



A Comparison of the Female and Male Racial Disparities in Imprisonment

Junsoo Lee¹ · Paul Pecorino¹ · Anne-Charlotte Souto²

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Abstract

We examine the behavior of the incarceration rate and the racial disparity in imprisonment for black women over the period 1978–2016 and compare this to the results for black men. At the beginning of our sample, the racial disparity is high and of similar magnitude for both groups. Black women and black men both experience a large run-up in incarceration between 1978 and 1999. This run-up can be entirely explained by the increase in overall incarceration in the USA during this period. Black women and black men both experience a decrease in incarceration between 1999 and 2016, but the decline for women is much steeper. The decline in incarceration for black women is entirely explained by a decline in the racial disparity, where for men, a decline in the disparity and a decline in the overall male incarceration rate are both important. At the state level, there are frequent upturns in the racial disparity in the 1980s for both black women and black men, followed by frequent downturns in the 1990s. The data provide no prima facie evidence that the 1994 Crime Bill exacerbated the racial disparity in imprisonment. By the end of the sample, the racial disparity for females is 1.8, and the disparity for males is 5.2, where this disparity measures the per capita black imprisonment rate divided by the per capita white imprisonment rate for each group.

Keywords Incarceration · Racial disparity · Gender

Introduction

The criminal justice system in the USA is marked by extremely high incarceration rates and a large racial disparity in imprisonment for both men and women. The observed large racial disparity reflects a long legacy of past discrimination in the USA as well as ongoing

discrimination within the criminal justice system.¹ While both black men and black women face discrimination, the effect of this discrimination on disparities within the criminal justice system may differ by gender. This paper uses state-level data to compare the racial disparity for black men and black women over the 1978–2016 period. This analysis provides insight into the extent to which the factors leading to racial disparities in imprisonment affect black men and women in common or differentially.

Even though women are incarcerated at a much lower rate than men in the USA, the female incarceration rate in the USA is extremely high by global standards. While they

✉ Paul Pecorino
ppecorin@cba.ua.edu

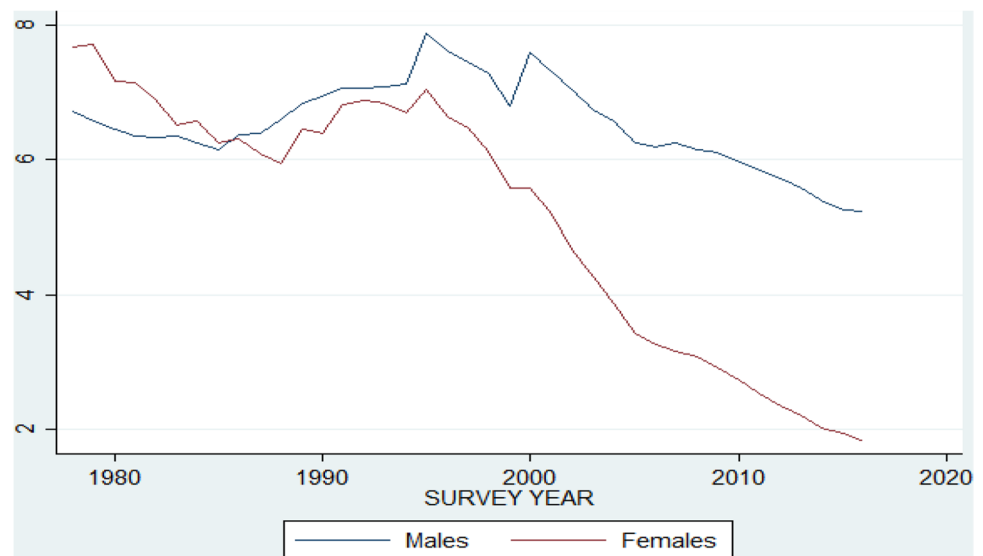
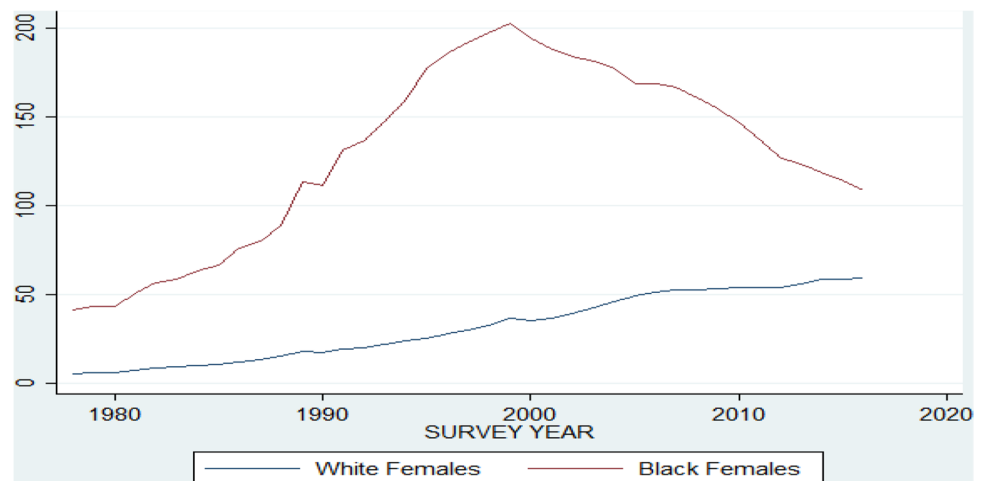
Junsoo Lee
jlee@cba.ua.edu

