes (i.e., Pr(prison admission | arrest) and average length of sentence served) have become more stringent for almost all types of offenses over years. Figure 5 presents the number of persons *per 1,000 arrests* who served t years (on the

[36] Crime rates have similar patterns as arrest rates for violent and property crimes, so changes in the arrest rates are not likely to be due to changes in police behaviors. Crimes rates are not available for drug offenses.

x axis) in prison for those who were arrested in 1988 (in dotted blue lines) and in 2000 (in solid red lines) for each type of offense. Solid red lines are higher than dotted blue lines for all types of offenses, which implies that those who were arrested in 2000 were more likely to enter prison and spend longer time in prison than those who were arrested in 1988.[37] This figure provides evidence that it is more likely that sentencing policies have become more punitive toward almost all types of offenses, rather than that people have committed more serious crimes for all the offenses.[38]

Fourth, I explore the impact of the Anti-Drug Abuse Act in 1986 and 1988, which resulted in more mandatory minimum sentences for drug possession.[39] Figure 6 shows dramatic increases in the likelihood of prison admission conditional on arrest for black offenders of drug possession after the law changes.

Dominating MSAs Another potential threat to identification is that big MSAs could dominate their states' policy-making. If so, state-level sentencing policies are likely to be endogenous to the dominating MSAs. For example, the black population and crime in Maryland have been concentrated in the Baltimore metropolitan area. Therefore, Maryland may introduce more punitive sentencing policies on drug offenses if drug dealing becomes more prevalent in Baltimore. In this case, using leave-one-out means does not address the endogeneity problem. As a robustness check, I calculate the average Herfindahl-Hirschman index (HHI) for each state across years, which reflects the relative black population of MSAs within states.[40] I restrict the sample to states with relatively smaller HHI (i.e., states with

[37] At the extensive margin, arrestees in 2000 are more likely to be admitted to prison for a short sentence (reflected on the left-hand side of the solid solid lines). At the intensive margin, imprisoned arrestees in 2000 tend to spend more time in prison (reflected on the right-hand slide of the solid solid lines).

[38] Neal and Rick (2016) conduct a similar analysis and find similar results: The probability of admission given arrest rose between 1985 and 2000 within every crime category (Table 2). In particular, estimating distributions requires more accurate data than constructing the IV. Also, to be comparable with Neal and Rick (2016), the distributions are estimated using data from eight states with high data quality: California, Colorado, Michigan, New Jersey, New York, South Carolina, Washington, and Wisconsin. Neal and Rick (2016) show that the prison population patterns in these states are comparable to those of all states.

[39] The act became effective on October 27, 1986, which mandated a minimum sentence of 5 years without parole for possession of 5 grams of crack cocaine. The amended act became effective on November 18, 1988, which made crack cocaine the only drug with a mandatory minimum penalty for a first offense of possession.

[40] The HHI is a measure of market concentration. In this context, I use the index to measure concentration of black population within states, calculated by squaring the black population share of each MSA in a state and then summing the resulting numbers. It is small if a state consists of many MSAs of relatively equal sizes of black population, and reaches the maximum of 10,000 if a single MSA contains all the black population of

many MSAs of relatively equal sizes of black population).[41] In this sample, the exclusion restriction is more likely to be satisfied, since it is less likely that dominating MSAs affect state-level policy changes. Results in Section 6.8 (Table A9) indicate that the impacts obtained with the unrestricted sample are less likely to be driven by omitted variables.

Other Channels The third threat is that harsher sentencing policies may directly affect black women or affect black women through female incarceration, instead of through the incarceration of black men. I argue that these are unlikely to be major concerns for three reasons. First, sentencing policies may not be salient to the general population. Instead, people are more likely to believe that policies are harsher by witnessing more peers from their community incarcerated. If so, this is a mechanism through which women are affected by mass incarceration. Second, female incarceration is not likely to be a channel because the share of women who are incarcerated is very small.[42] Third, it is hard to find such a channel, other than black male incarceration, that would induce lower marriage, more out-of-wedlock children, and higher female employment at the same time.[43]

Prison Overcrowding Sentencing policy changes and sentencing outcomes can be affected by prison overcrowding. For instance, judges may be reluctant to impose incarceration or long sentences if prisons in the state are too crowded. I argue that this is not likely to be a major concern, because judges' discretion to impose alternatives to incarceration has been curtailed due to sentencing guidelines. In addition, I provide evidence in Section 6.8 that current incarceration rates cannot predict future policy changes.

5.5 Estimation of the Instrument

The sentencing outcomes used to construct the simulated IV are estimated using the NCRP and UCR data on black male offenders only, since the endogenous variable is the incarceration

a state. In my sample, the index ranges from 1,595 in Florida to 9,034 in Maryland, with a mean of 4,000.

[41] I restrict the sample to states with an average HHI smaller than 3,500. The sample include Arkansas, California, Florida, Louisiana, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

[42] The share of black women who are in prison has been smaller than one tenth of the share of black men who are in prison.

[43] Another robustness check is using a simulated IV constructed with drug offenses only, because many drug offenses are governed by federal laws. More details can be found in Section 6.8.

rate of black men.[44]

First, I estimate the probability of incarceration conditional on arrest ($\gamma^c_{s(m)t}$) using the number of black adults admitted to prison (from the NCRP) divided by the number of black adults arrested (from the UCR) for each category of offense, state, and year.[45] Because of data limitations, the variable is estimated at the state level.[46]

Second, I estimate the (leave-one-out) average number of years spent in prison ($\bar{S}^c_{mt}$ and $\bar{S}^c_{-mt}$) using Admissions and Releases Data from the NCRP, 1983-2009. Specifically, I match the two datasets by year of prison admission, MSA of sentence, offense, race, and gender. For the matched type of offenders, $\bar{S}^c_{mt}$ can be estimated with the year of prison release (from Releases Data) subtracting the year of prison admission. For the type of offenders appearing in the Admissions Data only, it is likely that they were still in prison by 2009. Therefore, I approximate $\bar{S}^c_{mt}$ using the average length of sentence.[47]

Third, I approximate $C\alpha$ with the average number of arrests per MSA and type of offense, using the UCR data.[48] The purpose of estimating $C\alpha$ is to interpret the first-stage results. However, the estimation does not affect the second-stage results.

6 Results

6.1 First Stage

To consider the first-stage relationship, I estimate the following equation:

$$IR_{mt} = \alpha_0 + \alpha_1 SI_{mt} + X_{imt}\pi + \theta_t + \mu_m + v_{imt}, \tag{7}$$

where IR_{mt} is the incarceration rate of black men; SI_{mt} is the simulated IV (equation (6)); X_{imt} is a vector of women's or children's characteristics; θ_t is year fixed effects; and μ_m is

[44] The denominator of the simulated IV is the same as the dominator of the endogenous variable, the resident population of black men ages 20-54 or ages 20-39.

[45] This requires two assumptions: (1) the offense listed in the UCR data is the most serious charge against the arrestee at the time of arrest, since I use the offense of the longest sentence from the NCRP data; and (2) the year of prison admission is same as the year of arrest.

[46] Appendix A3.2 provides more details on the estimation.

[47] For offenders with life sentences or sentences longer than 30 years, I apply an upper bound of 30 years. Using higher upper bounds, such as 60 years or 80 years, does not affect the results.

[48] I estimate $C\alpha$ using agent-level data from the UCR. More details can be found in Appendix A3.2.

MSA fixed effects (Table 3 Columns 1-2). I also consider alternative simulated IVs, including a simulated IV constructed with impacts of sentencing polices at the extensive margin, using $\gamma^c_{s(m)t}$ and $\bar{S}^c_{-m0}$ (Column 3), and a simulated IV constructed with impacts of sentencing polices at the intensive margin, using $\gamma^c_{s(m)0}$ and $\bar{S}^c_{-mt}$ (Column 4).

Results in Table 3 show that the simulated IVs are highly predictive of the black male incarceration rate. Including additional controls in Column 2 does not change the results. In particular, the result in Column 2 indicates that a 1 SD increase in the simulated IV increases the incarceration rate of black men by 0.9 pp.[49]

6.2 Marriage Market Outcomes

I estimate the impacts of the incarceration rate of black men (IR) on women's marriage market outcomes, including the probability of being married, being never married, being divorced, having a non-black husband, and having a husband whose years of education are at least equal the wife's, according to equation (2):

$$y_{imt} = \beta_0 + \beta_1 IR_{mt} + X_{imt}\delta + \gamma_m + \xi_t + \epsilon_{imt},$$

where y_{imt} is an indicator for whether woman i in MSA m in year t was currently married, divorced, and so on. I present both OLS regression results and 2SLS results, in which I instrument for IR_{mt} using SI_{mt} (equation (6)). I also present results both with and without controls (X_{imt}), including age, age-squared, and years of education[50]. All results include MSA and year fixed effects. The analysis focuses on black women between 18 and 34 years old without or with some college education (but no 4-year college education).[51] The sample is restricted to MSAs with at least 1,000 black men and 1,000 black women ages 20-34.[52]

[49]The result in Column 2 means that a 1 pp increase in the simulated IV (behavior-constant incarceration rate) is associated with a 0.03 pp increase in the real incarceration rate. It it noteworthy that the coefficients in Table 3 are subject to normalization. However, different ways of normalizing do not affect the estimates in the first stage in SD and the results in the second stage.

[50]Table A2 in the Appendix shows that the impact of black male incarceration on years of education for black women (ages 18-34) is small and statistically insignificant.

[51]I focus on black women of prime marriageable ages. Aughinbaugh et al. (2013) show that for the black respondents in their study, at age 15, none have married. By age 25, 65% have never married. By age 35, 40% have never married, and as they age by 10 years, the portion only declines by 7 percentage points.

[52]Restricting the sample in different ways does not affect the results significantly (Appendix A4.2 Table A14).

Standard errors are clustered at the level of MSA.[53]

Table 4 presents the estimates of the impact of black male incarceration on the likelihood of marriage for black women with some college education but without a degree (Columns 1-3) and for black women without any college education (Columns 4-6). The 2SLS estimates in Columns 3 and 6 suggest that a 1 pp increase in the black male incarceration rate decreases the probability of being currently married by 3 pp for black women with some college education, and by 2.6 pp for black women without any college education.[54]

OLS vs. 2SLS Estimates It is noteworthy that the 2SLS estimates are considerably larger in magnitude than the OLS estimates. One potential reason is that the IV identifies the local average treatment effect for compliers. Compliers are marginal prisoners who are incarcerated due to harsher sentencing policies. They could be more marriageable had they not been incarcerated. In contrast, the always-takers are likely to have committed very serious crimes and would be locked up for a long time no matter how harsh sentencing policies were. Therefore, they are less likely to be considered potential marriage partners.

Table 5 presents the mean characteristics for compliers and all black offenders.[55] The results suggest that compliers are younger and less likely to have committed violent crimes. The compliers could be more marriageable than an average prisoner, because women may not want to marry a man who committed violent offenses, even if he was not incarcerated. In contrast, men who committed less serious crimes, such as driving under the influence or gambling, could be relatively more marriageable. Moreover, the results suggest that compliers are more likely to have committed drug offenses and more likely to have ever been previously confined for a felony as a juvenile or adult. These results are reasonable, because some policies are likely to have a large impact for black drug offenders (e.g., the Anti-Drug Abuse Act) and some policies aim to punish repeat offenders with harsher sentences (e.g.,

[53] Clustering standard errors at the state level slightly increases the standard errors in most specifications, but all estimates remain statistically significant (Appendix A4.2 Table A7 Panel A).

[54] The difference is not statistically significant.

[55] For simplicity, I assume a binary instrument Z_{mt}, where $Z_{mt} = 1$ if the change in the simulated IV for MSA m and year t (relative to 1986) is greater than the median. Similarly, I assume a binary treatment W_{mt}, where $W_{mt} = 1$ if the change in the black male incarceration rate (relative to 1986) is greater than the median. Define $W_{mt}(j)$ to be the potential outcome of W_{mt} given that $Z_{mt} = j, j \in \{0, 1\}$. Therefore, compliers are prisoners who were sentenced in MSA m and year t, where $W_{mt}(0) = 0$ or $W_{mt}(1) = 1$.

the three-strikes laws).

Another reason for the difference between the OLS and 2SLS estimates can be omitted variables. One example could be economic returns to crime. On the one hand, higher returns to some criminal activity can lead to higher crime rates, and therefore higher incarceration rates. On the other hand, the higher returns may also make some men involved in the related criminal activity more attractive if they had not been incarcerated.[56] This omitted variable could lead to smaller OLS estimates in magnitude. In addition, measurement error could also lead to the OLS estimates being biased toward zero, since I do not observe the actual incarceration rate of a marriage market.

Magnitude It might be surprising to find that the 2SLS estimates are greater than 1 in magnitude. However, the results are reasonable for several reasons. First, since most black male inmates are young and single, a 1 pp increase in the incarceration rate of black men is associated with a larger increase in the incarceration rate of *single* black men. Single black men could also be more related to the marriage market. As a robustness check, I estimate the impact of the incarceration rate of *single* black men, and indeed the estimates get closer to 1 (Section 6.8, Table A8, Panel C).

Second, higher incarceration rates are associated with higher chances of having some contact with the criminal justice system, including being on probation, in jail, or on parole. Higher incarceration rates also result in a large proportion of people who have ever been incarcerated, but are no longer in prison. Changes in all these outcomes are partially driven by changes in sentencing policies. Moreover, all these outcomes could make black men less viable as potential marriage partners (Section 3.4.3).

Potential Mechanisms The results suggest that black male incarceration has a similar impact on the likelihood of marriage for more educated black women (Column 3) and for less educated black women (Column 6). This result may seem surprising, since most black men in prison are high school dropouts, who are more likely to be potential marriage partners for less educated women. However, in addition to this direct impact, there are several

[56] Clear (2008) shows that money earned by some family members contribute to the welfare of the families, and this is true even if some earnings are from criminal activity such as drug sales.

indirect mechanisms through which more educated women could be affected. First, black men without any criminal record may gain higher bargaining power in the marriage market. They are more likely to be well educated, and therefore could have a larger impact on more educated black women. As evidence, I find that with higher black male incarceration rates, more educated black men are less likely to be married, more likely to marry women with higher levels of education then themselves, and more likely to marry across racial boundaries (Section 6.7, Table A6, Panel B). Moreover, women may choose not to get married because of bad marriage market conditions, and choose to work more to support themselves. This is more likely to be the case for more educated black women, who have better outside options. This hypothesis is consistent with the result in Section 6.3 that higher black male incarceration rates increase the probability of employment for more educated black women.

Other Marriage Outcomes Table 6 presents the results of the impacts on other marriage market outcomes for black women, including the likelihood of being never married, being divorced, having a non-black husband, and having a husband whose years of education are at least equal to the wife's.[57]

First, I find higher incarceration rates of black men increase the likelihood of being never married, which suggests that the lower prevalence of marriage caused by higher incarceration rates is mainly due to a higher percentage of women who were never married. Second, I do not find a statistically significant impact on the likelihood of being divorced.[58] Third, I do not find an impact on the probability of having a non-black husband. Theoretically, black women could be more likely to marry a non-black husband, since there are fewer marriageable black men. However, in reality, black women have been much less likely than black men to marry across racial boundaries.[59] Finally, I find a negative impact on the likelihood of

[57]To save space, I only report 2SLS estimates with fixed effects and control variables. The 2SLS estimates are larger in magnitude than the OLS estimates.

[58]Restricting the sample to black women between 29 and 34 years old, I find that a 1 pp increase in the incarceration rate of black men increases the probability of being divorced by 2.63 pp, and the estimate is 5% statistically significant. The higher probability of divorce could be due the imprisonment of husbands, although for more educated women, their husbands should face a relatively lower risk of incarceration. Another potential reason is that more educated husbands who do not have criminal record may gain higher bargaining power because of higher incarceration rates, which can increase the probability of marriage dissolution (Becker et al., 1977).

[59]For instance, for all blacks who were newlyweds in 2008, 22% of black men married someone of a different race, compared with 8.9% of black women, which makes black women the least likely to be interracially

marrying up, and the impact is larger for less educated black women than for more educated black women. This is reasonable, because less educated black women could suffer more from declining bargaining power in the marriage market than more educated black women.

6.3 Labor Market Outcomes

I estimate the impacts of black male incarceration on women's labor market outcomes, including the probability of employment and income. Table 7 presents the results of the impact on the probability of being currently employed for black women with at least some college education (Columns 1-3) and for black women without any college education (Columns 4-6). The 2SLS estimates are larger in magnitude than the OLS estimates.[60] The estimate in Column 3 suggests that a 1 pp increase in the incarceration rate of black men increases the probability of being currently employed for black women with at least some college education by 3 pp.[61] One potential mechanism could be that more educated women choose to work more to support themselves, as an outside option of being single in the face of bad marriage market conditions. Another reason could be incarceration or criminal records of family members, and therefore women may have to work more to support their family. As evidence, I find that higher black male incarceration rates decrease the likelihood of employment for black men without any college education (Section 6.7, Table A6, Panel A).

Table 8 presents the 2SLS estimates of the impact on black women's income, including their wage income (Columns 1-2) and the value of food stamps received (Columns 3-4). Columns 1 and 3 include all income levels (including 0), and Columns 2 and 4 only include positive income. Overall, I find a large positive impact on women's wage income, but the estimates are statistically insignificant. The estimate is largest for women with at least some college education, including those with zero wage income (Panel A, Column 1), which could

married of all groups. Since 1980, the gender disparity of interracial marriage among blacks has grown progressively larger (Passel et al., 2010). Anecdotal evidence also suggests that black women with higher education levels are facing social pressure to sustain the race and build strong black families, and they are encouraged to "marry down before they marry out" (Banks, 2011).

[60] Economic returns to crime could still be a potential omitted variable. On the one hand, higher economic returns to some criminal activity can lead to higher crime rates, and therefore higher incarceration rates. On the other hand, higher earnings from criminal activity can contribute to the welfare of the family, and therefore women can be less likely to be employed. This would lead to biased OLS estimates (with smaller magnitude).

[61] The estimate for black women without any college education is small and statistically insignificant.

be driven by the higher likelihood of employment among more educated black women. In addition, I find that a 1 pp increase in the incarceration rate of black men increases the value of food stamps received by women without any college education by $166 (Panel B, Column 3). The result suggests that black women with lower levels of education could be more likely to be hurt, which in turn requires higher government expenses for social welfare programs. Therefore, both groups of women could have higher incomes in the face of higher black male incarceration rates: More educated black women work more and earn more wage income, and less educated black women get more social assistance. Nevertheless, the results do not imply that black women become better off, since they could be more likely to have lower household income.

6.4 Children's Outcomes

I estimate the impacts of black male incarceration on black children's short-run outcomes, including the probability of being born out of wedlock and the probability of living in a mother-only family, according to equation (2) in Section 5:

$$y_{imt} = \beta_0 + \beta_1 IR_{mt} + X_{imt}\delta + \gamma_m + \xi_t + \epsilon_{imt},$$

where y_{imt} is a dummy for whether the mother of a newly born black infant i in MSA m and year t was never married or a dummy for whether a black child i under 15 years old in MSA m and year t lived in a mother-only family. X_{imt} is a vector including age and gender. Other variables remain the same.

According to Table 9, a 1 pp increase in the incarceration rate of black men increases the likelihood of living in a mother-only family by 3.5 pp, and increases the likelihood of out-of-wedlock birth by 4.3 pp.[62] The results could be driven directly by the imprisonment of fathers. In addition, the scarcity of men in the marriage market could lead to less committed relationships, which could also lead to negative impacts for children.[63]

[62] Table A3 in the Appendix shows that the impact of black male incarceration on the likelihood of having at least one child for black women is small and statistically insignificant. Therefore, the impacts for children found in this section are not likely to be driven by selection. For instance, more children are born, and therefore the average outcome per child becomes worse.

[63] Anecdotal evidence suggests that many black men maintain long-standing non-monogamous relationships (Banks, 2011). Additionally, based on the National Health and Social Life Survey (Laumann et al., 1992),

I also estimate the long-run impact of the incarceration rate of black men that a young black adult i faced in early adolescence, $\overline{IR}^{child}_{(i)m}$, on the probability of having at least some college education in early adulthood, according to equation (3):

$$y_{imt} = \beta_0 + \beta_1 \overline{IR}^{child}_{(i)m} + X_{imt}\delta + \gamma_m + \xi_t + \epsilon_{imt},$$

where y_{imt} is an indicator for whether a young black adult i between 22 and 24 years old in MSA m and year t had at least some college education. In particular, I do not observe the MSA where a young black adult lived during childhood. Therefore, I assume that there was no migration since early adolescence, and measure $\overline{IR}^{child}_{(i)m}$ with the average incarceration rate of MSA m when individual i was between the ages of 10 and 12.[64]

In Table 10, Columns 1-3 show the estimates for black men and Columns 4-6 show the estimates for black women. In Columns 4 and 6, I furthermore restrict the sample to those whose current state of residence was the same as their state of birth, so that they were less likely to have migrated.[65] Nevertheless, this could also introduce selection bias. Results in Columns 2 and 5 show that a 1 pp increase in the black male incarceration rate faced in early adolescence decreases the likelihood of having at least some college education by 4.3 pp for black boys and 3.2 pp for black girls in early adulthood. These findings are consistent with that of Chetty and Hendren (2018): Neighborhoods matter more for boys than girls. As to the potential mechanisms, the negative long-run impacts on black children's educational outcomes could be due to lower household income, because their mothers could be less likely

Banks (2011) shows that black men were substantially more likely to be in long-term concurrent relationships than white men. In one African American Chicago neighborhood, almost two out of every five men had simultaneous relationships, and the relationships endured for 6 months or more (Banks, 2011). Thus, non-monogamous relationships could lead to a higher rate of out-of-wedlock births.

[64] Figure A1 in the Appendix presents estimates when $\overline{IR}^{child}_{(i)m}$ is measured by the incarceration rate of MSA m when individual i was at different ages. The estimates are not statistically significant when $\overline{IR}^{child}_{(i)m}$ is estimated before the age of 9 for both black men and black women, so they are not shown on the graphs. The estimates for black men are robust, although they are small and statistically insignificant when $\overline{IR}^{child}_{(i)m}$ is estimated at the ages of 14 and 15. This could be due to the fact that education is a relatively long-run decision, so the environment faced at the ages of 14 or 15 could have less impact on the outcome of college education. Nevertheless, the estimates for black women are relatively less robust. The estimates are close to zero or positive when $\overline{IR}^{child}_{(i)m}$ is estimated at the ages of 13-15. To provide more evidence, studies show that the transition to middle school is important for early adolescent development (e.g., Anderman and Midgley, 1997). Moreover, Balfanz et al. (2007) show that behaviors in sixth grade play an important role in predicting high school dropout.

[65] 79% of the young black adults lived in their state of birth.

to be married and their fathers could be more likely to be incarcerated. The absence of fathers may also negatively affect black boys due to lack of disciplinary infractions (Chetty et al., 2018). Moreover, higher incarceration rates faced in childhood could also lead to higher chances of juvenile incarceration, and in particular for boys. Aizer and Doyle Jr (2015) show that juvenile incarceration leads to substantially lower high school completion rates.

6.5 Effects of Black Men at Different Margins of Incarceration

In this subsection, I examine the effects of "missing" black men at different margins of incarceration. Specifically, a fraction of black men missing from a community because of being locked up for a short period of time, and the same fraction of black men missing from the community because of serving longer sentences in prison, can have different impacts on women and children. Contact with the criminal justice system can foster stigmatization and make potential employers reluctant to hire people with a criminal record (Pager, 2003). Therefore, even short jail stays could render men less attractive in the marriage market and be devastating for families because of social stigma. Furthermore, separation from the community or family due to long-term imprisonment could make men less likely to become an intimate partner and lead to family instability, which can have damaging effects on children as well. Massoglia et al. (2011) show that the duration of physical separation is more likely to be the reason that leads to divorce instead of exposure to incarceration itself. Andersen (2016) uses Danish data and shows that both duration and frequency of paternal incarceration are correlated with children's outcomes.

To explore heterogeneity in the effects of black men at different margins of incarceration, I construct two simulated IVs: SI^{EX} only exploits the impact of sentencing policies at the extensive margin, and SI^{IN} only exploits the impact of sentencing policies at the intensive margin.[66] With SI^{EX}, I estimate the local average treatment effect of black men who serve relatively short sentences and would not have been incarcerated at all under less punitive

[66] SI^{EX} is constructed using variation in the probability of incarceration given arrest for black men by state, year, and offense ($\gamma^c_{s(m)t}$), and the *initial* leave-one-out average time served in prison for black men by MSA and offense ($\bar{S}^c_{-m0}$). SI^{IN} is constructed using variation in the leave-one-out average time served in prison for black men by MSA, year, and offense ($\bar{S}^c_{-mt}$), and the *initial* probability of incarceration given arrest for black men by state and offense ($\gamma^c_{s(m)0}$).

sentencing policies. With SI^{IN}, I estimate the local average treatment effect of black men who serve relatively long sentences and would have been released more quickly from prison under less punitive sentencing policies.

In Table 11, Panel A shows the estimates with the baseline IV for comparison,[67] Panel B shows the estimates with instrument SI^{EX}, and Panel C shows the estimates with instrument SI^{IN}. The results suggest that black men at the extensive margin of incarceration have a larger impact on the marriage of more educated black women (Panel B, Column 1) and that black men at the intensive margin of incarceration have a larger impact on the marriage of less educated black women (Panel C, Column 2). These findings are reasonable, because black men at the extensive margin of incarceration are more likely to have committed less serious crimes, and therefore more likely to be considered potential marriage partners by more educated black women. In contrast, black men at the intensive margin of incarceration are more likely to be considered potential marriage partners by less educated black women.

As to the impact on the likelihood of employment, black men at both margins of incarceration have a large effect for more educated women (Panels B and C, Column 3). For less educated black women, black men at the extensive margin of incarceration have a sizable impact (Panel B, Column 4).

Finally, although black men at both margins of incarceration have large effects on children's outcomes, the impact of black men at the intensive margin of incarceration is especially large (Panels B and C, Columns 5 and 6). The results suggest that physical separation due to long-term imprisonment could be particularly harmful for children.

6.6 Racial Disparities in Income

Chetty et al. (2018) document large intergenerational gaps in individual incomes between black and white men, but there are no such gaps between black and white women.[68] They also find a substantial variation in black and white boys' outcomes across commuting zones (CZs), and that the presence of low income black fathers in the neighborhood is strongly associated

[67] Estimates are from Table 4, Table 7, and Table 9.

[68] They find that differences in family characteristics and ability explain very little of the black-white income gap conditional on parental income.

with black boys' income ranks in adulthood, but not white boys' or black girls' income ranks, conditional on parental income. The patterns of black-white intergenerational gaps in income and the association between father presence and children's outcomes documented in Chetty et al. (2018) are in a highly race-by-gender specific manner, which is consistent with the large gender and race disparities in incarceration.

In this section, I ask whether the punitiveness of sentencing policies contributes to the black-white intergenerational gaps in income.[69] I use statistics provided by Chetty et al. (2018): the mean individual income rank in adulthood of children who grow up in CZ c with parents at the 25th or 75th percentile of the national household income distribution by race $r \in \{b, w\}$ and sex $s \in \{m, f\}$, denoted by $\bar{y}_{25}^{crs}$ and $\bar{y}_{75}^{crs}$. In particular, the data only vary across CZs, not over time. To merge with their CZ-level data, I construct a measure of the punitiveness of sentencing policies in CZ c during the period of time when children in their sample grow up, denoted by I_c^*, according to equation (5). The measure is standardized so that the mean is 0 and the SD is 1 across CZs, with higher values representing harsher sentencing policies. More details on the measurement of $\bar{y}_{25}^{crs}$, $\bar{y}_{75}^{crs}$, and I_c^* are presented in Appendix A3.3.

Figure 8 characterizes the association between the punitiveness of sentencing policies and children's income rank across CZs. Panel A presents a binned scatter plot of black and white boys' mean income ranks in adulthood with parents at the 25th percentile of the household income distribution, $\bar{y}_{25}^{cbm}$ and $\bar{y}_{25}^{cwm}$, vs. the punitiveness of sentencing policies across CZs, I_c^*. I find a strong negative correlation between the punitiveness of sentencing policies where children grow up and black boys' incomes in adulthood. In contrast, I find no statistically significant correlation for white boys. Similar differences are found in Panel B for black and white boys with parents at the 75th percentile of the household income distribution.

Panels C and D compare mean income ranks of black boys and girls with parents at the 25th or 75th percentile. Panel C shows that for black girls with parents at the 25th percentile, the punitiveness of sentencing policies in areas where they lived during childhood does not have an impact on their income ranks in adulthood. Panel D shows that for black

[69] A related paper by Derenoncourt (2018) studies the impact of the Great Migration on the racial gap in intergenerational mobility.

girls with parents at the 75th percentile, the punitiveness of sentencing policies is positively correlated with their income in adulthood.[70] However, it is noteworthy that this does not imply that harsher sentencing policies are good for more educated black women, because they are still likely to have lower household income because they are less likely to marry or have a husband with higher income.

Regression results of the impact of harsher sentencing policies on the intergenerational gaps in income between black and white men and between black men and women are reported in Table 12. In Column 1 of the first panel, I regress $\bar{y}_{25}^{cwm} - \bar{y}_{25}^{cbm}$ on I_c^*, weighting by the CZ population. I further control for the poverty rate in Column 2.[71] The results suggest that CZs with a 1 SD more punitive sentencing policies have a 0.6-percentile larger income gap between white and black men. Moreover, the black-white income gap between areas with the least punitive sentencing policies (1st percentile with I_c^* = -1.72) and areas with the most punitive sentencing policies (99th percentile with I_c^* = 3.49) exceeds 3 percentiles. Columns 3-4 of the first panel show similar impacts for black and white boys with parents at the 75th percentile. The second panel of Table 12 shows the impact on the income gap between black women and men. The results suggest that CZs with a 1 SD more punitive sentencing policies have have a gap in mean income ranks between black women and men that is 0.6-0.9 percentiles higher.

In summary, I find evidence that harsher sentencing policies faced in childhood have a negative long-run impact on the income for black boys, but not for white boys or black girls. Because of data limitations, I only use cross-sectional variation in the average harshness of sentencing policies faced in childhood. This sacrifices substantial power, because there are many sentencing policy changes over years. Nevertheless, the results suggest that even the cross-sectional variation can still explain the intergenerational gaps in income between black and white men to a large degree, with a difference of more than 3 percentiles between areas with the least and most punitive sentencing policies. While I cannot be certain about the underlying mechanisms of the finding, there are several possibilities. First, harsher

[70] These results are consistent with the findings in Section 6.3: Higher incarceration rates of black men increase the likelihood of employment and income for more educated black women, but not for less educated black women.

[71] Chetty et al. (2018) show that neighborhoods with lower poverty rates tend to have larger intergenerational gaps between blacks and whites.

sentencing policies may increase the possibility of incarceration for black fathers, which may lead to worse outcomes for black children, and in particular for boys. Notably, although the estimates are conditional on parental income, they are not conditional on parental marital status. Black boys are more likely to have grown up in mother-only families than white boys, although their parent(s) have the same household income. Therefore, the results suggest that family structures could play an important role through mechanisms other than income. Second, harsher sentencing policies may also increase the possibility of juvenile incarceration for black boys. Aizer and Doyle Jr (2015) show that juvenile incarceration leads to substantially lower high school completion rates and higher adult incarceration rates, which can be another reason for the worse outcomes of black boys in adulthood.

6.7 Heterogeneous Effects and Potential Mechanisms

To examine the potential mechanisms, I explore heterogeneity in the treatment effects across observable characteristics of women and conduct additional analyses. Specifically, I estimate the impacts of black male incarceration on (1) the likelihood of marriage and employment for black women of different education levels and age groups (Table A4), (2) the likelihood of employment for black women of different types of marital status and education levels (Table A5),[72] and (3) the marriage and labor market outcomes for black *men* of different education levels (Table A6). More discussion is presented in Appendix A4.1.

I find large impacts of black male incarceration on (i) the likelihood of marriage for more educated *older* black women, and (ii) on the likelihood of employment for more educated *younger* black women and more educated *never-married* black women. The results suggest that more educated black women may choose to delay marriage and to start working at younger ages when facing worse marriage market conditions, as insurance against the potential lack of promising marriage partners in the future. In addition, I find a large impact on the employment of less educated married women whose husbands are present. This is consistent with the hypothesis of declining bargaining power of women, and in particular less educated women with few better outside options. Finally, I find large impacts on the

[72]Dividing the sample based on women's marital status may lead to biased estimates, since women's marriage decisions are endogenous. Nevertheless, the results may shed light on potential mechanisms.

employment of married women whose husbands are absent. The results could be due to the incarceration of husbands, which results in less financial support for black women.

For black men, I find that higher black male incarceration rates lower the likelihood of being married and increase the likelihood of having a white wife for more educated black men. The results are consistent with the theory of higher bargaining power of more educated black men in the marriage market due to the scarcity of marriageable men. In addition, I find that higher black male incarceration rates lower the likelihood of marriage and employment for less educated black men. This could be due to the high *prevalence* of incarceration as a consequence of high incarceration rates. This means that less educated black men are more likely to be former inmates or face higher risks of incarceration at some point in their lives, which make them less attractive as both potential marriage partners and employees.

6.8 Robustness Tests

I conduct six sets of robustness tests. More detailed discussion is presented in Appendix A4.2. First, I construct an alternative simulated IV using drug offenses only, and conduct analysis with standard errors clustered at the state level (Table A7). The purpose is to provide supporting evidence that the direct impact of policy changes on women and the impact of prison overcrowding on sentencing outcomes are not major concerns for identification. I find that the main results remain statistically significant when standard errors are clustered at the state level (Panel A). Moreover, results with the IV constructed with drug offenses are mostly comparable with the baseline results (Panel B).

Second, I consider alternative independent variables, including the incarceration rate of black men ages 20-39, the incarceration rate of single black men ages 20-54, and the sex ratio of black adults ages 20-34 without a 4-year college education (Table A8).

Third, I restrict the sample to states in which the black population is less concentrated toward specific MSAs, so that it is less likely that big MSAs dominate their states' policy-making (Table A9). The results are larger in magnitude with this restricted sample. Since the exclusion restriction is more likely to be satisfied with the restricted sample, the larger results indicate that the baseline results are not likely to be driven by omitted variables.

Fourth, I provide evidence that the results are not likely to be driven by pre-trends. In

particular, I perform the first-stage regression and the reduced-form regressions controlling for lags and leads of the simulated IV (Table A10). The F-tests fail to reject the null that the leading coefficients are jointly equal to zero, so the presence of a pre-trend is less likely to be a concern. Moreover, I show that the simulated IV is not correlated with potential confounds, such as crime rates and the proportion of the black population (Table A11). Third, I control for state-specific time trends (Table A12, Panel B). Lastly, I adopt a strategy proposed by Freyaldenhoven et al. (2018) by instrumenting for the violent crime rate with a lead of the simulated IV, because the crime rate is likely to be a confound that affects sentencing policy-making (Table A12, Panel C). Most results remain comparable with baseline results, which suggests that the findings are not likely to be driven by confounding factors.

Fifth, I conduct a placebo test, which shows that the incarceration rate of black men does not have statistically significant impacts on white women and children (Table A13). This suggests that the effects of black male incarceration on black women and children are not likely to be driven by some other MSA- and year-specific factors such as economic shocks, which should be faced by both blacks and whites.

Sixth, I show that alternative ways of restricting the sample based on the size of the MSA black population do not affect the results (Table A14).

7 Conclusion

This paper identifies the causal impacts of the incarceration rate of black men on black women and children. I overcome the potential endogeneity of the incarceration rate by exploiting plausibly exogenous changes in sentencing policies across states and over years. Specifically, I construct a simulated IV that characterizes how sentencing policies affect incarceration at the extensive margin, through the probability of incarceration conditional on arrest, and at the intensive margin, through the average length of sentence served in prison. The IV identifies the causal effects of "missing" black men at the margins of incarceration, where the punitiveness of sentencing policies matters.

I find that rising incarceration rates of black men decrease the likelihood of marriage for black women, and increase the likelihood of employment for those with relatively higher

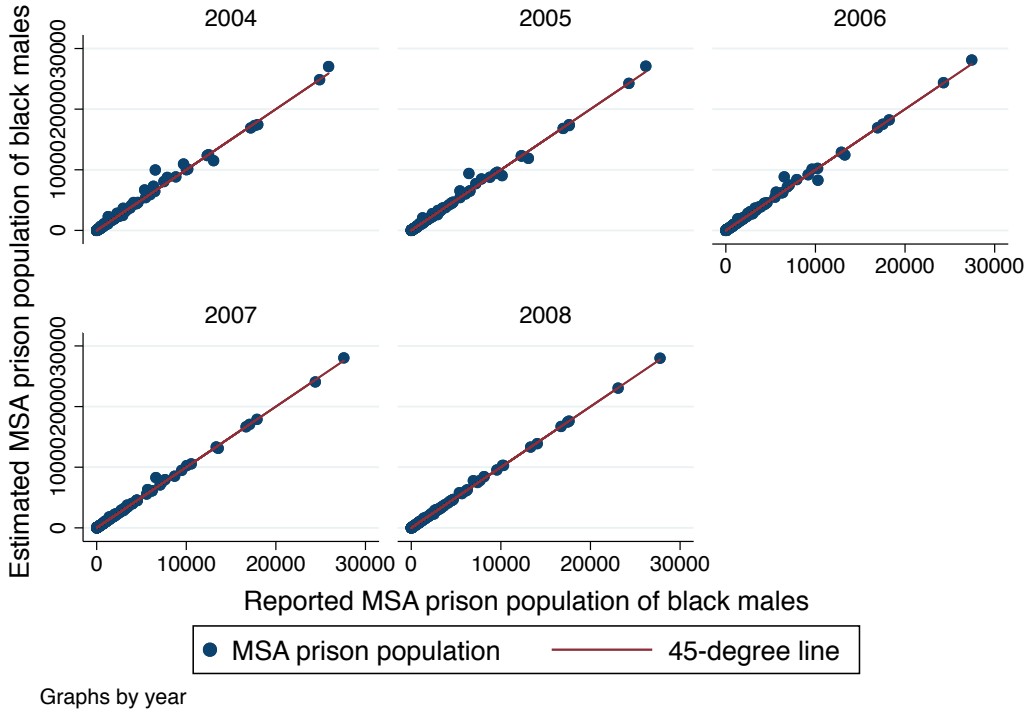
education levels. For black children, rising incarceration rates of black men increase the likelihood of being born out of wedlock and living in a mother-only family, and decrease the likelihood of having some college education in the long run. Moreover, black boys who grow up in areas with harsher sentencing policies tend to have lower income in adulthood compared with white boys who grow up in the same area with similar parental income. Finally, I find that black men at the extensive (intensive) margin of incarceration have a larger impact on the marriage of more (less) educated women. For children, the impacts of intensive-margin black male incarceration are especially large.

The results could be due to the declining availability of marriageable black men in the marriage market. In particular, I find that black men without any college education are less likely to be employed in areas with higher incarceration rates. In addition, higher incarceration rates of black men may increase the bargaining power of black men without criminal record. As evidence, I find that as the incarceration rate of black men increases, black women are more likely to marry down and black men with some college education are less likely to be married and more likely to have white wives. Finally, surging incarceration rates of black men may also change women's beliefs about marriage, and they may choose to stay single if it is a better alternative to marriage. Consistently, I find that more educated black women are less likely to be married and more likely to be employed.

The results have implications for sentencing policies and other correctional programs. First, my results suggest negative impacts of black male incarceration on black women and children. In particular, lower marriage rates of black women could lower both their and their children's welfare because of lower household income. Thus, the collateral impacts of incarceration could be taken into consideration when evaluating benefits and costs of sentencing policies. Second, my results indicate that black men at the extensive margin of incarceration due to harsher sentencing policies have negative impacts on black women and children. Therefore, alternative sentencing to incarceration for those who commit less serious crimes or crimes that cause less harm to society could be more welfare enhancing if the collateral impacts of incarceration are considered. For instance, New York State has created a number of Alternative to Incarceration Programs to help some offenders, particularly those with misdemeanors, without incarcerating them. Finally, my results suggest that the

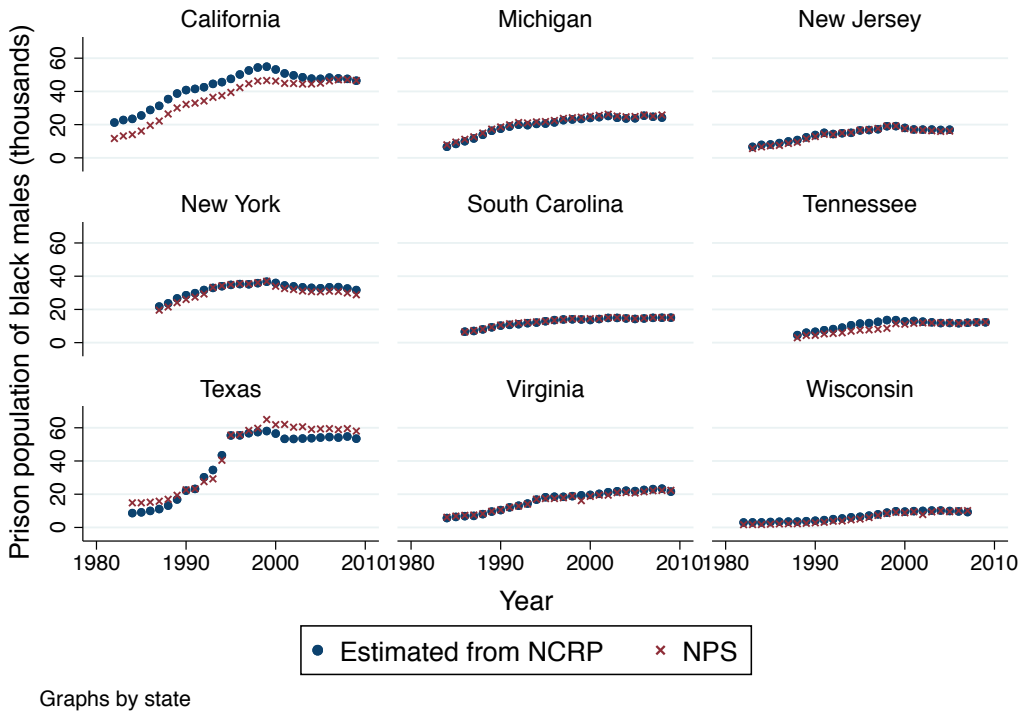
negative collateral consequences of black male incarceration could fall primarily on the poor and minorities, which could exacerbate inequality and racial gaps. For example, a simple back-of-the-envelope calculation suggests that the average gap in income rank between white and black men conditional on parental income could be reduced by 1 percentile, if they were exposed to the 1986 sentencing policies prior to age 23 (between 1986 and 2001). This potential consequence could also be considered when evaluating the criminal justice system.