Anne-Charlotte Souto
acharlotte.souto@gmail.com

¹ Department of Economics, Finance and Legal Studies, University of Alabama, Tuscaloosa, AL 35487, USA

² In4mation Insights, Needham, MA, USA

¹ To the extent that past discrimination leads to current poverty and to the extent that poverty is correlated with crime, past discrimination can lead to current disparities in imprisonment. Ongoing discrimination need not be from within the criminal justice system to have an impact on racial disparities within this system. For example, discrimination in the labor market can reduce opportunities for legal employment and may lead to higher rates of crime. This point is made by Lang and Spitzer (2020), and they also provide a summary of the literature documenting racial discrimination in labor markets and the criminal justice system.

Fig. 1 Male and female Black-White ratio**Fig. 2** Incarceration rates for females (per 100,000)

make up only 4% of the world's female population, women in the USA constitute 30% of incarcerated women worldwide.² This underscores the importance of understanding the racial dynamics of female imprisonment within the USA.

There are very large increases in incarceration for black men and black women between 1978 and 1999, with the rate per 100,000 of the population rising from 1063 to 3358 for men, and the corresponding increase for women being from 42 to 204 (Figs. 1 and 2).³ Between 1999 and 2016,

both groups experience a decline, but while the male rate falls by about 25% to 2508, the female rate drops by almost 50%, falling to 108. Notably, the rate for both groups is much higher at the end of the sample compared to the beginning.

From the beginning of our sample in 1978 until the mid-1990s, the racial disparity for black men and black women is very similar in magnitude. We measure the disparity as the per capita black imprisonment rate divided by the per capita white imprisonment rate for each group.⁴ At the beginning of our sample in 1978, the female disparity at 7.7 is higher than the male disparity of 6.7 (Fig. 1). The disparities for men and women

² This data, from the Prison Policy Initiative, may be found here: <https://www.prisonpolicy.org/global/women/2018.html>

³ Note that, unless otherwise specified, all national numbers exclude both federal prisoners and prisoners under the jurisdiction of the District of Columbia. The District of Columbia stopped operating a prison system by year-end 2001 and sentenced prisoners were transferred to the federal Bureau of Prisons. Thus, neither the D.C. series nor the federal series is directly comparable to the state level data. Approximately 87% of prisoners are held at the state level (Pfaff 2017).

⁴ The ratio of the incarceration rates is widely used in the literature and is readily interpretable. For example, a disparity of 6 means that a black person is 6 times more likely than a white person to be incarcerated on a per capita basis. A possible alternative measure of the disparity is to use the difference in the incarceration rates rather than their ratio. While we do not pursue that avenue in this paper, this may be an interesting approach for future work on this topic.

exhibit similar dynamics, with a fall into the mid-1980s, followed by an increase until the mid-1990s, at which point the disparities for men (7.9) and women (7.0) are still of a similar magnitude. From 1995 to the end of the sample in 2016, there is a sustained decrease in the racial disparity for both men and women, but the decrease for women is much more dramatic. Between 1995 and 2016, the male disparity falls from 7.9 to 5.2, while the female disparity falls from 7.0 to 1.8 over the same period. Thus, while the directional movements in the racial disparity have been similar, the magnitude of the reduction for black women has far outstripped the reduction for black men.

Enders et al. (2019) analyze the male racial disparity. They perform two exercises in the paper. First, they decompose the run-up in black male incarceration between 1978 and 1999 into changes in the racial disparity, changes in overall incarceration, and changes in demographic weights.⁵ They find that the run-up in incarceration is driven almost entirely by increases in the overall incarceration rate. The racial disparity is high in 1978, and while it exhibits some dynamics, it does not change much over the 1978–1999 period. They also analyze the reduction in black male incarceration in the 1999–2014 period. Reductions in racial disparity explain more than 50% of this reduction. Next, they use Fourier approximations to date turning points in the racial disparity at the state level. The racial disparity turns upward in many states in the early to mid-1980s, a timing that suggests a role for the crack epidemic. Many downturns in the disparity date to the early and mid-1990s, including the period after the 1994 Crime Bill was passed. Thus, they find no prima facie evidence that the crime bill exacerbates the racial disparity.

We use the techniques from their paper in comparing the racial disparity for men and women. The decomposition of changes in the black female incarceration rate between 1978 and 1999 is similar to the male results, with somewhat more than 100% of the increase in black female incarceration being due to an increase in the overall female incarceration rate. A reduction in the racial disparity makes a modest contribution towards reducing black female incarceration during this period. Over the 1999–2016 period, reductions in the racial disparity explain almost 100% of the reduction in the black female incarceration rate.