Figure 1: Estimated and Reported Prison Population
(MSA Level, Black Male)



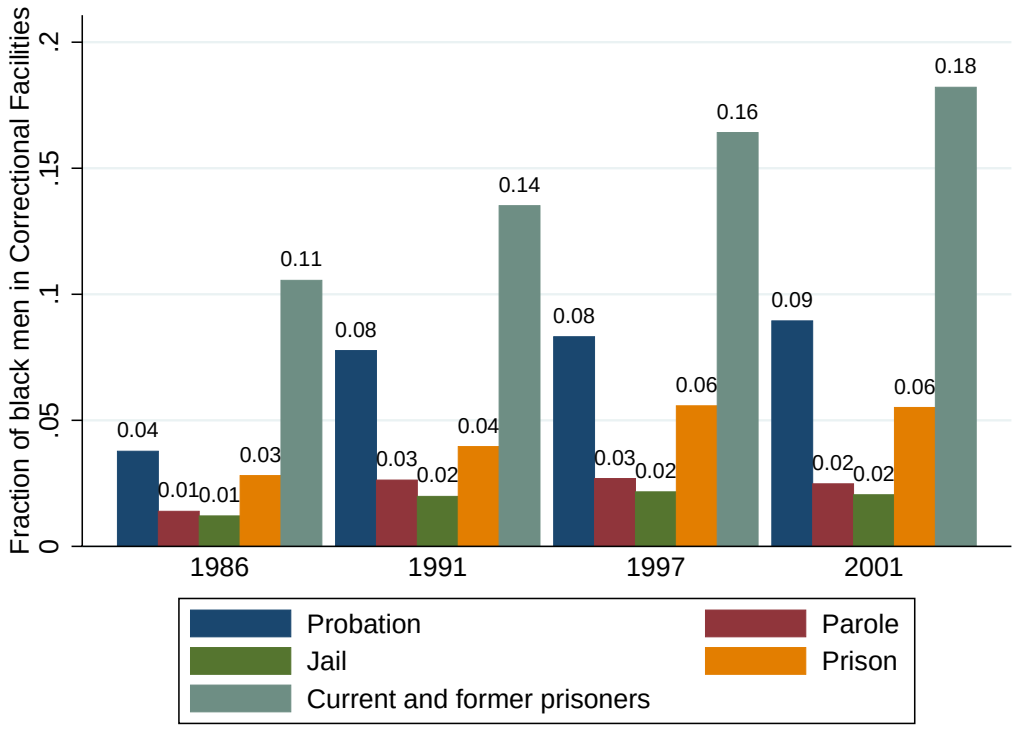
Note: These figures check the consistency between NCRP Yearend Population Data and NCRP Admissions and Releases Data. The x-axis shows the year-end prison population directly estimated from NCRP Yearend Population Data. The y-axis shows the prison population backed out using the year-end prison population in 2009 from Yearend Population Data, and the yearly changes in the prison population (i.e., the number of admissions minus the number of releases within each year and MSA) from Admissions and Releases Data between 2005 and 2009. Each point represents a MSA.

Figure 2: Prison Population from NCRP and NPS
(State Level, Black Male)



Note: These figures checks the reliability of the MSA-level prison population estimated from the NCRP. The blue circles represent the state prison population obtained by aggregating the MSA prison population estimated from the NCRP. The red x-markers represent the state prison population from the NPS. The figures show estimates for large states that have admission and release records going back to the 1980s. The average correlation of the two estimates for all the states in my sample is 0.935.

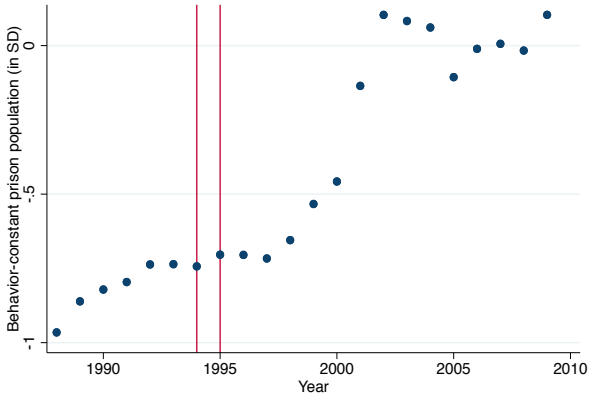
Figure 3: Fractions of Black Male Adults (Ever) in Correctional Facilities



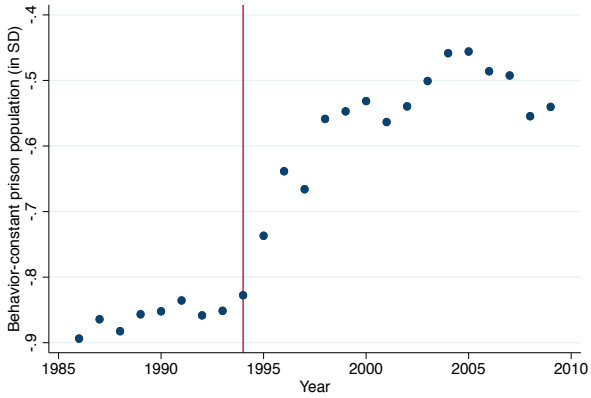
Note: These figures checks the reliability of the MSA-level prison population estimated from the NCRP. The blue circles represent the state prison population obtained by aggregating the MSA prison population estimated from the NCRP. The red x-markers represent the state prison population from the NPS. The figures show estimates for large states that have admission and release records going back to the 1980s. The average correlation of the two estimates for all the states in my sample is 0.935.

Figure 4: Sentencing Policy Changes and Behavior-Constant Prison Population

(A) Arkansas



(B) Colorado

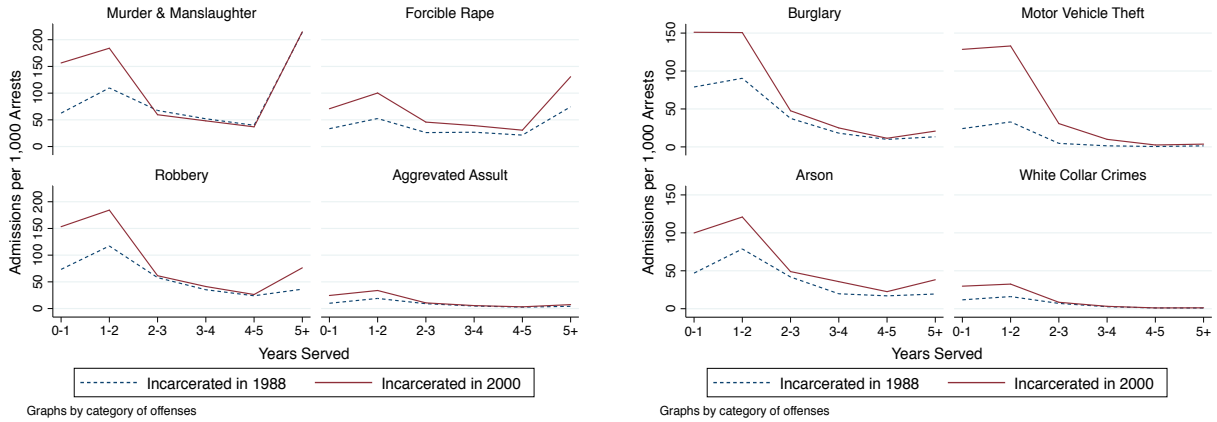


Note: These figures show how the simulated behavior-constant prison population is affected by sentencing policy changes in Arkansas and Colorado, where sentencing policy changes are implemented in a relatively discrete way. The y-axis denotes the state-level simulated prison population in SD. Specifically, I aggregate the simulated prison population by MSA and year (I^*_{mt} in equation (5)) to the state level, and standardize the aggregate simulated prison population by state and year, so that the mean is 0 and the SD is 1. The values on the y-axes are mostly negative because these states are relatively small.

Figure 5: Number of Persons Serving Time in Prison Per 1,000 Arrests

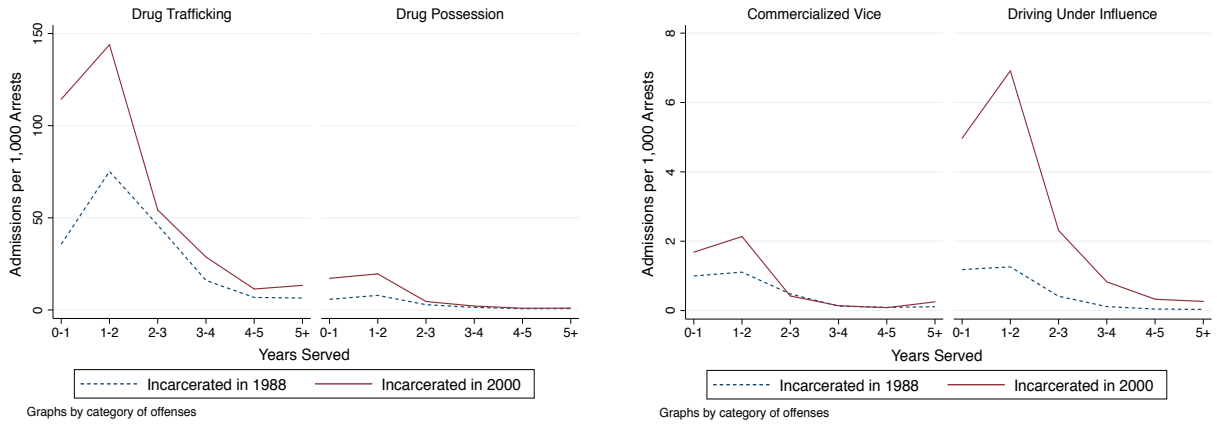
(A) Violent Offenses

(B) Property Offenses



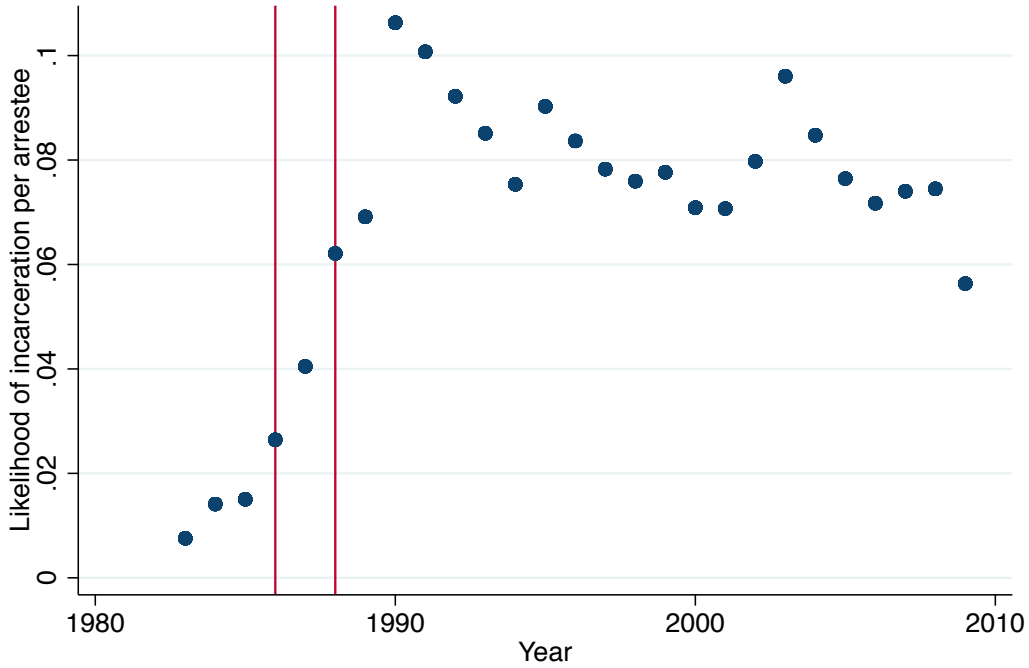
(C) Drug Offenses

(D) Public Order Offenses



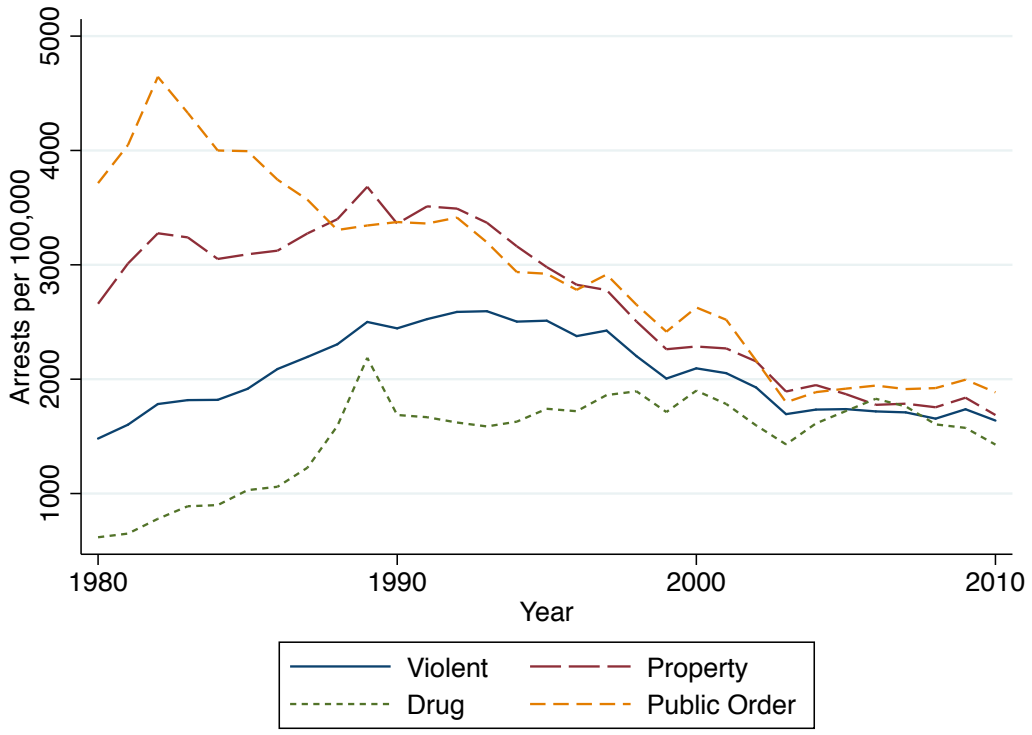
Note: This figures show the number of persons per 1,000 arrests who served t years in prison for those who were arrested in 1988 (in dotted blue lines) and in 2000 (in solid red lines) for each type of offense. t is divided into 6 groups shown on the x-axis: 0-1 year, 1-2 years, 2-3 years, 3-4 years, 4-5 years, and 5 or more years. The number of arrests is from the UCR. The number of admissions and the average time served in prison are estimated from the NCRP. Estimation requires two assumptions: (1) the offense listed in the UCR data is the most serious charge against the arrestee at the time of arrest, since I use the offense of the longest sentence from the NCRP data, and (2) the year of prison admission is same as the year of arrest. To be comparable with Neal and Rick (2016), the figures are obtained using admission and release records from eight states with high data quality: California, Colorado, Michigan, New Jersey, New York, South Carolina, Washington, and Wisconsin. Neal and Rick (2016) show that the prison population patterns in these states are comparable to those in all state.

Figure 6: Likelihood of Incarceration Per Arrestee
(Black Adults, Drug Possession)



Note: This figure shows the likelihood of incarceration conditional on arrest for drug possession for black adults. The number of arrests is from the UCR and the number of prison admissions is from the NCRP.

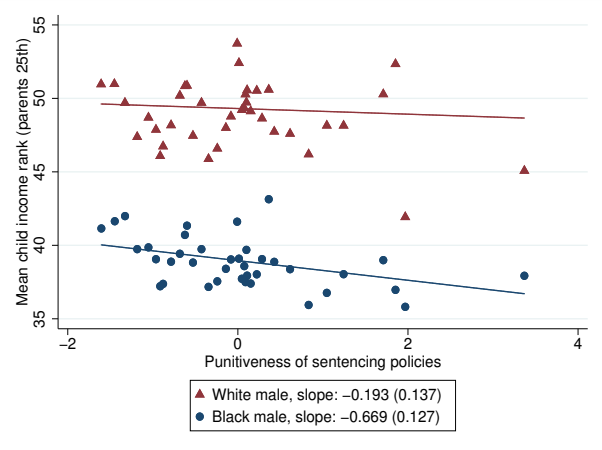
Figure 7: Arrest Rates Among Black Adults



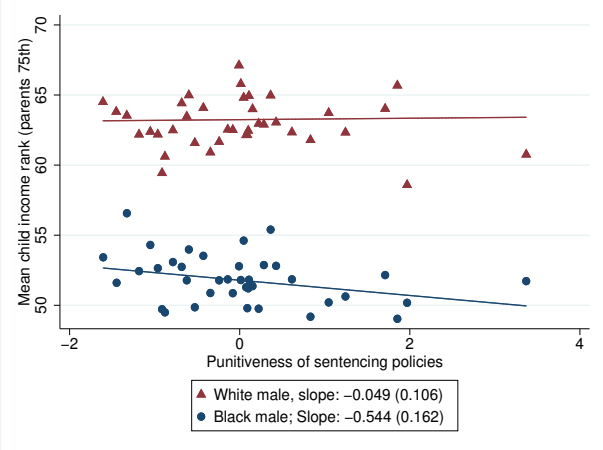
Note: This figure shows the arrest rate (i.e. the number of arrests per 100,000 residents) for black adults between 1980 and 2010 for different types of crimes, based on the UCR.

Figure 8: Intergenerational Gaps in Individual Income Rank and Punitiveness of Sentencing Policies

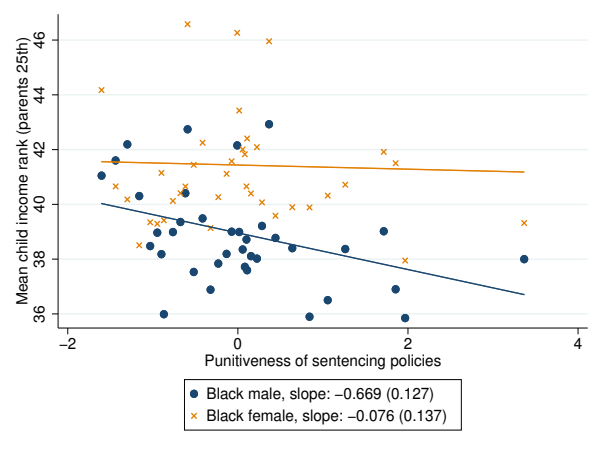
(A) Black-White, Males, Parents at 25th Percentile



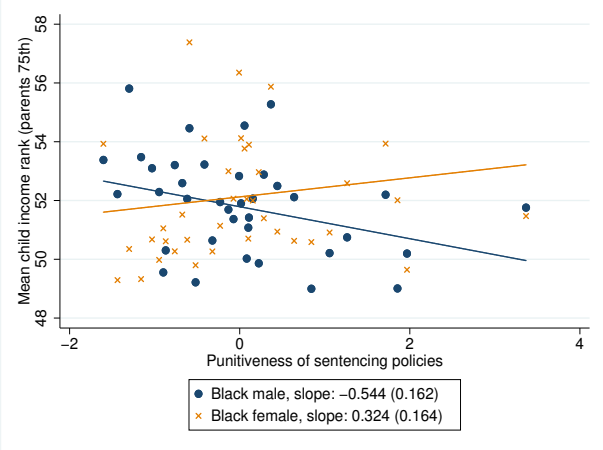
(B) Black-White, Males, Parents at 75th Percentile



(C) Male-Female, Blacks, Parents at 25th Percentile



(D) Male-Female, Blacks, Parents at 75th Percentile



Note: These figures present binned scatter plots of the relationship between child individual income rank conditional on parents' income and the punitiveness of sentencing policies across commuting zones where children grow up. In each panel, the punitiveness of sentencing policies (I_c^*) is binned into 40 quantiles and plotted on the x-axis. The mean child individual income rank is plotted on the y-axis. I control for the poverty rate in all panels. I estimate the fit lines on the binned points using OLS and report the slope coefficients and standard errors (in parentheses).

Table 1: Summary Statistics for Black Men

Samples	Prison Admission		State Prisons		Institutions		Resident Pop.	
	Mean (1)	SD (2)	Mean (3)	SD (4)	Mean (5)	SD (6)	Mean (7)	SD (8)
Share of ages 20-54	0.93	0.25	0.94	0.23	0.83	0.37	0.59	0.49
For black men ages 20-54								
Married	NA	NA	0.16	0.36	0.14	0.35	0.40	0.49
Single	NA	NA	0.79	0.41	0.81	0.39	0.55	0.50
Never married	NA	NA	0.67	0.47	0.71	0.46	0.45	0.50
HS diploma	0.34	0.47	0.28	0.45	0.39	0.49	0.34	0.47
Some college	0.07	0.25	0.11	0.31	0.15	0.36	0.28	0.45
College degree	0.01	0.09	0.02	0.14	0.02	0.13	0.14	0.35
Employed	NA	NA	0.67	0.47	NA	NA	0.72	0.45
Full-time employed	NA	NA	0.53	0.50	NA	NA	0.61	0.49
Observations	2,460,870		20,524		37,650		1,070,933	

Note: Estimates in Columns 1-2 are based on NCRP Admissions Data 1986-2009. Estimates in Columns 3-4 are based on the SISCF 1986, 1991, 1997, and 2004. Estimates in Columns 5-6 are based on ACS 2006-2009 samples in institutions. Estimates in Columns 7-8 are based on the household data 1986-2009. All estimates are for black men ages 20-54 (except for row 1 for all black male adults). Variables *HS diploma*, *Some college*, and *College degree* are indicators for the highest level of education.