Regionally, the south plays a large role in both the 1978–1999 and 1999–2016 periods for both men and women, but this is simply a reflection of the fact that more than half of the country's black population is located in the south. Between 1978 and 1999, an increase in overall incarceration in the south explains 58% of the national increase in black female incarceration and 51% of the national increase in black male incarceration. Between 1999 and 2016, a reduced racial disparity in the south explains 57% of the reduction in the national

black female incarceration rate and 21% of the reduction in the national black male incarceration rate. Reduced overall incarceration in the south explains an additional 19% reduction of the national black male incarceration rate during this period.

Our results shed some additional light on the possible effects of the 1994 crime bill on the racial disparity in imprisonment. Some of the provisions of the crime bill only affected federal offenses, while we analyze state-level data. However, the bill also contained provisions to hire more police and incentives for states to build more prisons and adopt truth in sentencing laws.⁶ Thus, there is some prospect for the bill to have aggravated the racial disparity in imprisonment at the state level, but our evidence does not support this view. The results for women confirm Enders et al.'s (2019) result for men: There is no prima facie evidence that the 1994 crime bill exacerbated the racial disparity in imprisonment. For both men and women, upturns in the racial disparity were about as likely as downturns in the disparity at the state level in the 10 years prior to the crime bill. In the 10 years after the bill, this remains true for women, while for men, downturns in the disparity at the state level were almost four times as common as upturns. At the aggregate level, the period after the bill was enacted is marked by declining disparities for both men and women. Moreover, the decline for women is very steep.

Chetty et al. (2020) have noted an important asymmetry regarding the racial disparity in earnings over the 1989–2015 period. Conditional on parental income, black women as adults have earnings that are quite similar to white women as adults. By contrast, conditional on parental income, black men have substantially lower earnings than similarly situated white men. The recent data on imprisonment also reflects a sharp asymmetry between black men and black women. Notably, we find that this asymmetry does not exist at the beginning of our sample in 1978 but only begins to emerge in the 1990s. Ultimately, this timing may help us understand how social and economic forces impact black women and men differently.

Background

The racial disparity in imprisonment results from both past and ongoing discrimination. The long history of discrimination in the USA has led to a higher rate of poverty among black Americans than for Americans as a whole, and poverty is associated with higher crime rates.⁷ There have been a

⁵ Overall incarceration here describes the incarceration rates of blacks and whites combined.

⁶ For an analysis of the effects of hiring more police under the bill's COPS grants programs, see Evans and Owens (2007) and GAO (2005). For an analysis of the extent to which the bill led to the adoption of truth-in-sentencing laws, see GAO (1998).

⁷ For a discussion of the costs of past discrimination, see Darity et al. (2022).

large number of efforts to estimate how much of the racial disparity in imprisonment can be explained by differential rates of offending. Work in this line begins with Blumstein (1982) and includes work by Langan (1985), Tonry and Melewski (2008), and Baumer (2013). The recent work of Beck and Blumstein (2018) argues that 72% of the disparity in imprisonment can be explained by differential rates of offending.⁸ This still leaves an important scope for other factors, including ongoing discrimination.

The United States Sentencing Commission (2017) estimates that black male defendants receive sentences that are about 20% longer than those received by white male defendants who are similarly situated. Rehavi and Starr (2014) analyze federal criminal cases and estimate that black males receive sentences that are 10% longer than similarly situated white males.⁹ It is notable that females generally receive shorter sentences than similarly situated males and that there does not appear to be a black-white sentencing disparity for females.¹⁰ This may play at least some role in the smaller racial disparity in imprisonment for females, compared with males.

Discrimination in sentencing is one way in which disparities may arise in the criminal justice system, but there are others. For example, Bulman (2019) has shown that the racial identity of the county sheriff affects the ratio of black to white arrests. When a county transitions to a black sheriff, there are fewer arrests for less severe crimes more frequently committed by blacks. Flanagan (2018) uses data on North Carolina juries to show that jury racial composition affects jury decision making. In particular, having more blacks in the jury pool lowers the conviction rate for black defendants. Flanagan's results are consistent with the findings of Anwar et al. (2012) for the state of Florida. Arnold et al. (2018) use data from Miami and Philadelphia and identify racial bias in bail decisions.¹¹

An early analysis of the racial disparity in imprisonment is provided by Bridges and Crutchfield (1988), who use a

cross-sectional analysis to estimate the sources of this disparity. Urban concentration and black-white economic inequality were both found to be positively associated with a racial disparity in imprisonment. Muller (2012) uses census data from the 1880–1950 period to uncover the sources of the racial disparity in northern states. He shows that influxes of black immigrants from the south are associated with subsequent increases in the racial disparity in imprisonment in that state. Recent European immigrants may have viewed black migrants as potential economic competitors. The mechanism identified by Muller is likely important in explaining the large racial disparity that we observe at the beginning of our sample in 1978. Rubio (2019) links the origin of racial disparities in imprisonment to the incidence of slavery at the local level as well as to the convict leasing system.

The decline in the racial disparity for women is documented in Myers et al. (2022).¹² They conduct a panel analysis over 2000–2016, which are the years of declining racial disparity for women. While much of the reduction in the racial disparity for women remains unexplained, they find an association whereby an increase in the black population share is associated with a decrease in the racial disparity. An increase in female drug overdose deaths is also associated with a reduced disparity. This reflects the fact that the opioid epidemic has led to greater imprisonment of white women.