Table 2: Sentencing Policy Changes

States	Determinate	Sentencing Guidelines		Truth in Sentencing[d]		Three-Strikes
	Sentencing[a]	Years[b]	Voluntary[c]	Years	Requirements	Laws[e]
Alabama						
Alaska	1980**	1980	No		100%	
Arizona	1994	1978***		1994	85%	
Arkansas*	1994**	1994	Yes		70%	1995
California*	1976	1976***		1994	85%	1994
Colorado*	1979-1985	1979***			75%	1994
Connecticut	1981-1990			1994	50%	1994
				1996	85%	
Delaware	1990	1987	Yes	1990	85%	
District of Col.				2000	85%	
Florida*	1983	1983	1983-1994	1995	85%	1995
Geogia*				1995	85%	1995
Hawaii						
Idaho					100%	
Illinois	1978			1995	85%	
Indiana	1977	1977***			50%	1994
Iowa				1996	85%	
Kansas	1993	1993	No	1993	80%	1994
				1995	85%	
Kentucky				1998	85%	
Louisiana*		1987	Yes	1997	85%	1994
Maine	1976			1995	85%	
Maryland		1983	Yes		50%	1994
Massachusetts					75%	
Michigan*		1984	1984-1999	1994	85%	
Minnesota*	1980	1980	No	1993	85%	
Mississippi	1995-2000			1995	85%	
Missouri*		1997	Yes	1994	85%	
Montana					25%	1995
Nebraska					50%	
Nevada					100%	1995
New Hampshire				1982	100%	
New Jersey*		1977***		1997	85%	1995
New Mexico	1977	1977***				1994
New York*				1995	85%	
North Carolina*	1981	1994	No	1994	85%	1994
North Dakota				1995	85%	1995
Ohio	1996	1996	No	1996	85%	
Oklahoma*				1998	85%	
Oregon*	1989	1989	No	1990	80%	

				1995	100%	
Pennsylvania*		1982	No	1911	85%	1995
Rhode Island*		1981***				
South Carolina*				1996		1996
South Dakota					85%	
Tennessee*	1989**	1989	No	1995	85%	1994
Texas*					50%	
Utah		1979	Yes	1985	85%	1995
Vermont						1995
Virginia*	1995	1991	Yes	1995	85%	1994
Washington*	1984	1984	No	1990	85%	1993
West Virginia						
Wisconsin*	1999	1985-1995	Yes	1999	100%	1994
Wyoming						

Note: 22 states (*) are in the sample of analysis because of data limitations of the NCRP. Details are discussed in Section 3 and Appendix A2.
[a]Years of determinate sentencing are from Stemen et al. (2006). A range means that indeterminate sentencing reinstated later. Some states (**) partially abolished parole release (Frase, 2005).
[b]Years of sentencing guidelines are from Frase (2005). Some states (***) adopted presumptive sentencing, a system of single recommended terms or narrow sentence ranges (Stemen et al., 2006).
[c]Information on whether sentencing guidelines are voluntary is from Frase (2005) and Stemen et al. (2006). A range means that guidelines were voluntary during the period.
[d]Years of truth-in-sentencing laws and requirements are from Ditton and Wilson (1999) and Sabol et al. (2002).
[e]Years of three-strikes laws are from Marvell and Moody (2001).

Table 3: First Stage

Dependent variable	**Fraction of black men in prison**			
	(1)	(2)	(3)	(4)
Simulated IV	0.028***	0.028***		
	(0.004)	(0.004)		
Simulated IV (extensive margin)			0.018***	
			(0.004)	
Simulated IV (intensive margin)				0.023***
				(0.004)
Observations	285,811	282,968	284,680	284,680
R-squared	0.868	0.868	0.858	0.856
Mean of dep. var.	0.062			
SD of dep. var.	0.026			
Year & MSA FEs	Yes	Yes	Yes	Yes
Control variables		Yes	Yes	Yes
F-statistics	45.40	45.40	21.55	27.89

Note: The sample includes MSAs with at least 1,000 black women and 1,000 black men ages 20-34. The analysis is restricted to black women ages 18-34 without a 4-year college education. Restricting the sample in other ways based on the second stage does not affect the power of the first stage. Control variables include age, age-squared, and years of education. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Impact of Black Male Incarceration on the Likelihood of Being Married for Black Women

Dependent variable	**Married**					
Samples	Black women with some college			Black women with no college		
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction of black men in prison	-0.336	-3.192**	-3.121**	-0.272	-2.797**	-2.640**
	(0.380)	(1.518)	(1.324)	(0.352)	(1.213)	(1.156)
Observations	119,511	119,511	116,668	166,300	166,300	166,300
R-squared	0.037	0.033	0.129	0.033	0.030	0.103
Mean of dep. var.	0.238			0.193		
SD of dep. var.	0.426			0.395		
Year & MSA FEs	Yes	Yes	Yes	Yes	Yes	Yes
Control variables			Yes			Yes

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34. Columns 1-3 include black women ages 18-34 with some college education (without degrees) and Columns 4-6 include black women ages 18-34 without any college education. Control variables include age, age-squared, and years of education. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Mean of Characteristics for Compliers and All Black Offenders

	Compliers	All Black Offenders
Age	27.73	32.38
Violent offense	0.20	0.27
Property offense	0.21	0.28
Drug offense	0.43	0.36
Public offense	0.16	0.08
Prior felony	0.79	0.49

Note: The sample includes all black male offenders who were admitted to prison between 1986 and 2009, and whose MSAs of sentence include at least 1,000 black men and 1,000 black women ages 20-34. For simplicity, I assume a binary instrument Z_{mt}, where $Z_{mt} = 1$ if the change in the simulated IV for MSA m and year t (relative to 1986) is greater than the median. Similarly, I assume a binary treatment W_{mt}, where $W_{mt} = 1$ if the change in the black male incarceration rate (relative to 1986) is greater than the median. Define $W_{mt}(j)$ to be the potential outcome of W_{mt} given that $Z_{mt} = j, j \in \{0, 1\}$. Therefore, compliers are prisoners who were sentenced in MSA m and year t, where $W_{mt}(0) = 0$ or $W_{mt}(1) = 1$.

Table 6: Impact of Black Male Incarceration on Other Marriage Market Outcomes for Black Women

Dependent variables	**Never married**	**Divorced**	**Marry out**	**Marry up**
	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)
Panel A: Impact for black women with some college				
Fraction of black	2.332**	0.994	-0.489	-1.876*
men in prison	(0.981)	(0.823)	(0.470)	(1.018)
Observations	116,668	116,668	116,668	116,668
R-squared	0.234	0.083	0.030	0.074
Mean of dep. var.	0.661	0.0984	0.0184	0.160
SD of dep. var.	0.474	0.298	0.134	0.366
Panel B: Impact for black women with no college				
Fraction of black	2.573**	0.274	0.114	-2.937***
men in prison	(1.196)	(0.693)	(0.254)	(1.094)
Observations	166,300	166,300	166,300	166,300
R-squared	0.190	0.073	0.017	0.080
Mean of dep. var.	0.709	0.0918	0.0108	0.199
SD of dep. var.	0.454	0.289	0.104	0.400
Year & MSA FEs	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34. The dependent variable is an indicator of being never married in Column 1, an indicator of being divorced in Column 2, an indicator of having a non-black husband in Column 3, and an indicator of having a husband whose years of education are at least equal to the wife's in Column 4. Panel A includes black women ages 18-34 with some college education, and Panel B includes black women ages 18-34 without any college education. Control variables include age, age-squared, and years of education. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Impact of Black Male Incarceration on the Likelihood of Being Employed for Black Women

Dependent variable	**Employed**					
Samples	Black women with college			Black women with no college		
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction of black men in prison	0.404	2.883***	2.989***	0.487	0.748	0.821
	(0.424)	(1.091)	(1.100)	(0.372)	(1.394)	(1.306)
Observations	138,354	138,354	135,715	116,146	116,146	116,146
R-squared	0.020	0.017	0.042	0.035	0.035	0.067
Mean of dep. var.	0.769			0.557		
SD of dep. var.	0.422			0.497		
Year & MSA FEs	Yes	Yes	Yes	Yes	Yes	Yes
Control variables			Yes			Yes

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34. Columns 1-3 include black women ages 22-34 with some college education or higher, and Columns 4-6 include black women ages 22-34 without any college education. Control variables include age, age-squared, and years of education. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Impact of Black Male Incarceration on Black Women's Income

Dependent variables	**Wage income**		**Value of food stamps**	
Samples	with zero	without zero	with zero	without zero
	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)
Panel A: Impact for black women with some college or higher				
Fraction of black	63,985	33,966	3,001	6,413
men in prison	(42,589)	(43,938)	(2,402)	(9,142)
Observations	135,715	117,429	39,533	6,726
R-squared	0.198	0.246	0.066	0.112
Mean of dep. var.	18600	21922	269	1957
SD of dep. var.	15530	14540	840	1353
Panel B: Impact for black women with no college				
Fraction of black	10,204	37,395	16,614**	15,271
men in prison	(27,759)	(31,536)	(7,247)	(9,662)
Observations	116,146	78,206	31,285	12,804
R-squared	0.083	0.102	0.074	0.077
Mean of dep. var.	9257	13927	977.9	2554
SD of dep. var.	10564	10142	1587	1597
Year & MSA FEs	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34. The dependent variable is wage income with observations of 0 in Column 1 and without observations of 0 in Column 2, and the value of food stamps received with observations of 0 in Column 3 and without observations of 0 in Column 4. Top 1% observations of the dependent variables are winterized. Panel A includes black women ages 22-34 with some college education or higher and Panel B includes black women ages 22-34 with no college education. Control variables include age, age-squared, and years of education. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Impact of Black Male Incarceration on Children's Family Structure

Dependent variables	**Live with mother only**			**Out-of-wedlock birth**		
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction of black men in prison	0.427	3.535***	3.533***	0.834*	4.343***	4.292***
	(0.403)	(1.119)	(1.119)	(0.467)	(1.487)	(1.495)
Observations	661,425	661,425	661,425	120,778	120,778	120,778
R-squared	0.020	0.017	0.018	0.038	0.034	0.035
Mean of dep. var.	0.496			0.472		
SD of dep. var.	0.500			0.499		
Year & MSA FEs	Yes	Yes	Yes	Yes	Yes	Yes
Control variables			Yes			Yes

Note: In Columns 1-3, the depend variable is an indicator of living in a mother-only family; the sample includes MSAs with at least 2,000 black children age 0-14; the analysis is restricted to black children ages 0-14. In Columns 4-6, the depend variable is an indicator that mother is never married; the sample includes MSAs with at least 2,000 black children age 0-14; the analysis is restricted to black infants. Control variables include age and gender. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Long-Run Impact of Black Male Incarceration on Black Children's Educational Outcome

Dependent variable	**Have at least one-year college**					
Samples	Black men 22-24			Black women 22-24		
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Mean fraction of black men in prison in early adolescence	-1.123**	-4.432**	-3.897**	-0.749	-3.216**	-3.185**
	(0.449)	(2.221)	(1.926)	(0.531)	(1.639)	(1.522)
Observations	19,326	19,326	13,571	23,975	23,975	17,242
R-squared	0.043	0.040	0.050	0.041	0.040	0.043
Mean of dep. var.	0.434	0.434	0.394	0.524	0.524	0.495
SD of dep. var.	0.496	0.496	0.489	0.499	0.499	0.500
Year & MSA FEs	Yes	Yes	Yes	Yes	Yes	Yes

Note: Columns 1-3 include black men ages 22-24. Columns 4-6 include black women ages 22-24. Columns 3 and 6 further restrict the sample to individuals whose state of birth is same as the current state of residence. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Impact of Black Men at Different Margins of Incarceration

Dependent variables	**Married**		**Employed**		**Live with mother**	**Out-of-wedlock**
	Some coll. 2SLS (1)	No college 2SLS (2)	College 2SLS (3)	No college 2SLS (4)	**only** 2SLS (5)	**birth** 2SLS (6)
Panel A: Baseline simulated IV						
Fraction of black men in prison	-3.121** (1.324)	-2.640** (1.156)	2.989*** (1.100)	0.821 (1.306)	3.533*** (1.119)	4.292*** (1.495)
R-squared	0.129	0.103	0.042	0.067	0.018	0.035
F-statistics	42.905	43.139	35.007	42.801	46.839	47.521
Panel B: Simulated IV (extensive margin)						
Fraction of black men in prison	-4.119** (1.855)	-1.768 (1.439)	3.171** (1.502)	2.982* (1.708)	3.548** (1.653)	4.491** (1.898)
R-squared	0.126	0.105	0.041	0.065	0.018	0.034
F-statistics	24.99	19.912	14.754	21.176	24.96	30.78
Panel C: Simulated IV (intensive margin)						
Fraction of black men in prison	-1.435 (3.714)	-4.124* (2.238)	5.156* (3.113)	1.625 (2.456)	6.858*** (2.549)	7.323** (3.698)
R-squared	0.132	0.097	0.034	0.066	0.007	0.024
F-statistics	10.474	13.473	11.013	10.586	14.529	12.867
Observations	116,668	166,300	135,715	116,146	661,425	120,778
Year & MSA FEs	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes

Note: In Columns 1-2, the dependent variable is an indicator of being married; the sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34; the analysis is restricted to black women ages 18-34 with some college education (Column 1) and without any college education (Column 2). In Columns 3-4, the dependent variable is an indicator of being employed; the sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34; the analysis is restricted to black women ages 22-34 with at least some college education (Column 3) and without any college education (Column 4). In Column 5, the dependent variable is an indicator of living in a mother-only family; the sample includes MSAs with at least 2,000 black children age 0-14; the analysis is restricted to black children ages 0-14. In Column 6, the dependent variable is an indicator that mother is never married; the sample includes MSAs with at least 2,000 black children ages 0-4; the analysis is restricted to black infants. Control variables include age, age-squared, and years of education in Columns 1-4, age and sex in Column 5, and sex in Column 6. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 12: Impact of Punitiveness of Sentencing Policies on Intergenerational Income Gap

Dependent variable	**Difference between white and black men's income rank**			
	Parents at 25th percentile		Parents at 75th percentile	
	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)
Punitiveness of sentencing policies	0.614***	0.619***	0.698***	0.709***
	(0.140)	(0.139)	(0.166)	(0.166)
Poverty rate		-12.06***		-9.016**
		(3.379)		(4.035)
Observations	517	517	517	517
R-squared	0.035	0.058	0.033	0.042
Mean of dep. var.	10.273		11.392	
SD of dep. var.	3.221		3.851	

Dependent variable	**Difference between black women and men's income rank**			
	Parents at 25th percentile		Parents at 75th percentile	
	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)
Punitiveness of sentencing policies	0.578***	0.601***	0.887***	0.901***
	(0.146)	(0.142)	(0.213)	(0.213)
Poverty rate		-19.046***		-11.303**
		(3.442)		(5.168)
Observations	506	506	506	506
R-squared	0.03	0.086	0.033	0.042
Mean of dep. var.	2.486		0.283	
SD of dep. var.	3.317		4.9	

Note: The sample includes all CZs. Standard errors are clustered at the state level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

References

Abramitzky, Ran, Adeline Delavande, and Luis Vasconcelos (2011), "Marrying up: The role of sex ratio in assortative matching." *American Economic Journal: Applied Economics*, 3, 124–57.

Abuse, Substance (2014), "Mental Health Services Administration (SAMHSA)(2014) Results from the 2013 national survey on drug use and health: Summary of national findings." *Substance Abuse and Mental Health Services Administration, Rockville, MD*.

Ackerman, Jeffrey M and D Kim Rossmo (2015), "How far to travel? A multilevel analysis of the residence-to-crime distance." *Journal of Quantitative Criminology*, 31, 237–262.

Aizer, Anna and Joseph J Doyle Jr (2015), "Juvenile incarceration, human capital, and future crime: Evidence from randomly assigned judges." *The Quarterly Journal of Economics*, 130, 759–803.

Alexander, Michelle (2012), *The new Jim Crow: Mass incarceration in the age of colorblindness*. The New Press.

Anderman, Eric M and Carol Midgley (1997), "Changes in achievement goal orientations, perceived academic competence, and grades across the transition to middle-level schools." *Contemporary Educational Psychology*, 22, 269–298.

Andersen, Lars H (2016), "How children's educational outcomes and criminality vary by duration and frequency of paternal incarceration." *The ANNALS of the American Academy of Political and Social Science*, 665, 149–170.

Angrist, Josh (2002), "How do sex ratios affect marriage and labor markets? Evidence from America's second generation." *The Quarterly Journal of Economics*, 117, 997–1038.

Aughinbaugh, Alison, Omar Robles, and Hugette Sun (2013), "Marriage and divorce: Patterns by gender, race, and educational attainment." *Monthly Lab. Rev.*, 136, 1.

Balfanz, Robert, Liza Herzog, and Douglas J Mac Iver (2007), "Preventing student disengagement and keeping students on the graduation path in urban middle-grades schools: Early identification and effective interventions." *Educational Psychologist*, 42, 223–235.

Banks, Ralph Richard (2011), *Is marriage for white people?: How the African American marriage decline affects everyone*. Penguin.

Beck, Allen J, Jennifer C Karberg, and Paige M Harrison (2002), "Prison and jail inmates at midyear 2001." *Bureau of Justice Statistics Bulletin*, 1.

Becker, Gary S (1968), "Crime and punishment: An economic approach." In *The economic dimensions of crime*, 13–68, Springer.

Becker, Gary S (1973), "A theory of marriage: Part I." *Journal of Political economy*, 81, 813–846.

Becker, Gary S (1974), "A theory of marriage: Part II." *Journal of political Economy*, 82, S11–S26.

Becker, Gary S, Elisabeth M Landes, and Robert T Michael (1977), "An economic analysis of marital instability." *Journal of political Economy*, 85, 1141–1187.

Blumstein, Alfred and Allen J Beck (1999), "Population growth in US prisons, 1980-1996." *Crime and justice*, 26, 17–61.

Bonczar, Thomas P (2003), "Prevalence of imprisonment in the US population, 1974-2001."

Brainerd, Elizabeth (2017), "The lasting effect of sex ratio imbalance on marriage and family: Evidence from World War II in Russia." *Review of Economics and Statistics*, 99, 229–242.

Caucutt, Elizabeth M, Nezih Guner, and Christopher Rauh (2016), "Is marriage for white people? Incarceration and the racial marriage divide."

Centers for Disease Control and Prevention (2018), "CDC Wonder: Bridged-race population estimates 2001." URL https://wonder.cdc.gov/bridged-race-population.html.

Champion, Dean J (2008), *Sentencing: A Reference Handbook*. Abc-clio.

Charles, Kerwin Kofi and Ming Ching Luoh (2010), "Male incarceration, the marriage market, and female outcomes." *The Review of Economics and Statistics*, 92, 614–627.

Chetty, Raj and Nathaniel Hendren (2018), "The impacts of neighborhoods on intergenerational mobility I: Childhood exposure effects." *The Quarterly Journal of Economics*, 133, 1107–1162.

Chetty, Raj, Nathaniel Hendren, Maggie R Jones, and Sonya R Porter (2018), "Race and economic opportunity in the United States: An intergenerational perspective." Technical report, National Bureau of Economic Research.

Chiappori, Pierre-Andre, Bernard Fortin, and Guy Lacroix (2002), "Marriage market, divorce legislation, and household labor supply." *Journal of political Economy*, 110, 37–72.

Clark, John, James Austin, and D Alan Henry (1997), *"Three Strikes and You're Out": A Review of State Legislation*. US Department of Justice, Office of Justice Programs, National Institute of Justice.

Clear, Todd R (2008), "The effects of high imprisonment rates on communities." *Crime and Justice*, 37, 97–132.

Cox, Oliver C (1940), "Sex ratio and marital status among Negroes." *American sociological review*, 5, 937–947.

Currie, Janet and Jonathan Gruber (1996), "Health insurance eligibility, utilization of medical care, and child health." *The Quarterly Journal of Economics*, 111, 431–466.

Derenoncourt, Ellora (2018), "Can you move to opportunity? Evidence from the Great Migration."

Ditton, Paula M and Doris James Wilson (1999), *Truth in sentencing in state prisons*. US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics Washington, DC.

Donohue III, John J and Steven D Levitt (2001), "The impact of race on policing and arrests." *The Journal of Law and Economics*, 44, 367–394.

Easterlin, Richard A. (1961), "The American baby boom in historical perspective." *The American Economic Review*, 51, 869–911, URL http://www.jstor.org/stable/1813841.

Flood, Sarah, Miriam King, Steven Ruggles, and J. Robert Warren (2017), "Integrated Public Use Microdata Series, Current Population Survey: Version 5.0. [dataset]." Minneapolis: University of Minnesota, URL https://doi.org/10.18128/D030.V5.0.

Frase, Richard S (2005), "State sentencing guidelines: Diversity, consensus, and unresolved policy issues." *Colum. L. Rev.*, 105, 1190.

Freyaldenhoven, Simon, Christian Hansen, and Jesse M Shapiro (2018), "Pre-event trends in the panel event-study design." Technical report, National Bureau of Economic Research.

Grob, Gerald N (2000), "Mental health policy in 20th-century America." *AUTHOR Manderscheid, Ronald W., Ed.; Henderson, Marilyn J., Ed. TITLE Mental Health, United States, 2000. INSTITUTION Substance Abuse and Mental Health Services Administration*, 18.

Gruber, Jon and Emmanuel Saez (2002), "The elasticity of taxable income: Evidence and implications." *Journal of public Economics*, 84, 1–32.

Guttentag, Marcia and Paul F Secord (1983), "Too many women? The sex ratio question."

Johnson, Rucker C and Steven Raphael (2009), "The effects of male incarceration dynamics on acquired immune deficiency syndrome infection rates among African American women and men." *The Journal of Law and Economics*, 52, 251–293.

Kalmijn, Matthijs (1998), "Intermarriage and homogamy: Causes, patterns, trends." *Annual review of sociology*, 24, 395–421.

Kuziemko, Ilyana and Steven D Levitt (2004), "An empirical analysis of imprisoning drug offenders." *Journal of Public Economics*, 88, 2043–2066.

Lafortune, Jeanne (2013), "Making yourself attractive: Pre-marital investments and the returns to education in the marriage market." *American Economic Journal: Applied Economics*, 5, 151–78.

Laumann, Edward O., John H. Gagnon, Robert T. Michael, and Stuart Michaels (1992), "National Health and Social Life Survey, 1992: [United States]." Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], URL https://doi.org/10.3886/ICPSR06647.v2.

Levitt, Steven D (1996), "The effect of prison population size on crime rates: Evidence from prison overcrowding litigation." *The quarterly journal of economics*, 111, 319–351.

Levitt, Steven D (2004), "Understanding why crime fell in the 1990s: Four factors that explain the decline and six that do not." *Journal of Economic perspectives*, 18, 163–190.

Marvell, Thomas B and Carlisle E Moody (2001), "The lethal effects of three-strikes laws." *The Journal of Legal Studies*, 30, 89–106.

Massoglia, Michael, Brianna Remster, and Ryan D King (2011), "Stigma or separation? Understanding the incarceration-divorce relationship." *Social Forces*, 90, 133–155.

Mechoulan, Stéphane (2011), "The external effects of black male incarceration on black females." *Journal of Labor Economics*, 29, 1–35.

Mueller-Smith, Michael (2015), "The criminal and labor market impacts of incarceration." *Unpublished Working Paper*.

Neal, Derek and Armin Rick (2016), "The prison boom and sentencing policy." *The Journal of Legal Studies*, 45, 1–41.

Nicholson-Crotty, Sean (2004), "The impact of sentencing guidelines on state-level sanctions: An analysis over time." *Crime & Delinquency*, 50, 395–411.

Pager, Devah (2003), "The mark of a criminal record." *American journal of sociology*, 108, 937–975.

Passel, Jeffrey S, Wendy Wang, and Paul Taylor (2010), "One-in-seven new US marriages is interracial or interethnic." *Pew Social & Demographic Trends*.

Pfaff, John F (2011), "The myths and realities of correctional severity: Evidence from the national corrections reporting program on sentencing practices." *American Law and Economics Review*, 13, 491–531.

Raphael, Steven and Michael A Stoll (2013), *Why are so many Americans in prison?* Russell Sage Foundation.

Rodrigue, Edward and Richard Reeves (2015), "Single black female BA seeks educated husband: Race, assortative mating and inequality." *Brookings Institution*, 8, 1–6.

Ruggles, Steven, Katie Genadek, Ronald Goeken, Josiah Grover, and Matthew Sobek (2017), "Integrated Public Use Microdata Series: Version 7.0 [dataset]." Minneapolis: University of Minnesota, URL https://doi.org/10.18128/D010.V7.0.

Sabol, William J et al. (2002), "The influences of truth-in-sentencing reforms on changes in states' sentencing practices and prison populations."

Stemen, Don, Andres Rengifo, and James Wilson (2006), "Of fragmentation and ferment: The impact of state sentencing policies on incarceration rates, 1975–2002." *Final Report to the US Department of Justice by the Vera Institute of Justice*, 1–217.

Stemen, Don and Andres F Rengifo (2011), "Policies and imprisonment: The impact of structured sentencing and determinate sentencing on state incarceration rates, 1978–2004." *Justice Quarterly*, 28, 174–201.

Tonry, Michael (2013), "Sentencing in America, 1975–2025." *Crime and Justice*, 42, 141–198.

Travis, Jeremy, Bruce Western, and F Stevens Redburn (2014), "The growth of incarceration in the United States: Exploring causes and consequences."

United States Department of Justice. Federal Bureau of Investigation (1983-2009), "Uniform crime reporting program data: Arrests by age, sex, and race, summarized yearly, 1983-2009." Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], URL https://doi.org/10.3886/ICPSR30762.v1.

United States Department of Justice. Office of Justice Programs. Bureau of Justice Statistics (1983-2009), "National corrections reporting program, 1983-2009." Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], URL https://doi.org/10.3886/ICPSR30799.v2.

United States Department of Justice. Office of Justice Programs. Bureau of Justice Statistics (1993), "Survey of inmates of state correctional facilities, 1991: [united states]." Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], URL https://doi.org/10.3886/ICPSR06068.v1.

United States Department of Justice. Office of Justice Programs. Bureau of Justice Statistics (2005), "Survey of inmates of state correctional facilities, 1986: [united states]." Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], URL https://doi.org/10.3886/ICPSR08711.v2.

United States Department of Justice. Office of Justice Programs. Bureau of Justice Statistics (2013), "National prisoner statistics, 1978-2011." Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], URL https://doi.org/10.3886/ICPSR34540.v1.

United States Department of Justice. Office of Justice Programs. Bureau of Justice Statistics (2018), "Survey of inmates in state and federal correctional facilities, 2004." Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], URL https://doi.org/10.3886/ICPSR04572.v3.

United States Department of Justice. Office of Justice Programs. Bureau of Justice Statistics, and United States Department of Justice. Federal Bureau of Prisons (2006), "Survey of inmates in state and federal correctional facilities, 1997." Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], URL https://doi.org/10.3886/ICPSR02598.v1.

Van der Klaauw, Wilbert (1996), "Female labour supply and marital status decisions: A life-cycle model." *The Review of Economic Studies*, 63, 199–235.

Visher, Christy Ann, Sara Debus, and Jennifer Yahner (2008), *Employment after prison: A longitudinal study of releases in three states*. Urban Institute, Justice Policy Center Washington, DC.

Western, Bruce (2002), "The impact of incarceration on wage mobility and inequality." *American sociological review*, 526–546.

Western, Bruce and Leonard Lopoo (2004), "Incarceration, marriage, and family life." *Princeton University, Department of Sociology (paper)*.

Western, Bruce and Sara McClanahan (2000), "Fathers behind bars: The impact of incarceration on family formation."

Wildeman, Christopher and Christopher Muller (2012), "Mass imprisonment and inequality in health and family life." *Annual Review of Law and Social Science*, 8, 11–30.

Zhang, Yan, Christopher D Maxwell, and Michael S Vaughn (2009), "The impact of state sentencing policies on the US prison population." *Journal of Criminal Justice*, 37, 190–199.

Appendix

A1 Extended Literature Review

This paper is most related to Charles and Luoh (2010) and Mechoulan (2011), who estimate the impact of male incarceration on female outcomes. Charles and Luoh (2010) study the impact of male incarceration on women's marriage and labor market outcomes, using decennial census data from IPUMS from 1970 to 2000. The census data specify observations in institution. The authors define a marriage market by the interaction of race, age group, and state, and exploit variation in the incarceration rates across different marriage markets using a fixed effect model. Their identification assumptions include that (1) marriages occur within the specific race, age, and regional cells, (2) variation in the incarceration rates comes from shocks that are exogenous to women's marriage and labor market outcomes, and (3) marriage markets of the whites are viable control groups for marriage markets of the blacks. Although variation in the incarceration rates is likely to come from sentencing policy changes to a large extent, it can still be correlated with other unobserved changes in confounds within each marriage market over time, which may affect women's marriage and labor supply decisions independently. In addition, marriage markets of the whites may not be proper control groups for marriage markets of the blacks. Charles and Luoh (2010) also instrument for changes in the incarceration rates between 2000 and 1980 using average drug caseloads between 1990 and 2000, using a first difference approach (because of data limitation on drug caseloads in early years). However, drug caseloads do not plausibly satisfy the exclusion restriction. For instance, drug caseloads can be correlated with prevalence of illicit drugs or police discrimination, which can affect women's marriage decisions independently. Furthermore, women may not want to marry a man who is addicted to drugs. Mechoulan (2011) differs from Charles and Luoh (2010) by using prisoner statistics (1978-2003) from the Bureau of Justice Statistics (BJS) and annual household data from the Current Population Survey (CPS). In addition, the author controls for state-specific time trends. However, the estimates may still not represent causal relationships because of omitted variables within states and over years.

Results from these two studies are mixed. In general, my OLS estimates of the impact of black male incarceration on women's marriage and employment are comparable with those of either Charles and Luoh (2010) or Mechoulan (2011), but the OLS estimates are substantially smaller in magnitude than my 2SLS estimates. As to the impact on women's marriage, the OLS estimate with the fixed effect model of Charles and Luoh (2010) suggests that a 1 pp increase in the male incarceration rate increases women's likelihood of being never married by 1.1 pp (for women of all education levels). Their OLS estimate with the first difference model is much smaller than the OLS estimate with the fixed effect model, and their 2SLS estimate with the first difference model is similar to the OLS estimate with the fixed effect model. Mechoulan (2011) does not find a statistically significant impact on women's marriage. My OLS results are similar to that of Charles and Luoh (2010): I find that a 1 pp increase in the incarceration rate of black men increases the likelihood of being never married by 1.1 pp (0.45 pp) for black women at the state level (MSA level).[73] Differences between my state-level and MSA-level OLS estimates can be driven by measurement error. Nevertheless, the OLS estimates are considerably smaller than my 2SLS estimates (Table 4 and Table 6).

In terms of the impact on women's employment, Charles and Luoh (2010) find that a 1 pp increase in the male incarceration rate increases women's likelihood of being employed by 0.6 pp with the fixed effect model, 0.4 pp with the first difference model, and 0.3 pp with the first difference model and instrument. My OLS estimates at both the state and MSA level show that a 1 pp increase in the incarceration rate of black men increases the likelihood of being employed for black women by 0.4 pp. Again, the OLS estimates are much smaller than my 2SLS estimates (Table 7). Mechoulan (2011) focuses on the impact on the likelihood of being full-time employed for black women ages 20-22. He does not find a statistically significant impact without state-specific time trend, and finds that a 1 pp increase in the incarceration rate of black men increases the likelihood of being employed for black women by 3.5 pp with state-specific time trend. Restricting my sample to black women ages 20-22, I find an impact of 0.96 pp without controlling for state-specific time trend and an impact of 1.54 pp with state-specific time trend. In general, my main results do not change with or

[73] I perform OLS regressions with state-level incarceration rates to compare with the literature. The results are not presented in the paper.

without including state-specific time trends (Table A12).

A2 National Corrections Reporting Program

A2.1 Data Description

The National Corrections Reporting Program (NCRP) data are restricted-access data from the Bureau of Justice Statistics. They provide detailed information on persons admitted to prison or released from prison from 1983 to 2009. Since 2004, some states also started to provide information on inmates in custody at year end. These different types of records are reported in different data files for each year, including the Admissions Data, the Releases Data, and the Yearend Population Data.

The NCRP data include all the inmates who were sentenced to State or Federal prison. Those who were sentenced to State prison but were serving time in local jails or other facilities such as hospitals were also included in the sample. The data provide the state of custody, the state of jurisdiction, and the county where a person was sentenced.

The NCRP data provide detailed individual demographic information in all the records, including the date of birth, gender, race, Hispanic origin, and educational attainment. Since my analysis mainly focuses on the incarceration of the black male, I need a clear definition of race. The Uniform Crime Reports (UCR) arrest data report arrests by race (White, Black, Indian, and Asian) and by Hispanic origin (Hispanic and non-Hispanic) separately, without an interaction between race and Hispanic origin (such as non-Hispanic Black). Therefore, to be consistent with the UCR, I consider black inmates to be those whose race is Black, regardless of the Hispanic origin. It should be noted that before 1999, more than 60% of prisoners with Hispanic origin reported their race as White and more than 36% had their race missing. Since 1999, the NCRP introduced an additional race category, Other. Since then, more than 56% of prisoners with Hispanic origin reported their race as Other, and around 23% reported as White and another 20% had missing race information. Therefore, to be consistent over time, I treat all the prisoners with Hispanic origin as White, unless

they explicitly reported their race[74].

The NCRP data provide detailed categories for offenses. To estimate the probability of being admitted to prison conditional on being arrested, I collapse the offenses into 20 broader categories to be consistent with the UCR arrest data, including murder and manslaughter, forcible rape, robbery, aggravated assault, other assaults, other sex offenses (not forcible or prostitution), burglary, larceny theft, motor vehicle theft, arson, white collar crimes (including forgery, fraud, embezzlement, stolen property possession), vandalism, weapon crimes, commercialized vice (including prostitution and gambling), drug sale or manufacture, drug possession, offenses against family and children, driving under the influence, liquor laws, and drunkenness/ disorderly conduct/ vagrancy. However, I use much more detailed categories of offenses when I estimate the average length of time served in prison so that it is more likely to capture changes in punitiveness of sentencing policies instead of changes in severity of crimes.

A2.2 Data Cleansing

To estimate the year-end prison population before 2004 at the level of metropolitan statistical area (MSA), I have to obtain the year-end prison population in 2004 or afterward and yearly admissions and releases at the MSA level. Table A1 shows states that have the NCRP Yearend Population Data for at least one year between 2004 and 2009. The year-end prison population before 2004 can be ONLY estimated for these states.

For each year and MSA where sentence was imposed, I calculate the number of offenders admitted to prison and released from prison by race and gender. However, some states did not report admissions or releases for some years. In addition, for each year of admission t, I calculate the total number of prisoners released after t who were admitted to prison in year t using the release records. In principle, the total number of prisoners released for a specific year of admission should be no greater than the number of prisoners admitted in that year calculated using the admission records. However, this is not the case for some states, in particular in the early years. This is probably because the data quality is relatively lower in the early years of the program and states are likely to have under-reporting of admissions

[74]This definition is consistent with Neal and Rick (2016).

and releases in the early years. The under-reporting of admissions from the early years, however, can be reflected from the release records of later years. I follow the following procedures to clean the records by imputing some missing records or records with evidence of under-reporting.

1. Some states did not report regularly and some states reported unreasonably small numbers of admissions and releases in the early years of the program. Therefore, I delete the missing and unreliable records of the early years for each state. Table A1 column 3 shows the time periods during which the admission and release records were regularly submitted for each state.

2. For some states, the admission and release records are missing for a few years. I imput the missing records using records of the two closest years, assuming equal increments.

3. For some states and some year t, the total number of released prisoners who were admitted to prisoner in year t is greater than the number of prisoners admitted to prison in year t. This shows that the state is likely to have the issue of under-reporting in year t. I calculate a rate of under-reporting for admissions based on the total number of released prisoners who were admitted to prisoner in year t, which should be a lower bound for the number of admissions in year t. Assuming that the rate of under-reporting is the same for admissions and releases, I modify the number of prisoners admitted to prison in year t and the number of prisoners released from prison in year t based on the rate of under-reporting.

I calculate the year-end prison population before 2004 using the modified admission and release records, as well as the reported year-end prison population in 2004 or afterward.

A2.3 Perpetual Inventory Method

I use the perpetual inventory method to estimate the number of prisoners by year, MSA, race, and gender between 1986 and 2009. Let I_{mt}^{rs} be the number of persons incarcerated of race r and sex s, sentenced from MSA m at year end t. Let A_{mt}^{rs} and R_{mt}^{rs} be the number of persons admitted to prison and released from prison, of race r and sex s, sentenced from

MSA m in year t, respectively. In particular, I assume that if a person was sentence in MSA m, then he or she will return the MSA after being released. A^{rs}_{mt} and R^{rs}_{mt} can be calculated with the Admissions Data and the Releases Data from the NCRP. The change in the number of persons incarcerated between year end t and year end $t-1$ is

$$\Delta I^{rs}_{mt} = A^{rs}_{mt} - R^{rs}_{mt}.$$

Therefore, I can retrieve the number of persons incarcerated at year end using the number of persons in custody at year end 2004 or afterward, and yearly changes in the number of persons incarcerated:

$$\begin{aligned} I^{rs}_{m,2008} &= I^{rs}_{m,2009} - \Delta I^{rs}_{m,2009} \\ I^{rs}_{m,2007} &= I^{rs}_{m,2008} - \Delta I^{rs}_{m,2008} \\ &..... \\ I^{rs}_{m,1983} &= I^{rs}_{m,1984} - \Delta I^{rs}_{m,1984}, \end{aligned}$$

where $I^{rs}_{mt}, t \in \{2004, ..., 2009\}$ and $\Delta I^{rs}_{mt}, t \in \{1983, ..., 2009\}$ can be estimated from the NCRP data directly.

Prison population is estimated using all observations of black male offenders greater or equal to 18 years old from the NCRP. I do not furthermore restrict ages for estimation for three reasons: (1) limiting ages may introduce more errors – missing or wrong reports for the year of birth variable may lead to loss of observations or inaccurate estimation; (2) public-data on prisoners don't have information on the number of prisoners by year, state and age group, so I can't compare my estimates with reports from aggregated public-available data; and (3) I rely on flows of prisoners to back out the year-end prison population, which makes it hard to estimate the year-end population of a specific age group.

A3 More Details on Measurement

A3.1 Incarceration Rate of Single Black Men

The incarceration rate of single black men for each year t and MSA of sentence m is estimated as follows:

$$\text{Frac. of } \textit{single} \text{ black men in prison} = \frac{\text{\# of single black men in prison}}{\text{resident pop. of single black men ages 20-54}}. \quad (8)$$

The numerator is estimated by multiplying the number of black men who are in prison in year t sentenced from MSA m, and the share of black male inmates ages 20-54 who are single (estimated from the SISCF and ACS). The SISCF (ACS) provides age, gender, race, and marital status of individuals in state prisons (institutions), which allow me to estimate the share of black men ages 20-54 in state prisons (institutions) who are single (i.e. never married, divorced, or widowed). Unfortunately, the SISCF only provides the region (not state) where an inmate was interviewed. Therefore, the single rate is estimated at the region level from the SISCF and at the state level from the ACS.[75] Moreover, I cannot estimate the single rate for each year between 1986 and 2009, with data available for 1986, 1991, 1997, 2004, and 2006-2009 only. Therefore, I approximate the single rate in each year with the number in the closest available year. The denominator is estimated by multiplying the resident population of black men ages 20-54 and the share of black men ages 20-54 who are single (estimated from the household data by year and state).[76]

A3.2 Probability of Incarceration Given Arrest

One key variable used to construct the simulated IV is the probability of incarceration given arrest, $\gamma^c_{s(m)t}$. I estimate $\gamma^c_{s(m)t}$ using the number of black adults admitted to prison (from the NCRP) divided by the number of black adults arrested (from the UCR) for each category of offense, state, and year. First, although the NCRP data provide detailed categories of

[75] Although the ACS provides the MSA of residence, the single rate is estimated at the state level using the ACS. This is because the MSA only reflects where state prisons are located, and does not reflect where prisoners come from. Therefore, exploiting variation across MSAs is not informative.

[76] Although household data provide the MSA of residence, the single rate is estimated at the state level. This is because the sample size of black men ages 20-54 is very small in many MSAs, which leads to large measurement error.

offenses, the UCR arrest data only provide 43 categories of offenses. Therefore, I collapse the offenses in each data source into 20 broader categories that can be matched with each other. Since both datasets have reporting errors, employing broader categories can mitigate the problem of measurement error in the matching process. In addition, although the UCR data provide the county where a police agency locates, I estimate the variable $\gamma^c_{s(m)t}$ at the state level instead of at the MSA level for two reasons. First, the UCR relies on the reports of participating law enforcement agencies, so missing reports from some law enforcement agencies can have a big impact on the number of arrests of a county or a MSA. Second, the number of arrests at the MSA level is not an accurate measurement of the MSA's crime activities, since it is likely for offenders to commit crimes and get arrested at different places. Finally, the UCR data do not provide the number of arrests by race and gender directly; they only provide the number of arrests by race and by gender separately. Therefore, I use $\gamma^c_{s(m)t}$ for black adults as an approximate of that for black male adults. Estimating the number of arrested black men using the number of arrested black adults, adjusted by the share of male arrests among the adult arrests of all races do not change the results.

A3.3 Variables for the Analysis in Section 6.6

Chetty et al. (2018) characterize the mean income ranks of children who grow up in CZ c conditional on their parents' ranks by regressing the children's individual income ranks when they are between the ages of 31 and 37 ($y_{i,c}$) on their parents' income ranks ($y_{i,p}$):

$$y_{i,c} = \alpha^c_{rs} + \beta^c_{rs} y_{i,p} + \epsilon_i,$$

weighing by the number of years that child i is observed below age 23 in CZ c. Therefore, the mean individual income rank of children of race r ($r = b, w$) sex s ($s = m, f$) who grow up in CZ c with parents at the pth percentile of the national household income distribution is given by

$$\bar{y}^{crs}_p = \alpha^c_{rs} + \frac{p}{100}\beta^c_{rs}. \tag{9}$$

They provide statistics on $\bar{y}^{crs}_{25}$ and $\bar{y}^{crs}_{75}$ on the Equality of Opportunity Project website.[77]

[77] Link: http://www.equality-of-opportunity.org/data/. Online Data Table 4 of Chetty et al. (2018).

To merge with $\bar{y}_{25}^{crs}$ and $\bar{y}_{75}^{crs}$, I re-construct the measure of punitiveness of sentencing policies at the CZ level (I_{ct}^{*}) according to equation (5):

$$I_{ct}^{*} = \sum_{crime=1}^{N} \gamma_{s(c)t}^{crime} + \sum_{crime=1}^{N} \sum_{j=1}^{t-1} \gamma_{s(c)j}^{c} \mathbb{1}\{\bar{S}_{-cj}^{crime} > t - j\}.^{78}$$

Since Chetty et al. (2018) only provide $\bar{y}_{25}^{crs}$ and $\bar{y}_{75}^{crs}$ across CZs, not over time, I measure the mean punitiveness of sentencing policies of each CZ where children in their sample grow up with $\sum_{t=1986}^{2001} I_{ct}^{*}$, weighting by the CZ black population below age 25. Using the average between 1986 and 2001 is because the sample of Chetty et al. (2018) consists of all children in the 1978-83 birth cohorts, and $\bar{y}_{p}^{crs}$ is constructed by assigning children to CZs in proportion to years they spend below age 23 in each CZ. Since the NCRP data on admissions and releases are either unavailable or unreliable before 1986, I start with the year of 1986 in the construction. Moreover, using the average of I_{ct}^{*} between 1986 and 2001 (when the 1978 cohort gets age 22) or the average of I_{ct}^{*} between 1986 and 2005 (when the 1983 cohort gets age 22) does not affect the results. The weight is the CZ black population below age 25 since the Census U.S. Intercensal County Population Data only provide population by age group of 5 years. At last, I standardize the measure so that the mean is zero and the standard deviation is one across CZs (weighting by the CZ population), denoted by I_{c}^{*}, with higher values representing harsher sentencing policies.