Data

Our primary data is the number of incarcerated men and women broken down by race. To obtain this data, we use the National Prisoner Statistics (NPS) dataset, which is compiled by the Bureau of Justice Statistics (BJS). NPS dataset started to break down yearend prisoner counts under the jurisdiction of each state by race and Hispanic origin in 1978, which marks the beginning of our sample. Our analysis includes only non-Hispanic whites and non-Hispanic blacks and covers the period 1978–2016.

The other type of data we use is the state-level population, broken down by sex and race. Prior to 1980, the census did not separate Hispanics from non-Hispanics, so we estimated the 1978–1980 period by using the average subsequent growth rate for each population group. Starting in the year 2000, the census allowed individuals to identify with more than one racial category. To account for this, we use the “bridged” population estimates produced by the National Center for Health Statistics.¹³ In doing so, we are following Myers et al. (2022).

⁸ Tonry and Melewski (2008) and Baumer (2013) estimated that only 40–67% of the disparity could be explained by differential rates of offending. One difference in the Beck and Blumstein (Beck and Blumstein 2018) approach is that they take full account of Hispanic arrests. See Pfaff (2017) for an overview of incarceration in the USA, including an analysis of why incarceration rates are so high.

⁹ Ulmer et al. (2016) analyze both federal data and data from Pennsylvania and conclude that unexplained racial disparity is higher for the imprisonment decision than for the length of sentence conditional on imprisonment. They also note the important role of the discretionary consideration of criminal history beyond its effect on the presumptive sentence.

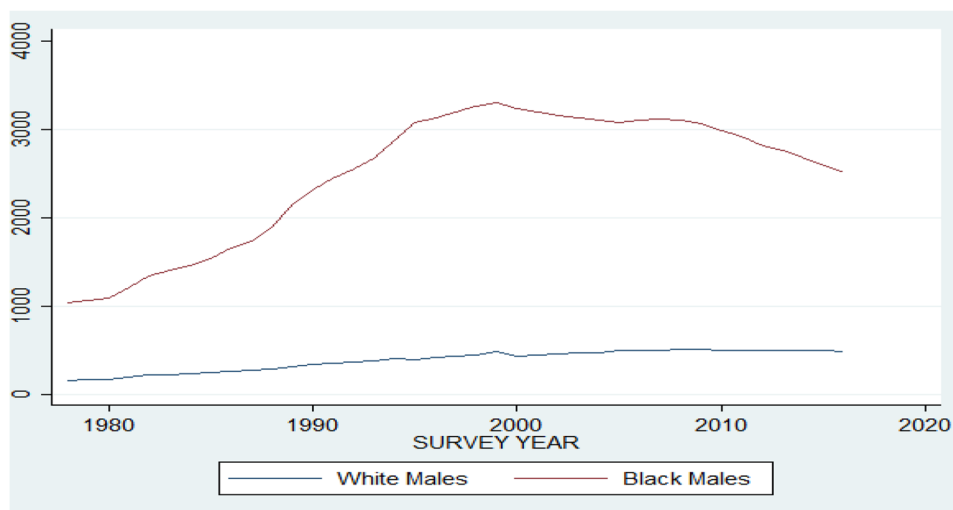
¹⁰ See United States Sentencing Commission (2017, p. 9), Starr (2015, p. 156) and Campaniello (2019). Campaniello also notes that over time, the imprisonment rate of women relative to men has risen.

¹¹ Also see Makowsky et al. (2019) who show that incentives to raise revenue affect policing in a racially disparate manner and Kimchi (2019) who documents racial disparity in probation conditions.

¹² Also see the United States Sentencing Commission (2017).

¹³ The bridged-race population estimates are produced under a collaborative arrangement between the National Center for Health Statistics and the U. S. Census Bureau. The bridging methodology and bridged-race population estimates are available for download from this website: https://www.cdc.gov/nchs/nvss/bridged_race.htm

Fig. 3 Incarceration rates for males (per 100,000)



Using the two types of data above, we create the incarceration rate per 100,000 population for black and white females and black and white males. (In this paper, the incarceration rate is always stated per 100,000 of the population of the relevant group.) The black incarceration rates are denoted B_F and B_M , and the white rates, W_F and W_M , where F stands for female and M for male. Figure 2 shows the incarceration rate for females, and Fig. 3 shows this for males. In both figures, black incarceration rates rise from 1978 to 1999 and fall after that. Because of this pattern, our decomposition results will focus on the years 1978, 1999, and 2016.

Figures 4 and 5 show the black imprisonment rate at the state level for women and men for the years 1978, 1999, and 2016.¹⁴ There is a great deal of variation cross-sectionally. For example, in 1999, the incarceration rate for black females in Oklahoma is over nine times as high as the rate in North Dakota. We can also see that the increase between 1978 and 1999 is very large and very widespread. There is no single state in which the incarceration rate for either black men or black women fails to rise over this period. The decreases between 1999 and 2016 are also very widespread. However, they are not as large in magnitude as the increases, with incarceration rates for both black men and women being generally higher in 2016 than in 1978.