A4 Additional Results

A4.1 Heterogeneous Effects and Potential Mechanisms

To examine the potential mechanisms behind my results, I explore heterogeneity in the treatment effects across observable characteristics of women and conduct additional analyses.

First, I estimate differential effects of black male incarceration on black women of different levels of education and age groups (Table A4). Panel A shows that the impact of black male incarceration on the likelihood of marriage is larger for women of older cohorts among those with some college education (Column 2), and larger for women of younger cohorts among

[78] I re-label m (MSA) with c (CZ), and c (crime) with $crime$ to avoid ambiguity.

those without any college education (Column 3). Since generally college-educated people are more likely to marry at older ages compared with their counterparts with fewer years of education (Aughinbaugh et al., 2013), more educated black women are likely to make marriage decisions at older ages, and therefore male incarceration could have a larger impact for the older cohorts. Panel B shows that, among black women with at least some college education, black male incarceration has a substantial impact on the likelihood of being employed for the younger cohorts. Nevertheless, the impact for black women without any college education is small and statistically insignificant. It is possible that more educated black women would like to start working at younger ages when facing a worse marriage market condition as an insurance of lack of promising marriage partners in the future or as an outside option of staying single.

Second, I estimate differential effects of black male incarceration on the likelihood of being employed for women of different types of marital status and education levels (Table A5). It should be noted that the results could be biased since I divide the sample based on marital status, which is endogenous. Nevertheless, the results may shed light on potential mechanisms. Columns 1-2 show that, among black women who were never married, there is a large effect of black male incarceration on the employment of more educated black women. This is consistent with the hypothesis that single black women with relatively higher education levels could be more likely to work when facing a worse marriage market condition as an insurance of lack of marriage partners or as an outside option of staying single. Columns 3-4 show that, among black women who were currently married with husbands present, there is a large effect of black male incarceration on their employment (although not statistically significant), in particular for those without any college education. It is possible that less educated married women are more likely to work because of declining bargaining power in the household. Moreover, for less educated black women, their husbands are also more likely to be former inmates than husbands of more educated black women. Therefore, they may be more likely to work in order to support the family given that employers are reluctant to hire people with a criminal record (Pager, 2003). Finally, Columns 5-6 show that, among black women who were currently married with husbands absent, the impact of black male incarceration is substantial on the employment for both more educated and less educated

black women. It is possible that absence of husbands, in particular for less educated black women, is due to incarceration. And therefore, black women are more likely to work to support themselves and the family.

Third, I estimate effects of black male incarceration on black *men*'s marriage and labor market outcomes (Table A6). Panel A shows that, for black men with some college education, higher black male incarceration rates lower their likelihood of being married (Column 1) and increase their likelihood of having a white wife (Column 2). The results could be partially due to higher bargaining power of men, in particular those with higher levels of education, in the marriage market. They may be less willing to commit to marriage given the prevalence of non-monogamous relationships in black communities (Banks, 2011). Marrying white women could be another consequence of higher bargaining power based on the exchange theory (Kalmijn, 1998). Nevertheless, there is no effect on their likelihood of being employed (Column 3). Panel B shows that, for black men without any college education, higher black male incarceration rates lower their likelihood of being married (Column 1) and being employed (Column 3). Higher incarceration rates indicate higher prevalence of incarceration, which means that black men with lower levels of education are more likely to be former inmates or face higher risks of incarceration at some point of time in their life. This can make them less attractive both as potential marriage partners and as potential employees.

These results suggest that higher employment rates and higher income from welfare programs for black women could be due to imprisonment of boyfriends, husbands, or other male family members, which results in less financial support to black women. Additionally, the poor marriage market condition and the difficulty of employment faced by less educated black men may also lead to changes in single black women's marriage perspectives, and therefore lower the likelihood of marriage and increase the likelihood of employment, in particular for those with higher education levels and better outside options.

A4.2 Robustness Tests

I conduct six sets of robustness tests. First, I construct alternative simulated instruments using drug offenses only, and conduct analysis with standard errors clustered at the state level. Second, I consider alternative independent variables, including the incarceration rate

of black men ages 20-39, the incarceration rate of single black men ages 20-54, and the sex ratio of black adults ages 20-34 without 4-year college education. Third, I restrict the sample to states where black population are less concentrated toward specific MSAs. Fourth, I provide evidence that the results are not likely to be driven by pre-trends. Fifth, I conduct a placebo test of the impact of black male incarceration on white women and children. Sixth, I consider alternative ways to restrict the sample based on the size of MSA black population.

In the first set of robustness checks, I address two concerns. First, harsher sentencing policies could affect women directly. Second, the incarceration rates may affect sentencing outcomes due to pressure of prison overcrowding. To investigate these possibilities, I construct a simulated IV using drug offenses for two reasons. First, drug-related sentencing policies can be more salient to the black communities than other sentencing laws, since the War on Drugs has affected the black population disproportionately. Second, drug offenses are more likely to be affected by federal laws. Suppose women are directly influenced by law changes, then women of different areas should be affected similarly despite facing different incarceration rates of black men, because federal laws apply to all the states. In addition, offenders sentenced from state s under federal laws will be sent to federal prisons, which are likely to locate in other states. Thus, sentencing outcomes of offenders sentenced from state s should not be affected by the state's own prison population. When constructing this simulated IV, I include initial arrest levels of different types of drug offenses for each state to exploit different impacts of federal laws across states due to different crime compositions. For instance, the same drug law can lead to very different consequences in a state that is dominated by drug trafficking compared with another state that is dominated by drug possession

Table A7 shows the results with the baseline IV (Panel A) and the IV constructed with drug offenses only (Panel B). As an additional robustness check, standard errors are clustered at the state level because it is a more conservative way of estimating standard errors. In order to exploit impacts of federal laws, it is also reasonable to assume correlation between MSAs within each state. First, Panel A shows that standard errors do not change significantly when clustered at the state level compared with those clustered at the MSA level (Table 11 Panel A). Second, Panel B shows that the estimates of the impacts of black male incarceration on

women and children are comparable with the baseline results (Panel A). Using the simulated IV constructed with drug offenses loses substantial power in the first stage, which may lead to higher standard errors of the estimates in Panel B. In particular, the impact on the likelihood of being married for women with some college (Panel B Column 1) becomes larger and the impact for women without any college becomes smaller (Panel B Column 2). There is a large impact on the likelihood of being employed for women of both groups of education (Panel B Columns 3-4). These results can be driven by the fact that drug-related sentencing policy changes are more likely to affect incarceration at the extensive margin (Figure 5 Panel C). The results for women shown in Panel B are comparable with the impacts of black male incarceration at the extensive margin (Table 11 Panel B), although the results for children are relatively smaller.

As a second set of robustness checks, I consider alternative measures of the incarceration rate (Table A8). In the baseline analysis, I use the incarceration rate of black men ages 20-54 because more than 90% of black male inmates in state or federal prisons and local jails were between 20 and 54 years old.[79] In Panel B, I use the incarceration rate of black men ages 20-39, because young black men are more likely to be potential marriage partners and on average 70% of black male inmates in state or federal prisons and local jails were between 20 and 39 years old.[80] In Panel C, I use the incarceration rate of *single* black men between 20 and 54 years old, because single men are more related to the marriage market and on average 80% of black male inmates are single.[81] In Panel D, I use the sex ratio of black adults ages 20-34 without 4-year college education (i.e. the number of black men ages 20-34 without 4-year college over the the number of black women of the same category). Because of the big gender gap in incarceration, high incarceration rates of black men can lead to unbalanced sex ratios, in particular among those who are relative younger and less educated. The sex ratio can be a good measurement of the relative supply of spouses in the marriage market.

Table A8 shows that results in Panels B and C are smaller in magnitude than baseline

[79] Prison and Jail Inmates at Midyear 2000-2009 provide the number of inmates in state or federal prisons and local jails by gender, race, and age group at June 30 2000-2009.

[80] The incarceration rate of black men ages 20-34 is estimated by replacing the denominator of equation (1) with the resident population of black men ages 20-39.

[81] The incarceration rate of single black men is estimated with equation (8).

results in Panel A. This is because a 1 pp change in the fraction of black men (ages 20-54) in prison is corresponding to a larger change in the fraction of black men (ages 20-39) in prison or in the fraction of single black men (ages 20-54) in prison. To interpret the results of the impact of the sex ratio, take the result in Panel D Column 2 for example: for every 100 black men and 100 black women without any college education, removing 10 men from the marriage market to prison (because of harsher sentencing policies) will result in 10 women unable to marry.

In the third robustness test, I explore the possibility that big MSAs may dominate their states' policy-making. In this case, state-level sentencing policies are likely to be endogenous to the dominating MSAs, and using leave-one-out estimators to construct instruments will not address the endogeneity problem. As a robustness check, I calculate the average Herfindahl-Hirschman index (HHI) for each state across years. The HHI for each state and year is calculated by squaring the black population share of each MSA in the state and then summing the resulting numbers. The index reflects the relative black population of the MSAs in a state: it is small if a state consists of many MSAs of relatively equal sizes of black population and reaches the maximum of 10,000 if a single MSA contains all the black population of a state. In my sample, the HHI ranges from 1595 in Florida to 9034 in Maryland, with the mean of 4000. I restrict the sample to states with an average HHI smaller than 3500, including Arkansas, California, Florida, Louisiana, North Carolina, Oklahoman, South Carolina, Tennessee, Texas, and Virginia. In these states, the exclusion restriction is more likely to be satisfied since it is less likely that dominating MSAs affect state-level policy changes.

Table A9 Panel B shows that the impacts of black male incarceration on both black women and children become larger when restricting the sample to states where black population are less concentrated towards specific MSAs. Since in these states the exclusion restriction of the IV strategy is more likely to be satisfied, larger impacts in the restricted sample in Panel B suggest that the baseline results obtained with the unrestricted sample in Panel A are less likely to be due to omitted variable bias.

As a fourth set of robustness tests, I check whether the results are likely to be driven by unobserved confounds that may be related to both women and children's outcomes and

sentencing policy changes. I particular, I conduct four sets of analysis. First, I perform the first-stage regression and the reduced-form regressions, controlling for lags and leads of the simulate IV:

$$IR_{mt} = \alpha + \sum_{k=-3}^{3} \lambda_k SI_{m,t+k} + X_{imt}\pi + \theta_t + \mu_m + v_{imt}, \text{ and}$$

$$y_{imt} = \alpha + \sum_{k=-3}^{3} \lambda_k SI_{m,t+k} + X_{imt}\pi + \theta_t + \mu_m + v_{imt},$$

where variables are defined in the same way as those in equation (7) and equation (2). If changes in sentencing policies are affected by pre-trend, then changes in the current incarceration rate or other outcomes of interest should be able to predict future policy changes. Nevertheless, Table A10 shows that the F-tests fail to reject the null that the leading coefficients are jointly equal to zero (with p-values reported in the last row), so presence of pre-trend is less likely to be a concern. The standard errors of the coefficients are large after controlling for lags and leads of the instrument, which is likely to be driven by serial correlation. Second, I regress some potential confounds that may be related to sentencing policy changes, including the share of black population, the violent crime rate, and the property crime rate, on the simulated IV. Table A11 shows that none of these variables has a statistically significant correlation with the simulated IV. Third, I control for state-specific time trends to capture trends in potential socioeconomic or political factors within states. Table A12 Panel B shows that results do not change with state time trends. Fourth, I consider an identification strategy proposed by Freyaldenhoven et al. (2018). Factors associated with crimes are likely to be confounds that may be related to both women and children's outcomes and sentencing policy changes. Women may be less likely to marry if men are more likely to be involved in some criminal activity. At the same time, states may be more likely to introduce punitive sentencing policies if crime rates or public concerns about crimes reach some level. According to the strategy proposed by Freyaldenhoven et al. (2018), I estimate the following equation:

$$y_{imt} = \beta_0 + \beta_1 IR_{mt} + \beta_2 Crime_{s(m)t} + X_{imt}\pi + \theta_t + \mu_m + v_{imt},$$

instrumenting for the incarceration rate of black men (IR_{mt}) with the simulated IV (SI_{mt})

and instrumenting for the state violent crime rate ($Crime_{s(m)t}$) with a lead of the simulated IV ($SI_{m,t+3}$). Table A12 Panel C shows that most results do not change significantly, and the result on the likelihood of marriage for black women without any college education (Column 2) and the result on the likelihood of employment for black women with at least some college (Column 3) become larger. The results suggest that most findings are not likely to be driven by confounding factors.

Fifth, I conduct a placebo test to check whether the black male incarceration rates affect white women and children's outcomes. Results in Table A13 show that the estimates either have large standard errors or the opposite sign. This indicates that the effects of the black male incarceration rates on black women and children are not likely to be driven by some other MSA and year specific factors such as economic shocks, which should be faced by both blacks and whites.

Sixth, I explore whether restricting the sample differently based on the size of MSA black population affect the results. Figure A2 shows the distribution of black population ages 20-34, with the top 10 percent trimmed (the 90th percentile population is 92802). The size of the bin is 1,000. The distribution has a large mass within 2,000, followed by 2,000-14,000. Therefore, in the baseline specification for the impact of black male incarceration on black women, I restrict the sample to MSAs where the population of black men ages 20-34 is greater than 1,000 and the population of black women ages 20-34 is greater than 1,000 (Table A14 Panel A). I also show the results where the sample includes all MSAs (Table A14 Panel B). Figure A3 shows the relationship between the incarceration rate of black men and the size of black population (with the top 10 percent trimmed). Both the mean and standard deviation are larger in MSAs with smaller black population. In particular, only MSAs with relatively small black population have incarceration rates greater than 0.2. It is possible that the measurement error is big for MSAs with small black population because fewer people were admitted to prison. Therefore, I also show the results where the sample is restricted to MSAs where the incarceration rate of black men is smaller than 0.2 (Table A14 Panel C). Results in Table A14 suggest that restricting the sample in different ways does not have a big impact on the results.

A5 A Three-Period Model

In order to interpret the results in a more economically-grounded way, I develop a simple three-period model. In the model, women make marriage and consumption decisions given their marriage market conditions, which differ by the incarceration rate of men. In particular, the model focuses primarily on the decision process of women, with the trade-off between the likelihood of meeting a potential marriage partner and the risk of incarceration faced by a potential marriage partner. To avoid the complications associated with searching and matching process in the marriage market and given the emphasis on female marriage decisions, I do not model the choice of men and each (potential) husband is characterized by his income (Van der Klaauw, 1996). As a result, the model does not capture the effects of the male incarceration rate on the bargaining power and the share of marital surplus between husbands and wives. To further simplify, I assume that all (potential) husbands have the same income, so the model does not capture the feature of assortative mating in the marriage market. Since marriage is less assortative among black couples than among white couples, and black women with higher levels of education are more likely to "marry down" in terms of education than white women (Rodrigue and Reeves, 2015), the assumption is reasonable when considering black marriage.

The model has three periods, and in the model, women can meet potential marriage partners only in period 1 and 2. At the start of period 1, a single woman meet a men with probability $1 - p_1$, where p_1 is an increasing function of the current male incarceration rate (δ_1). If she meets a man, she chooses whether or not to marry. On the one hand, if she chooses not to marry now, she faces the risk of not being able to meet a potential husband in the next period. On the other hand, if she chooses to marry now, she can enjoy financial support from the husband now, but takes the risk that her husband could be incarcerated in the future and she would incur a big cost from social stigma or process of divorce (K). Specifically, her expected probability of not meeting a potential husband in the next period is p_2[82], and her expected probability that her husband would be incarcerated before the start

[82]The expected probability of not meeting a marriage partner is not necessarily equal to the actual probability of not meeting a husband. However, the expected utility from getting married or staying single and marriage decisions only depend on the expectations instead of the actual probabilities. Therefore, I do not distinguish notations of expected and actual probabilities: Both the expected and actual probabilities of not

of period 2 is q_2, which is a function that increases with the current incarceration rate and decreases with her (potential) husband's income. For simplicity, I make two assumptions. The first simplifying assumption is that the uncertainty of a (potential) husband's income only comes from incarceration: if a man is incarcerated or has a criminal record, he has zero income; otherwise, he has income y. The second assumption is that there is no uncertainty in the incarceration rate: $\delta_1 = \delta_2 = \delta_3 = \delta$. In other words, women form beliefs about the likelihood of meeting a man and the likelihood that a man will be incarcerated based on the observed incarceration rate and do not predict changes of incarceration rates in the future.

At the start of period 2, if a woman is single, she can still meet a man with probability $1 - p_2$. However, if she does not meet a man or chooses to remain single, she will not have a chance to meet a man in the last period and has to stay single in period 3 as well. If a woman married at the beginning of period 1 and her husband was not incarcerated afterward, or decides to marry now at the beginning of period 2, she can enjoy financial support from her husband now, but still expects that her husband can be incarcerated in the future with probability q_3. If a woman married at the beginning of period 1, but her husband was incarcerated afterward, now she suffers from a cost K and can no longer enjoy her husband's financial from now on, given that it is hard for former inmates to get employed.

In period 3, women do not have chances to meet a marriage partner any more. Therefore, single women stay single; married women with husbands incarcerated or ever incarcerated suffer from a cost K and cannot enjoy financial support from husbands; married women with husbands never incarcerated can enjoy financial support from their husbands.

A5.1 Preferences

Each woman derives utility from the current consumption c. Preferences are separable across periods. The within-period utility takes the form

$$u(c_t) = -e^{-c_t},$$

where $t = 1, 2, 3$.

meeting a marriage partner in period t are denoted by p_t and both the expected and actual probabilities that a man will be incarcerated during period t are denoted by q_t, $t = 1, 2, 3$.

A5.2 Budget Constraints

The budget constraint for single women in period 1 and 2, and the budget constraint for women whose husbands have been incarcerated in period 2 take the following form:

$$\frac{A_{t+1}}{1+r} + c_t \leq A_t,$$

and the budget constraint for married women whose husbands have never been incarcerated in period 1 and 2 is

$$\frac{A_{t+1}}{1+r} + c_t \leq A_t + y,$$

where r is the market rate of return and y is husband's income or a fixed part of husband's income that is transferred to wife. For simplicity, I assume that all husbands transfer a fixed share of their income to their wives, without any bargaining process.

In period 3, the budget constraint for single women and married women whose husbands were or have been incarcerated is

$$c_3 \leq A_3,$$

and the budget constraint for married women whose husbands are present without any criminal record is

$$c_3 \leq A_3 + y.$$

A5.3 Problem of the Single

I start by characterizing the value of being single. Assume that the marriage decision is made at the beginning of period 1 and 2. In this subsection, I describe the consumption choice conditional on that an individual has made the marriage decision.

The state variable for single women is the level of asset A_t, and state variables for married women are A_t and $\tilde{y}$, where $\tilde{y} = y$ if husbands are not incarcerated and do not have criminal records, and $\tilde{y} = 0$ otherwise. I assume that the incarceration rate (δ) and husband's income if not incarcerated (y) are constants. The choice variable is the consumption c_t. Let $V_t^s(A_t)$ be the discounted expected utility of single women at the beginning of period t. Define $V_t^m(A_t, \tilde{y})$ analogously for married women.

In period 1, the value of being single is

$$V_1^s(A_1) = \max_{c_1}\Big\{u(c_1) + \beta\big[(1-p_2)\max\big(V_2^m(A_2,y), V_2^s(A_2)\big) + p_2 V_2^s(A_2)\big]\Big\} \quad (10)$$
$$\text{s.t. } \frac{A_2}{1+r} + c_1 \leq A_1,$$

where $p_2 = f(\delta)$ and $f'(\delta) > 0$. The value of being single in period 2 is

$$V_2^s(A_2) = \max_{c_2}\big\{u(c_2) + \beta V_3^s(A_2)\big\} \quad (11)$$
$$\text{s.t. } \frac{A_3}{1+r} + c_2 \leq A_2,$$

because there is no chance to meet a potential marriage partner in period 3. In period 3, the value of being single is

$$V_3^s(A_3) = \max_{c_3}\big\{u(c_3)\big\} \quad (12)$$
$$\text{s.t. } c_3 \leq A_3.$$

A5.4 Problem of the Married

Now, I describe the consumption choice of a married women conditional on the decision to marry at the start period 1 or period 2. Assume that the income transfer from husbands to wives takes place immediately after the marriage decision. Suppose a woman decides to marry at the start of period 1 and later her husband is incarcerated during the period, she can still obtain income y at the beginning of period 1, but she cannot obtain y at the beginning of period 2.

The value of being married in period 1 is

$$V_1^m(A_1, \tilde{y}) = \max_{c_1}\big\{u(c_1) + \beta[(1-q_2)V_2^m(A_2,y) + q_2 V_2^m(A_2,0)]\big\} \quad (13)$$
$$\text{s.t. } \frac{A_2}{1+r} + c_1 \leq A_1 + y,$$

where $q_2 = g(\delta, y)$, $\frac{\partial g(\delta,y)}{\partial \delta} > 0$, and $\frac{\partial g(\delta,y)}{\partial y} < 0$. In period 2, for women who married at the beginning of period 1 and their husbands were not incarcerated afterward, and for single women who meet a man at the beginning of period 2 and decide to marry, the value of being

married is

$$V_2^m(A_2, \tilde{y}) = \max_{c_2} \{u(c_2) + \beta[(1 - q_3)V_3^m(A_3, y) + q_3 V_3^m(A_3, 0)]\} \quad (14)$$
$$\text{s.t. } \frac{A_3}{1+r} + c_2 \leq A_2 + y,$$

where $q_3 = g(\delta_2, y)$. For women who married at the beginning of period 1, but their husbands were incarcerated later, the value of being married in period 2 is

$$V_2^m(A_2, 0) = \max_{c_2} \{u(c_2) - K + \beta V_3^m(A_3, 0)\} \quad (15)$$
$$\text{s.t. } \frac{A_3}{1+r} + c_2 \leq A_2,$$

where K is a fixed cost of having a husband (ever) incarcerated. Finally in period 3, for women who married at the beginning of period 1 or 2, and their husbands were never incarcerated, the value of being married is

$$V_3^m(A_3, y) = \max_{c_3} \{u(c_3)\} \quad (16)$$
$$\text{s.t. } c_3 \leq A_3 + y.$$

For women whose husbands were ever incarcerated, the value of being married is

$$V_3^m(A_3, 0) = \max_{c_3} \{u(c_3) - K\} \quad (17)$$
$$\text{s.t. } c_3 \leq A_3.$$

A5.5 Marriage Decisions

If a single woman meets a man at the beginning of period 1 or 2, her decision of whether or not to marry is

$$M_t(A_t, \tilde{y}) = 1\{V_t^m(A_t, \tilde{y}) > V_t^s(A_t)\}, t = 1, 2. \quad (18)$$

A5.6 Simulation Results

I assume that the (expected) probability of not meeting a man p_t and the (expected) probability that a potential husband will be incarcerated q_t are increasing and linear functions

in the incarceration rate δ for a given level of men's income y: $p_t = a\delta$ and $q_t = b\delta$, for $t = 1, 2, 3$, and some $a, b \in (0, 1/\delta]$.

Given a, b, y, and K, I consider how the incarceration rate δ affects the expected utility of being single $V_1^s(A_1)$ and the expected utility of being married $V_1^m(A_1, \tilde{y})$ at the beginning of period 1 for women of some asset level, and how the incarceration rate δ affects the faction of women choosing to marry $M_1(A_1, \tilde{y})$ at the beginning of period 1. Intuitively, $V_1^s(A_1)$ and $V_1^m(A_1, \tilde{y})$ should be decreasing in δ, because higher incarceration rates lower the chances of meeting a potential marriage partner for single women and increase the risk that husbands will be incarcerated for married women. However, it is difficult to prove that $\frac{\partial V_1^s(A_1)}{\partial \delta} \leq 0$ and $\frac{\partial V_1^m(A_1,\tilde{y})}{\partial \delta} \leq 0$. The reason is that the incarceration rate of period 1 ($\delta_1 = \delta$) affects $V_1^s(A_1)$ (or $V_1^m(A_1, \tilde{y})$) not only through p_2 in equation (10) (or q_2 in equation (13)), but also through the values of period 2, because incarceration rates across periods are correlated ($\delta_1 = \delta_2 = \delta_3 = \delta$ in this model). If I assume that incarceration rates are independent over time, so that δ_1 affects $V_1^s(A_1)$ (or $V_1^m(A_1, \tilde{y})$) only through p_2 (or q_2), then it is straightforward to prove that $\frac{\partial V_1^s(A_1)}{\partial \delta} \leq 0$ and $\frac{\partial V_1^m(A_1,\tilde{y})}{\partial \delta} < 0$.

Proposition 1 *Assume δ_1, δ_2, and δ_3 are independent. Let $p_2 = f(\delta_1)$ and $f'(\delta_1) > 0$. Then $\frac{\partial V_1^s(A_1)}{\partial \delta_1} \leq 0$.*

Proof. Let A_2^* be the optimal value of A_2 in equation (10). According to the Envelop Theorem,

$$\frac{\partial V_1^s(A_1)}{\partial \delta_1} = \beta f'(\delta_1) \left[V_2^s(A_2^*) - \max \left(V_2^m(A_2^*, y), V_2^s(A_2^*) \right) \right].$$

If $V_2^s(A_2^*) \geq V_2^m(A_2^*, y)$, then $\frac{\partial V_1^s(A_1)}{\partial \delta_1} = 0$. If $V_2^s(A_2^*) < V_2^m(A_2^*, y)$, then $\frac{\partial V_1^s(A_1)}{\partial \delta_1} < 0$. □

Proposition 2 *Assume δ_1, δ_2, and δ_3 are independent. Let $q_2 = g(\delta_1)$ and $g'(\delta_1) > 0$. Then $\frac{\partial V_1^m(A_1,\tilde{y})}{\partial \delta_1} < 0$.*

Proof. Let A_2^* be the optimal value of A_2 in equation (13). According to the Envelop Theorem,

$$\frac{\partial V_1^m(A_1, \tilde{y})}{\partial \delta_1} = \beta g'(\delta_1) \left[V_2^m(A_2^*, 0) - V_2^m(A_2^*, y) \right].$$

For $A_2 = A_2^*$, let $A_3^{(10)}$ and $c_3^{(10)}$ be the solution of equation (14), and $A_3^{(11)}$ and $c_3^{(11)}$ be the solution of equation (15). Then

$$
\begin{aligned}
&V_2^m(A_2^*, y) - V_2^m(A_2^*, 0) \\
&= u(c_2^{(10)}) + \beta \left[(1-q_3)V_3^m(A_3^{(10)}, y) + q_3 V_3^m(A_3^{(10)}, 0)\right] - \left[u(c_2^{(11)}) - K + \beta V_3^m(A_3^{(11)}, 0)\right] \\
&\geq u(c_2^{(11)}) + \beta \left[(1-q_3)V_3^m(A_3^{(11)}, y) + q_3 V_3^m(A_3^{(11)}, 0)\right] - \left[u(c_2^{(11)}) - K + \beta V_3^m(A_3^{(11)}, 0)\right] \\
&= K + \beta(1-q_3)[V_3^m(A_3^{(11)}, y) - V_3^m(A_3^{(11)})] \\
&= K + \beta(1-q_3)[u(A_3^{(11)} + y) - u(A_3^{(11)}) + K] > 0.
\end{aligned}
$$

The first inequality holds because $A_3^{(11)}$ and $c_3^{(11)}$ are also feasible in the budget constraint of equation (14). Therefore, $\frac{\partial V_1^m(A_1, \tilde{y})}{\partial \delta_1} < 0$. □

Figure A4 shows the relationship between the expected utility of being married (single) and the incarceration rate at the beginning of period 1 for a woman of low asset level (at the 25th percentile of the asset distribution) and a woman of high asset level (at the 75th percentile of the asset distribution) by simulating the model.[83] Both the expected utility of being married and the expected utility of being single at the beginning of period 1 decrease in the incarceration rate. The expected utility of being married (single) is greater than the expected utility of being single (married) when the incarceration rate is relatively low (high).[84] This is because when the incarceration rate is relatively low, a woman expects that her husband is less likely to be incarcerated later at some point of time, and therefore the financial support from a spouse overweighs the potential risk of having a spouse incarcerated. Moreover, the threshold of the incarceration rate at which a woman is indifferent between marrying and staying single is lower for women whose initial asset level is higher. This is because for women with a higher level of asset, the gain from marriage, namely financial support from a spouse, is less attractive compared with the potential loss from having a husband incarcerated.

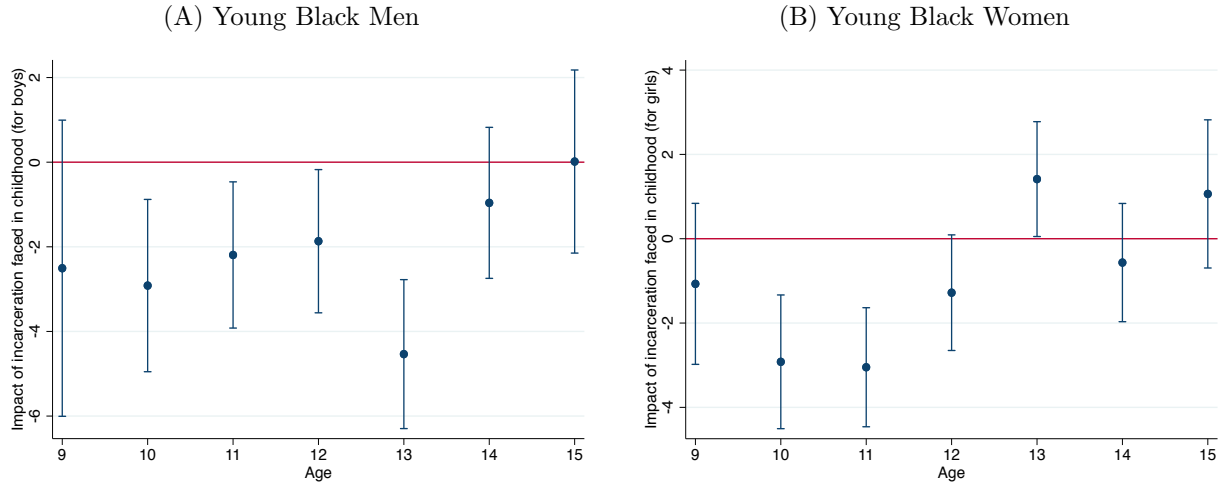
[83] Simulation parameters include $\beta = 0.98$, $r = 0.03$, A_1 drawn from a grid of equal distance points in $[0.01, 4]$, δ drawn from a grid of equal distance points in $[0.01, 0.3]$, $a = b = 1$, $y = 0.2$, and $K = 0.5$.

[84] Two curves do not necessarily intersect for $\delta \in [0.01, 0.3]$. Consider A_1 at the 50th percentile of the asset distribution. The expected utility of being married is alway greater than the expected utility of being single if the cost of having a husband incarcerated is small enough (e.g. $K < 0.15$), or the income transfer from husbands to wives is large enough (e.g. $y > 1$). On the other hand, if K is very large or y is very small, the expected utility of being single is always greater than the expected utility of being married.

Figure A5 shows the relationship between the fraction of single women of all asset levels who choose to marry in different periods and the incarceration rate. When the incarceration rate is low enough, women of all asset levels choose to marry since the risk of having potential husbands incarcerated is low, and the gain from marriage overweighs the risk. As the incarceration rate increases, a higher fraction of women will choose to stay single. According to Figure A4, women with higher asset levels are the first to opt out of marriage. In addition, fractions of single women who choose to marry at the beginning of period 1 and period 2 are (weakly) different, which implies that single women with the same asset level can make different marriage decisions under the same incarceration rate in different period. This is because at the beginning of period 2, single women face less cost of having potential husbands incarcerated. On the other hand, they also expect less chances (probability 0 in the model) of meeting potential marriage partners in the future.

The simulation evidence provides a potential explanation to the empirical result that higher incarceration rates decrease the marriage rate more for women with some college education than for women without any college education. When the incarceration rate is high enough, the risk and the associated cost of having a potential husband incarcerated can be higher than the gain from marriage, and this is more likely to be the case for women with higher levels of asset (e.g. human capital). In the model, this is because of the assumption that all men have the same income. And in reality, highly educated black women are also more likely to have husbands of lower education levels, compared with highly educated white women. However, the model does not capture the impact of male incarceration through changes in the bargaining power. In particular, the bargaining power of women with lower asset levels may decline more with higher male incarceration rates, which may lead to even lower gains from marriage for them. The simulation results also show that women in different periods (or of different ages) can make different marriage decisions under the same asset level and male incarceration rate. This is because tradeoffs that women face in different periods are different. Therefore, the empirical result should be interpreted as a weighted average effect on women of different ages.

Figure A1: Estimates of the Impact of the Black Male Incarceration Rates Faced in Early Adolescence



Note: The figures show the 2SLS estimates of β_1 in equation (3), with $IR^{child}_{(i)m}$ measured by the black male incarceration rate of MSA m when individual i was at different ages. Panel A shows estimates for young black men and Panel B shows estimates for young black women. Estimates with $IR^{child}_{(i)m}$ measured before the age of 9 are statistically insignificant for both black men and women, so they are not shown in the graphs.

Figure A2: Distribution of MSA Black Population (Ages 20-34)

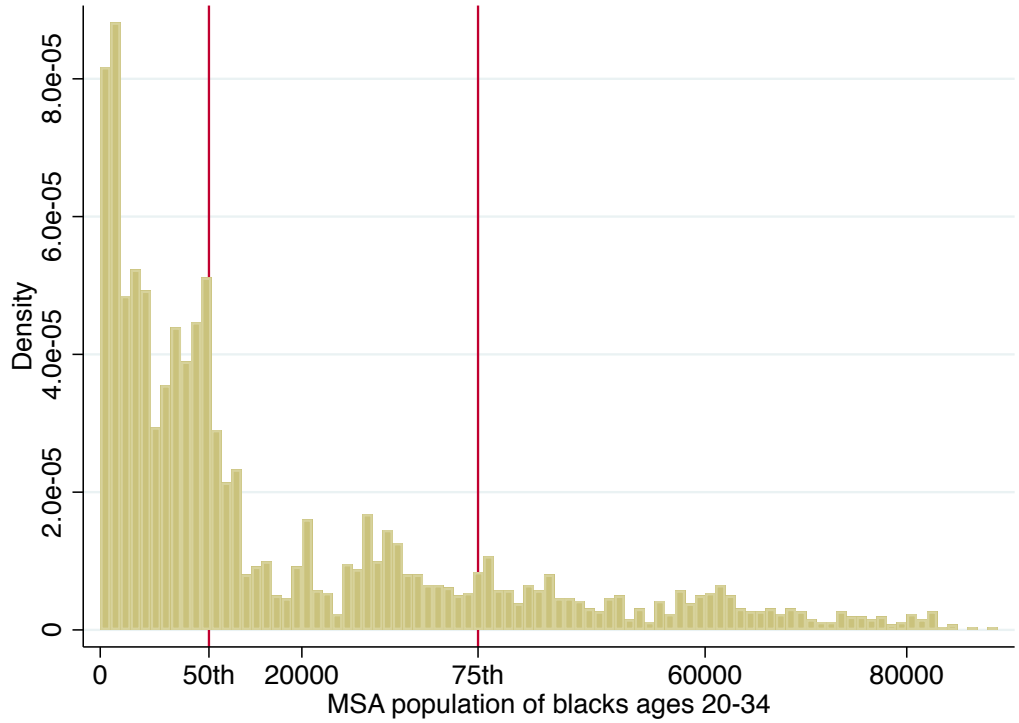


Figure A3: Black Male Incarceration Rates and MSA Black Population

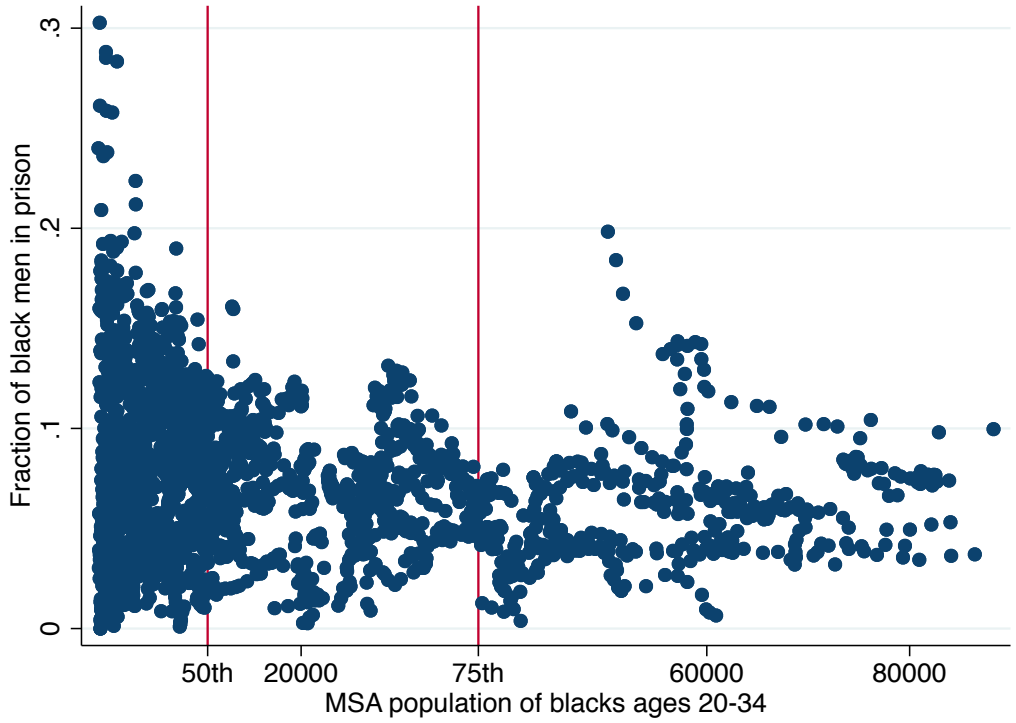
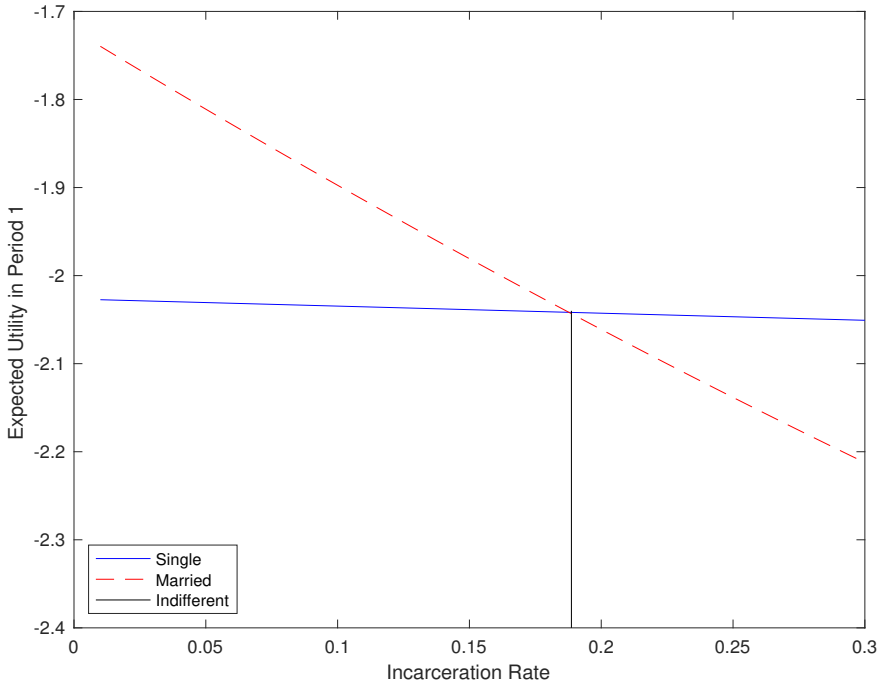


Figure A4: Expected Utility of Being Single (Married) and Incarceration Rate

(A) Low Asset Level



(B) High Asset Level

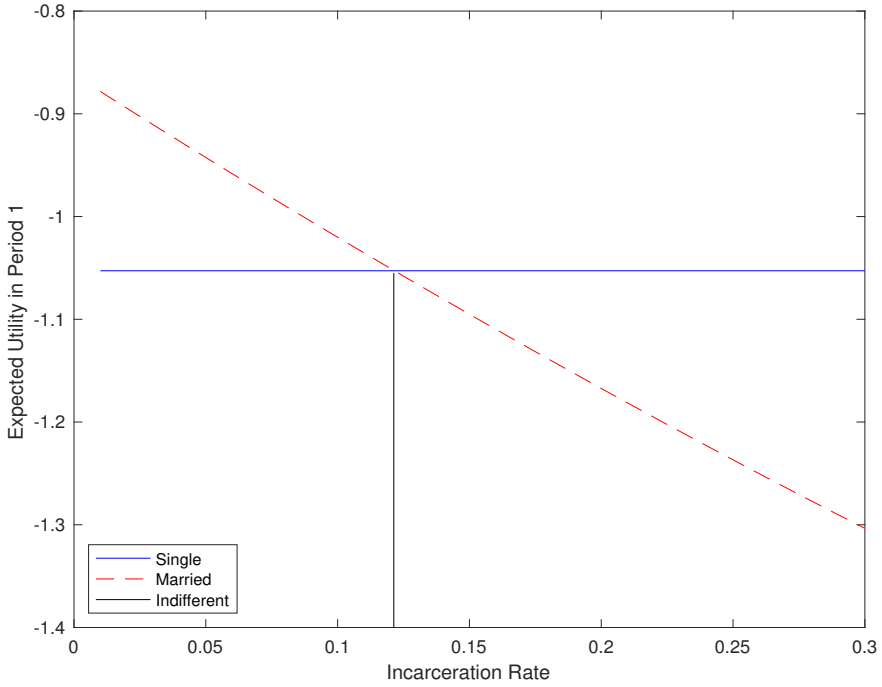


Figure A5: Marriage Rate and Incarceration Rate

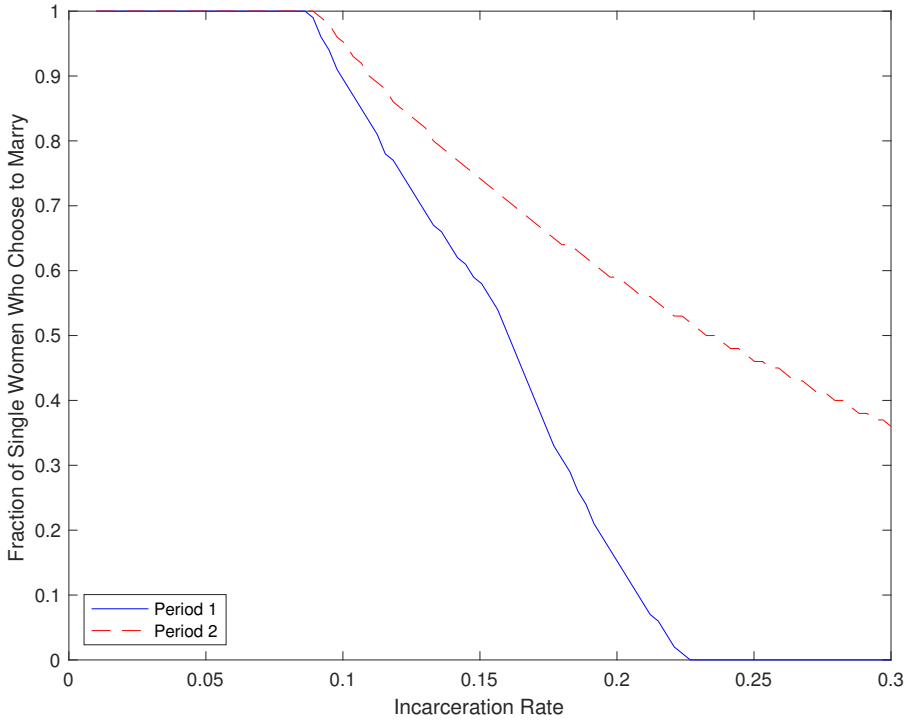


Table A1: Availability of the NCRP Data

States	Yearend Prison Population	Admissions & Releases
Arkansas	2005-2009	1989-2009
California	2004-2009	1983-2009
Colorado	2009	1985-2009
Florida	2004-2009	1995-2009
Georgia*	2004-2009	1988-2009
Louisiana	2004-2009	1992-2009
Maryland**	2004-2009	1983-2009
Michigan	2004-2006, 2008	1984-2009
Minnesota	2004-2009	1998-2009
Missouri	2004-2009	1998-2009
New Jersey	2004-2005	1984-2009
New York	2004-2009	1988-2009
North Carolina	2004-2009	2004-2009
Oklahoma	2004-2006, 2008	1986-2009
Oregon	2004-2009	1984-2009
Pennsylvania	2004-2009	1998-2009
South Carolina	2004-2009	1987-2009
Tennessee	2004-2009	1989-2009
Texas	2004-2009	1985-2009
Virginia	2009	1985-2009
Washington	2004-2009	1985-2009
Wisconsin	2004-2007	1983-2009

Note: The table only shows states that provide NCRP Yearend Prison Population Data for at least one year. Column 2 shows the years during which Yearend Prison Population Data were available. Column 2 shows the years during which Admissions and Releases Data were regularly submitted. (Records before 1986 were either missing or unreasonably small in most states. Records in some years in the middle of the time periods can be missing as well.)