We define the racial disparity r in the same manner as others in the literature so that the racial disparity for females would be $r_F = B_F/W_F$. The racial disparity for women is displayed in Fig. 6 and for men in Fig. 7. The cross-sectional disparity for women is very large in 1978, ranging from a low of 0 to a high of over 35. In part, this wide range reflects states where the black population is very low. By 2016, the range narrows

considerably as it is 0.8 to 6.9. There is some narrowing in the range for men over the same period, but it is not nearly as dramatic. For men, the regional effects are pretty sharp, with the largest disparities in 2016 being in the midwest and northeast and the lowest in the south and west. For women, the regional pattern is a little less sharp, except that the lowest disparities are located in the south. Kentucky, Mississippi, and Alabama have racial disparities of 1 or less in 2016, meaning the incarceration rate for black females in these states is less than or equal to the rate for white females.

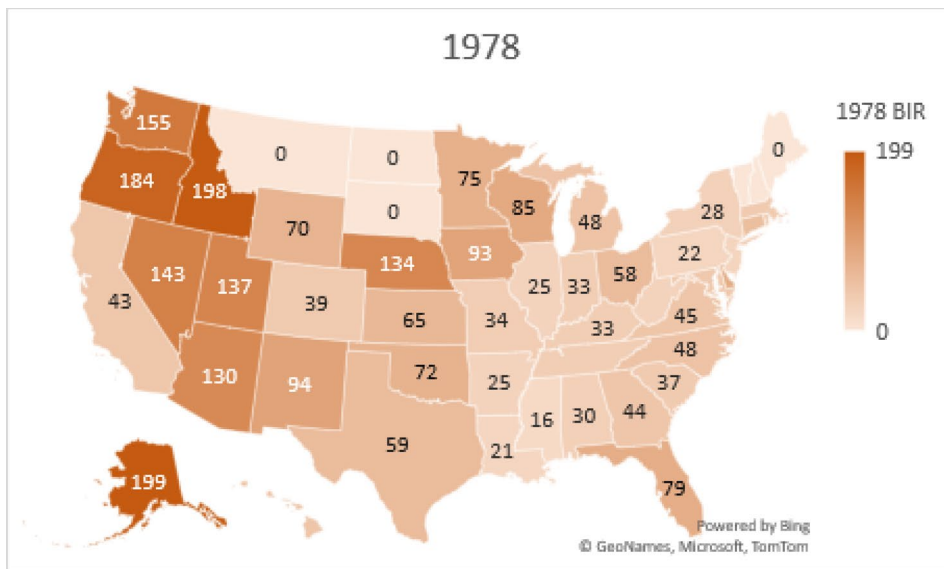
Figures 4, 5, 6, and 7 (and the corresponding online Appendix Tables 1–4) give an overview of state-level differences in black incarceration rates and the racial disparity, as well as some insights into the dynamics of these variables over time. However, it must be noted that the volatility of these variables in some states, particularly for females, is driven by very low black populations and correspondingly small absolute numbers of black prisoners. In the decomposition analysis to follow, each state's contribution to changes in the black imprisonment rate is weighted by their share of the national black population. Thus, states with low black populations, where the numbers are often volatile, contribute very little to the aggregate results.¹⁵

Decomposition Analysis

In this section, we will decompose the changes in black incarceration rates into changes in overall incarceration rates and changes in the racial disparity. We follow the same methods as

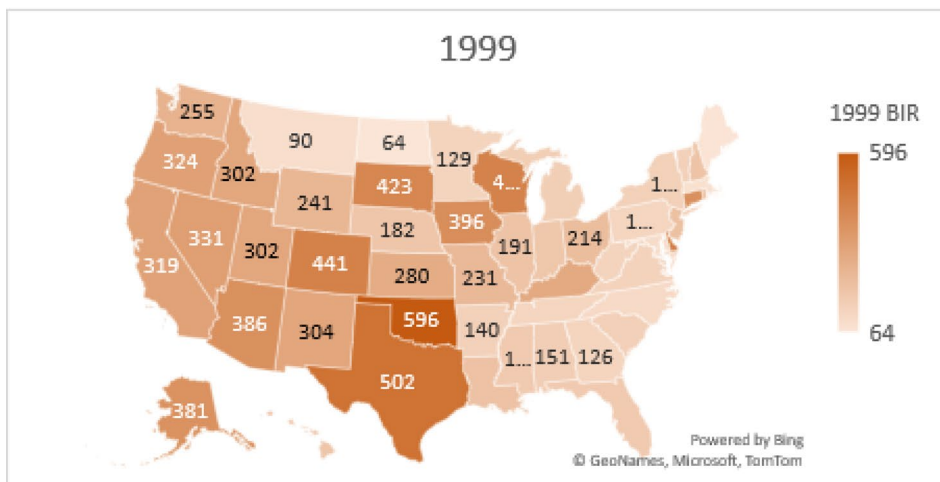
¹⁴ The details of Figs. 4, 5, 6, and 7 are given in the Online Appendix Tables 1–4, where we also report their respective ranking. A rank of 1 is given to the state which has the highest rate that year, a rank of 2 for the state with the second highest rate, and so on.

¹⁵ Our analysis of turning points in the racial disparity in “Estimating State-Level Turning Points in the Racial Disparity” section excludes 6 states for females due to missing data. These are all states with small black populations. Thus, states with low black populations are not driving our analyses.



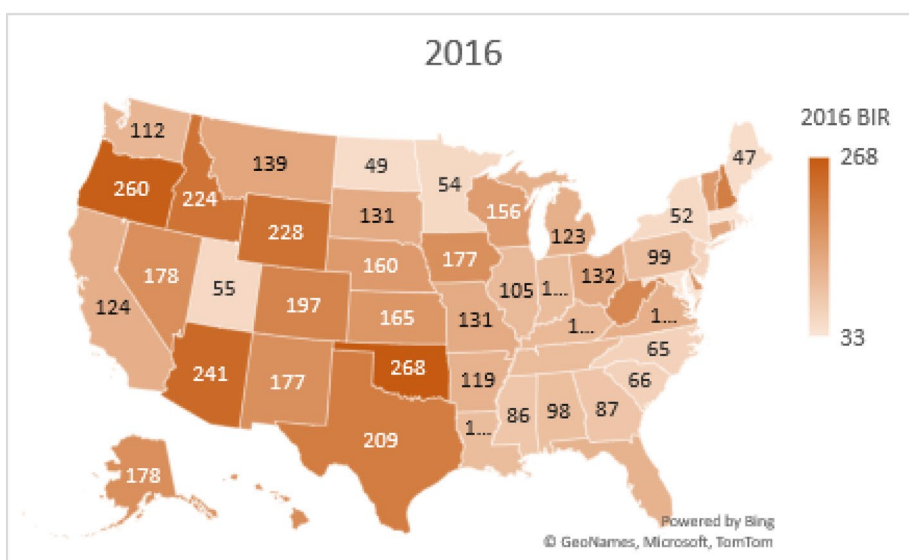
Mean	59.44
Std dev	51.58

Highest	
Nevada	143
Washington	155
Oregon	184
Idaho	198
Alaska	199



Mean	235.70
Std dev	126.80

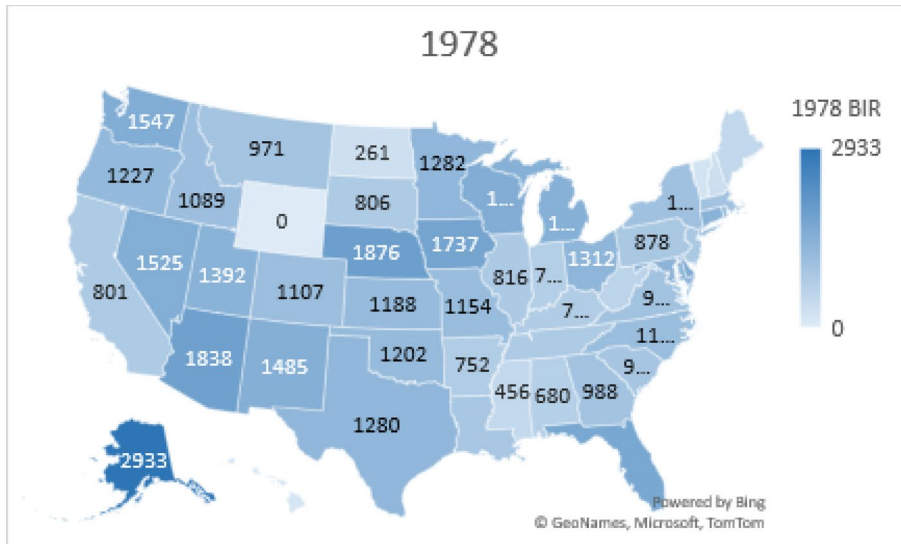
Highest	
Wisconsin	437
Colorado	441
Delaware	453
Texas	502
Oklahoma	596



Mean	131.90
Std dev	60.22

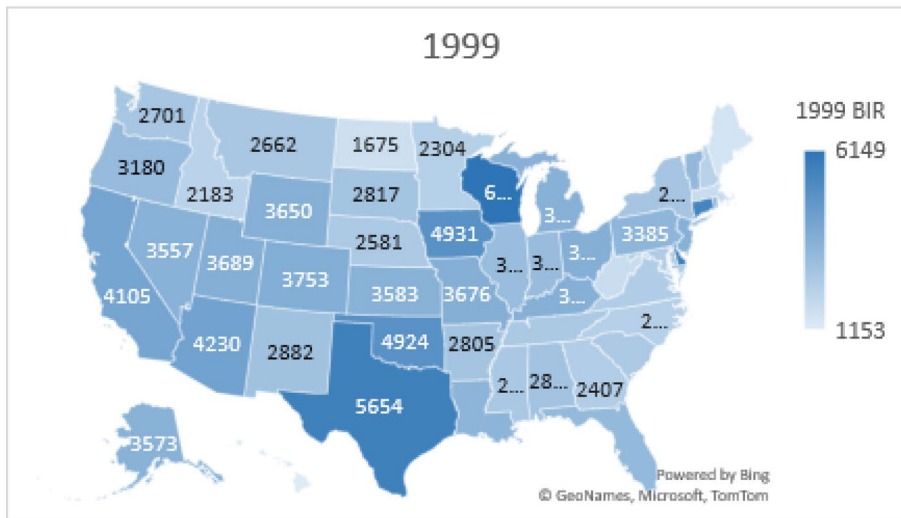
Highest	
Idaho	224
Wyoming	228
Arizona	241
Oregon	260
Oklahoma	268