* Admissions and Releases Data for Georgia are not reliable because prison population backed out using the perpetual inventory method are mostly negative. Therefore, only data in 2004-2009 for Georgia will be included in the sample.

** Maryland is excluded from the sample. According to the codebooks, the analytical value of the data for Maryland is limited due to a continuing problem in maintaining data entry accuracy.

Table A2: Impact of Black Male Incarceration on Black Women's Education

Dependent variable	**Years of education**		
	OLS	2SLS	2SLS
	(1)	(2)	(3)
Fraction of black men in prison	-2.360*	-5.788	-4.721
	(1.273)	(5.544)	(5.466)
Observations	327,456	327,456	327,456
R-squared	0.036	0.036	0.082
Mean of dep. var.	12.689		
SD of dep. var.	2.041		
Year & MSA FEs	Yes	Yes	Yes
Control variables			Yes

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34. The analysis is restricted to black women ages 18-34. Control variables include age and age-squared. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A3: Impact of Black Male Incarceration on Black Women's Fertility

Dependent variable	**Have a child or children**					
Samples	Black women with some college			Black women with no college		
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction of black men in prison	0.714	0.612	0.815	0.372	0.790	1.320
	(0.532)	(1.534)	(1.198)	(0.392)	(1.112)	(0.993)
Observations	119,511	119,511	116,668	166,300	166,300	166,300
R-squared	0.031	0.031	0.260	0.026	0.026	0.212
Mean of dep. var.	0.500			0.572		
SD of dep. var.	0.500			0.495		
Year & MSA FEs	Yes	Yes	Yes	Yes	Yes	Yes
Control variables			Yes			Yes

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34. Columns 1-3 include black women ages 18-34 with some college education (without degrees) and Columns 4-6 include black women ages 18-34 without any college education. Control variables include age, age-squared, and years of education. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A4: Impact of Black Male Incarceration on Women's Outcomes: Heterogeneity Across Education Levels and Age Groups

Education levels	Some coll. (or higher)		No college	
Age groups	Younger 2SLS (1)	Older 2SLS (2)	Younger 2SLS (3)	Older 2SLS (4)
Panel A: Dependent variable - **Married**				
Fraction of black men in prison	-1.745 (1.576)	-4.376** (1.903)	-2.563* (1.376)	-2.021 (1.712)
Observations	73,664	43,004	112,874	53,426
R-squared	0.126	0.054	0.099	0.062
Mean of dep. var.	0.163	0.380	0.140	0.306
SD of dep. var.	0.370	0.485	0.347	0.461
Panel B: Dependent variable - **Employed**				
Fraction of black men in prison	5.063*** (1.880)	0.713 (1.522)	0.597 (1.705)	1.034 (1.958)
Observations	69,529	66,185	62,726	53,418
R-squared	0.040	0.049	0.066	0.084
Mean of dep. var.	0.737	0.804	0.529	0.592
SD of dep. var.	0.440	0.397	0.499	0.492
Year & MSA FEs	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34. The dependent variable is an indicator of being married in Panel A and an indicator of being employed in Panel B. Column 1 includes black women ages 18-28 with some college, Column 2 includes black women ages 29-34 with some college, Column 3 include black women ages 18-28 without any college education and Column 4 include black women ages 29-34 without any college education. In Panel B, Columns 1-2 also include those with more than some college education, and Columns 1 and 3 exclude women below age 22. Control variables include age, age-squared, and years of education. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Impact of Black Male Incarceration on Women's Employment: Heterogeneity Across Education Levels and Types of Marital Status

Dependent variable	**Employed**					
Marital status	Never married		Husband present		Husband absent	
Education levels	College 2SLS (1)	No college 2SLS (2)	College 2SLS (3)	No college 2SLS (4)	College 2SLS (5)	No college 2SLS (6)
Fraction of black men in prison	2.386*	0.513	2.410	4.330	5.774	4.942
	(1.289)	(1.335)	(2.203)	(3.537)	(4.715)	(3.879)
Observations	77,295	70,789	39,039	25,644	3,560	3,934
R-squared	0.057	0.072	0.057	0.080	0.223	0.238
Mean of dep. var.	0.766	0.529	0.775	0.627	0.709	0.606
SD of dep. var.	0.424	0.499	0.418	0.484	0.454	0.489
Year & MSA FEs	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34, and black women ages 22-34. Control variables include age, age-squared, and years of education. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A6: Impact of Black Male Incarceration on Black Men's Outcomes

Dependent variables	**Married**	**White wife**	**Employed**
	2SLS	2SLS	2SLS
	(1)	(2)	(3)
Panel A: Impact on black men with some college			
Fraction of black	-1.568	1.726*	0.00438
men in prison	(1.418)	(0.884)	(1.141)
Observations	136,962	136,962	125,808
R-squared	0.182	0.042	0.059
Mean of dep. var.	0.318	0.0411	0.819
SD of dep. var.	0.466	0.198	0.385
Panel B: Impact on black men with no college			
Fraction of black	-1.461	-0.214	-3.077*
men in prison	(1.196)	(0.592)	(1.633)
Observations	165,666	165,666	144,810
R-squared	0.112	0.039	0.062
Mean of dep. var.	0.273	0.0325	0.667
SD of dep. var.	0.446	0.177	0.471
Year & MSA FEs	Yes	Yes	Yes
Control variables	Yes	Yes	Yes

Note: The sample includes MSAs with at least 1,000 black women and 1,000 black men ages 20-34. Panel A includes black men ages 22-39 with some college education, and Panel B includes black men ages 22-29 without any college education. Control variables include age, age-squared, and years of education. Standard errors are clustered at the MSA level Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A7: Robustness Test: Alternative Simulated Instrumental Variables

Dependent variables	**Married**		**Employed**		**Live with mother only**	**Out-of-wedlock birth**
	Some coll. 2SLS	No college 2SLS	College 2SLS	No college 2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Baseline simulated IV						
Fraction of black men in prison	-3.121***	-2.640*	2.989**	0.821	3.533**	4.292**
	(0.964)	(1.426)	(1.180)	(1.491)	(1.767)	(2.009)
F-statistics	27.136	23.768	17.471	23.408	28.096	19.964
Panel B: Simulated IV with drug-related offenses						
Fraction of black men in prison	-6.474***	-1.343	2.404**	2.584	2.847	2.036*
	(2.378)	(0.964)	(1.160)	(1.754)	(3.405)	(1.078)
F-statistics	6.809	10.164	6.172	9.375	13.421	17.287

Note: In Columns 1-2, the dependent variable is an indicator of being married; the sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34, and black women ages 18-34 with some college education (Column 1) and without any college education (Column 2). In Columns 3-4, the dependent variable is an indicator of being employed; the sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34, and black women ages 22-34 with at least some college education (Column 3) and without any college education (Column 4). In Column 5, the dependent variable is an indicator of living with mother only; the sample includes MSAs with at least 2000 black children age 0-14, and black children age 0-14. In Column 6, the dependent variable is an indicator that mother is never married; the sample includes MSAs with at least 2000 newly born black infants, and black children below age 2. Control variables include age, age-squared, and years of education in Columns 1-4, age and sex in Column 5, and sex in Column 6. Standard errors are clustered at the *state* level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A8: Robustness Test: Alternative Measures of Black Male Incarceration

Dependent variables	**Married**		**Employed**		**Live with mother**	**Out-of-wedlock**
	Some coll. 2SLS	No college 2SLS	College 2SLS	No college 2SLS	**only** 2SLS	**birth** 2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Independent variable - fraction of black men ages 20-54 in prison (baseline)						
Fraction of black men in prison	-3.121**	-2.640**	2.989***	0.821	3.533***	4.292***
	(1.324)	(1.156)	(1.100)	(1.306)	(1.119)	(1.495)
Mean of indep. var.	0.063	0.062	0.062	0.062	0.063	0.063
F-statistics	42.697	43.003	34.823	42.657	46.728	47.32
Panel B: Independent variable - fraction of black men ages 20-39 in prison						
Fraction of black men in prison	-1.761**	-1.535**	1.672***	0.491	1.995***	2.432***
	(0.786)	(0.689)	(0.643)	(0.800)	(0.632)	(0.879)
Mean of indep. var.	0.102	0.099	0.101	0.099	0.102	0.102
F-statistics	35.404	36.003	30.588	36.171	40.633	39.774
Panel C: Independent variable - fraction of single black men ages 20-54 in prison						
Fraction of single black men in prison	-1.799**	-1.503**	1.601**	0.494	2.280***	2.391**
	(0.850)	(0.748)	(0.680)	(0.862)	(0.658)	(0.943)
Mean of indep. var.	0.090	0.089	0.089	0.089	0.090	0.090
F-statistics	42.945	51.41	34.995	49.358	56.917	49.125
Panel D: Independent variable - sex ratio of single blacks ages 20-34 without college						
Sex ratio	0.720*	0.999**	-0.872**	-0.441	-1.329**	-0.682
	(0.413)	(0.470)	(0.427)	(0.549)	(0.602)	(0.524)
Mean of indep. var.	0.801	0.793	0.806	0.790	0.800	0.800
F-statistics	11.943	8.782	9.382	6.499	6.281	7.484

Note: In Columns 1-2, the dependent variable is an indicator of being married; the sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34, and black women ages 18-34 with some college education (Column 1) and without any college education (Column 2). In Columns 3-4, the dependent variable is an indicator of being employed; the sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34, and black women ages 22-34 with at least some college education (Column 3) and without any college education (Column 4). In Column 5, the dependent variable is an indicator of living with mother only; the sample includes MSAs with at least 2000 black children age 0-14, and black children age 0-14. In Column 6, the dependent variable is an indicator that mother is never married; the sample includes MSAs with at least 2000 newly born black infants, and black children below age 2. Control variables include age, age-squared, and years of education in Columns 1-4, age and sex in Column 5, and sex in Column 6. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A9: Robustness Test: Concentration of Black Population within States

Dependent variables	**Married**		**Employed**		**Live with mother only**	**Out-of-wedlock birth**
	Some coll. 2SLS (1)	No college 2SLS (2)	College 2SLS (3)	No college 2SLS (4)	2SLS (5)	2SLS (6)
Panel A: Baseline						
Fraction of black men in prison	-3.121** (1.324)	-2.640** (1.156)	2.989*** (1.100)	0.821 (1.306)	3.533*** (1.119)	4.292*** (1.495)
Mean of indep. var.	0.063	0.062	0.062	0.062	0.063	0.063
Panel B: MSAs in states with HHI < 3500						
Fraction of black men in prison	-4.540* (2.321)	-5.437** (2.320)	4.379** (2.007)	-1.557 (2.224)	6.796*** (2.008)	6.613** (2.610)
Mean of indep. var.	0.068	0.065	0.068	0.065	0.067	0.066

Note: In Panel A, the sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34 in Columns 1-4, MSAs with at least 2000 black children ages 0-14 in Column 5, and MSAs with at least 2000 black children ages 0-4 in Column 6. In Panel B, the sample includes states where the HHI of black population is smaller than 3500: including Arkansas, California, Florida, Louisiana, North Carolina, Oklahoman, South Carolina, Tennessee, Texas, and Virginia. Control variables include age, age-squared, and years of education of black women (ages 20-34) in Columns 1-4, age and sex of black children (ages 0-14) in Column 5, and sex of black infants in Column 6. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A10: Robustness Test: Regressions with Lagging and Leading Instruments

Dependent variables	**Fraction of black men in prison**		**Married**		**Employed**		**Live with mother only**		**Out-of-wedlock birth**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
IV_t	0.0279***	0.00944*	-0.0747***	-0.168**	0.0462*	-0.0962	0.0915***	0.255***	0.0872**	0.0934
	(0.00426)	(0.00488)	(0.0278)	(0.0658)	(0.0262)	(0.0949)	(0.0256)	(0.0759)	(0.0419)	(0.119)
IV_{t-1}		-0.00269		0.0677		-0.00188		-0.0510		-0.105
		(0.00456)		(0.0766)		(0.117)		(0.0781)		(0.174)
IV_{t-2}		0.00770		-0.0978		0.0634		0.0261		-0.130
		(0.00523)		(0.0737)		(0.0949)		(0.0796)		(0.150)
IV_{t-3}		0.00796		0.0471		-0.0383		0.000504		0.187*
		(0.00503)		(0.0434)		(0.0682)		(0.0559)		(0.0985)
IV_{t+1}		0.00571		0.0392		0.0343		-0.0396		0.105
		(0.00361)		(0.0700)		(0.100)		(0.0919)		(0.226)
IV_{t+2}		0.00148		-0.000770		0.00836		-0.112		0.153
		(0.00277)		(0.127)		(0.0789)		(0.0781)		(0.156)
IV_{t+3}		0.00261		-0.0326		0.109		0.0245		-0.176*
		(0.00382)		(0.0782)		(0.0882)		(0.0697)		(0.107)
Observations	327,456	211,630	166,300	126,430	209,248	147,248	661,425	488,710	123,167	91,648
R-squared	0.869	0.899	0.107	0.104	0.062	0.069	0.022	0.027	0.039	0.051
Leads=0		0.286		0.843		0.142		0.246		0.272

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34 in Columns 1-6, MSAs with at least 200 black children ages 0-14 in Columns 7-8, and MSAs with at least 2000 black children children ages 0-4 in Columns 9-10. Analysis is restricted to black women ages 18-34 without any college education in Columns 1-4, black women ages 22-34 with at least some college education in Columns 5-6, black children ages 0-14 in Columns 7-8, and black infants in Columns 9-10. MSA and year fixed effects, and controls variables are included. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A11: Robustness Test: Potential Confounds

Dependent variables	**Share of black population** (1)	**Violent crime rate** (2)	**Property crime rate** (3)
Simulated IV	-0.000211	0.00236	0.0195
	(0.00512)	(0.0122)	(0.0567)
Observations	327,456	327,456	327,456
R-squared	0.992	0.818	0.883
Mean of indep. var.			

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34, and analysis is restricted to black women ages 18-34. In Column 1, the share of black population is measured at the MSA level. Year and MSA fixed effects, and control variables for women are included. Standard errors are clustered at the MSA level. In Columns 2-3, crime rates are measured at the state level. Year and state fixed effects, and control variables for women are included. Standard errors are clustered at the state level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A12: Robustness Test: Alternative Specifications

Dependent variable	**Married**		**Employed**		**Live with mother only**	**Out-of-wedlock birth**
	Some coll 2SLS (1)	No college 2SLS (2)	College 2SLS (3)	No college 2SLS (4)	2SLS (5)	2SLS (6)
Panel A: Baseline specification						
Fraction of black men in prison	-3.121*** (0.964)	-2.640* (1.426)	2.989** (1.180)	0.821 (1.491)	3.533** (1.767)	4.292** (2.009)
Observations	116,668	166,300	135,715	116,146	661,425	120,778
R-squared	0.129	0.103	0.042	0.067	0.018	0.035
Panel B: State-specific time tends						
Fraction of black men in prison	-2.832* (1.516)	-2.838** (1.437)	2.187* (1.141)	0.825 (1.631)	3.854*** (1.357)	4.640** (1.828)
Observations	116,668	166,300	135,715	116,146	661,425	120,778
R-squared	0.134	0.105	0.045	0.069	0.020	0.039
Panel C: Identification strategy proposed by Freyaldenhoven et al. (2018)						
Fraction of black men in prison	-2.716* (1.545)	-4.158** (1.638)	5.134*** (1.633)	-0.876 (1.835)	3.767** (1.462)	3.668** (2.126)
Violent crime rate	0.289 (0.304)	0.256 (0.264)	-0.440* (0.246)	0.0942 (0.242)	0.138 (0.293)	0.041 (0.396)
Observations	88,991	135,757	102,359	95,990	522,507	98,110
R-squared	0.136	0.100	0.039	0.073	0.020	0.043

Note: The sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34 in Columns 1-4, MSAs with at least 2000 black children ages 0-14 in Column 5, and MSAs with at least 2000 black children ages 0-4 in Column 6. All specifications include year and MSA fixed effects, and control variables (age, age-squared, and years of education for black women (ages 18-34) in Columns 1-4, age and sex for black children (ages 0-14) in Column 5, and sex of black infants in Column 6). Panel B furthermore controls for state time trends. Panel C uses a lead of the simulated IV (IV_{t+3}) serving as an instrument for the violent crime rate. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A13: Placebo Test: Impact of Black Male Incarceration on White Women and Children's Outcomes

Dependent variable	**Married**		**Employed**		**Live with mother only**	**Out-of-wedlock birth**
	Some coll. 2SLS	No college 2SLS	College 2SLS	No college 2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction of black men in prison	0.00405	-0.835	-0.387	0.509	-0.553	-0.133
	(0.819)	(1.064)	(0.652)	(0.652)	(0.802)	(0.720)
Observations	701,748	811,761	1,025,145	577,222	3,766,166	715,064
R-Squared	0.270	0.204	0.024	0.056	0.009	0.019
Mean of dep. var.	0.391	0.470	0.781	0.586	0.160	0.125
Std dev of dep. var.	0.488	0.499	0.414	0.493	0.367	0.330
Year & MSA FEs	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes

Note: Analysis is restricted to white women ages 18-34 in Columns 1-2, white women ages 22-34 in Columns 3-4, white children ages 0-14 in Column 5, and white infants in Column 6. Control variables include age, age-squared, and years of education in Columns 1-4, age and sex in column 5, and sex in Column 6. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A14: Robustness Check: Black Population

Dependent variable	**Married**		**Employed**		**Live with mother only**	**Out-of-wedlock birth**
	Some coll. 2SLS (1)	No college 2SLS (2)	College 2SLS (3)	No college 2SLS (4)	2SLS (5)	2SLS (6)
Panel A: Baseline: MSAs with black population (ages 20-34) > 2000						
Fraction of black men in prison	-3.121**	-2.640**	2.989***	0.821	3.533***	4.292***
	(1.324)	(1.156)	(1.100)	(1.306)	(1.119)	(1.495)
Mean of indep. var.	0.063	0.062	0.062	0.062	0.063	0.063
Panel B: All MSAs						
Fraction of black men in prison	-5.420***	-2.046*	2.956*	1.401	4.295***	4.151*
	(1.504)	(1.126)	(1.515)	(1.433)	(1.375)	(2.155)
Mean of indep. var.	0.063	0.062	0.062	0.062	0.063	0.063
Panel C: MSAs with fraction of black men in prison < 20%						
Fraction of black men in prison	-5.221***	-2.041*	2.545*	1.395	4.235***	3.965*
	(1.430)	(1.122)	(1.328)	(1.428)	(1.348)	(2.075)
Mean of indep. var.	0.063	0.062	0.062	0.062	0.063	0.063

Note: In Panel A, the sample includes MSAs with at least 1,000 black men and 1,000 black women ages 20-34 in Columns 1-4, MSAs with at least 2000 black children ages 0-14 in Column 5, and MSAs with at least 2000 black children ages 0-4 in Column 6. In Panel B, the sample includes all MSAs. In Panel C, the sample includes MSAs where the incarceration rates of black men is smaller than 20%. Analysis is restricted to black women ages 19-34 with some college education or no college education in Columns 1-2, black women ages 22-34 with at least some college education or no college eduction in Columns 3-4, black children ages 0-14 in Column 5, black infants in Column 6. Control variables include age, age-squared, and years of education in Columns 1-4, age and sex in Column 5, and sex in Column 6. Standard errors are clustered at the MSA level. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.