Fig. 4 Female black incarceration rates (BIR) by state



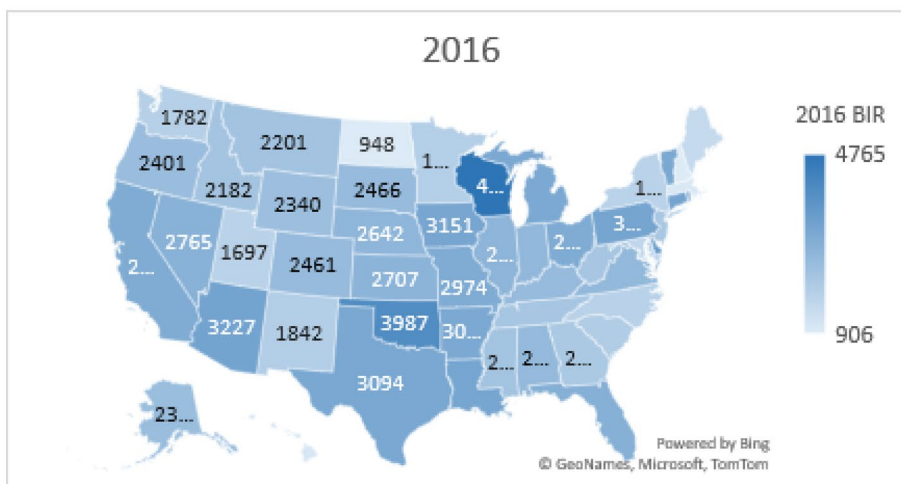
Mean	1068.3
Std dev	520.8

Highest	
Florida	1675
Iowa	1737
Arizona	1838
Nebraska	1876
Alaska	2933



Mean	3227.4
Std dev	1089.3

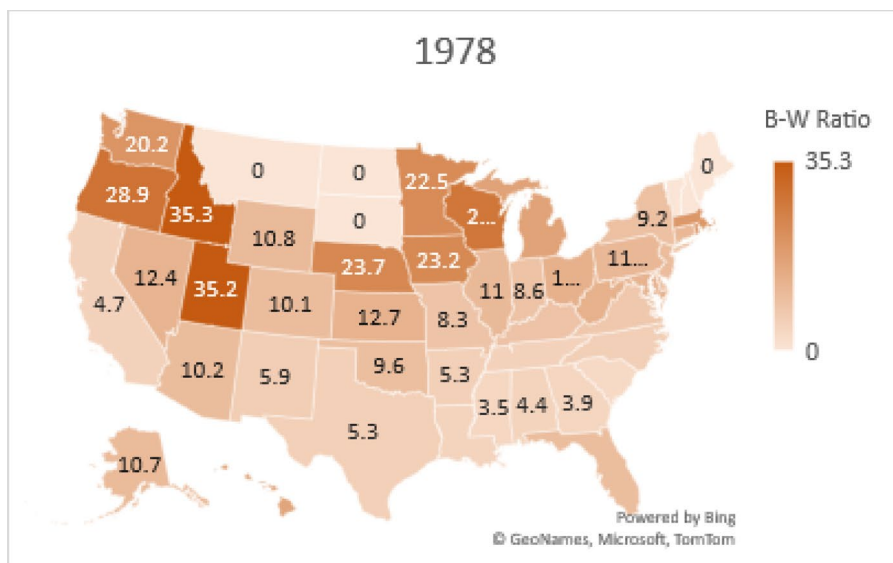
Highest	
Iowa	4931
Connecticut	5464
Texas	5654
Delaware	5742
Wisconsin	6149



Mean	2438.6
Std dev	767.5

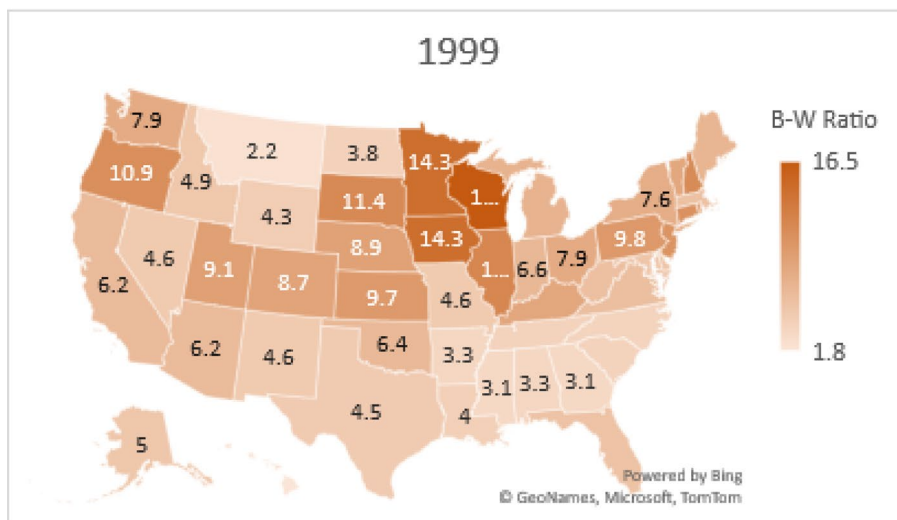
Highest	
Connecticut	3215
Arizona	3227
Delaware	3492
Oklahoma	3987
Wisconsin	4765

Fig. 5 Male black incarceration rates (BIR) by state



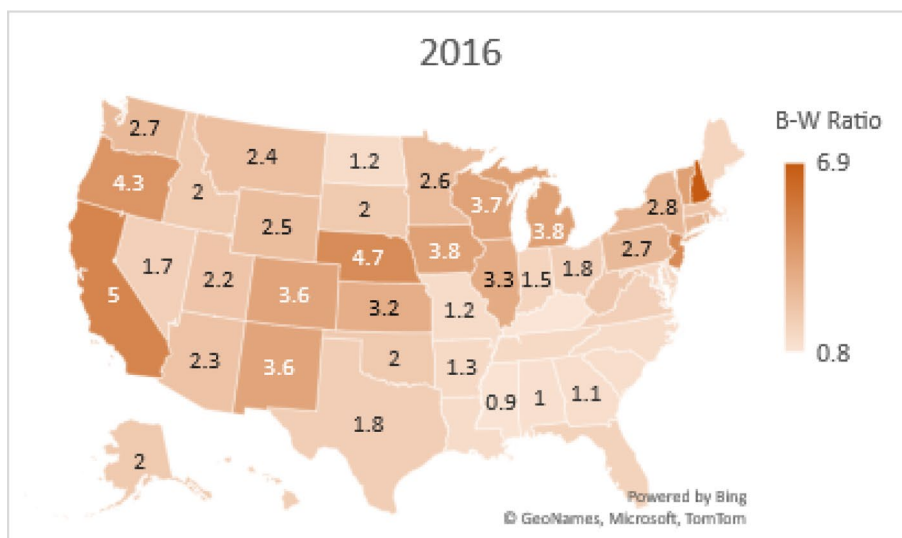
Mean	11.15
Std dev	8.76

Highest	
Nebraska	23.7
Wisconsin	27.9
Oregon	28.9
Utah	35.2
Idaho	35.3



Mean	6.92
Std dev	3.33

Highest	
South Dakota	11.4
Illinois	11.7
Iowa	14.3
Minnesota	14.3
Wisconsin	16.5



Mean	2.43
Std dev	1.28

Highest	
Oregon	4.3
Nebraska	4.7
New Jersey	4.8
California	5
New Hampshire	6.9

Fig. 6 Female Black-White ratio by state

Enders et al. (2019).¹⁶ The equations which underlie the decomposition have been relegated to the appendix. The decomposition is conducted at the state level and then aggregated up to the regional and national levels. This decomposition is important because, for example, an increase in the overall incarceration rate in a state with a large black population could cause an apparent increase in the racial disparity at the national level, even if the increase affected blacks and whites equally in the state in question. Moreover, this disaggregation will reveal important regional patterns that may be informative.

Both the black female and male rates of incarceration move sharply upward from 1978 to 1999 and then generally fall thereafter. Thus, we will decompose the increase from 1978 to 1999 and the decrease between 1999 and 2016 for both black females and males. We perform decompositions separately for males and females. The decomposition does not imply a causal relationship, as the black incarceration rate is a component of the overall rate. However, we believe this decomposition is useful when trying to understand changes in the black incarceration rate over time. In particular, decomposing the change in the incarceration rate into changes in overall incarceration and change in the racial disparity is one way to make sense of these changes.¹⁷

Table 1 includes the decompositions for women and men over both the 1978–1999 and 1999–2016 periods. Results are aggregated to the regional level and then summed across regions.¹⁸ In the aggregate, the increase in the overall incarceration rate for women explains more than 100% of the increase in black female incarceration between 1978 and 1999. In the south, increases in the overall incarceration rate explain 58% of the increase in the national black female incarceration, while in the midwest, increases in overall incarceration explain an additional 24%. Changes in the racial disparity make a “negative” contribution of 9% during this period, meaning that it led the incarceration rate for black females to be 9% lower than it otherwise would have been. Obviously, this modest reduction is swamped by increases in the overall incarceration rate.

¹⁶ Our decomposition does not include Federal prisoners or the District of Columbia. The full decomposition includes the effects of changes in the demographic weights, but the effects of these changes are not large and are not of independent interest. Thus, we omit them from our table. Also, we present aggregated results for the regional and national level. For the state level results which include the effects of the demographic weights, see the working version of this paper. This is available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3607330

¹⁷ Other decompositions are possible. For example, it is possible to decompose changes in the racial disparity into changes in the black incarceration rate and changes in the white incarceration rate.

¹⁸ We use the census demarcation of states into Northeast, Midwest, South, and West.

Between 1999 and 2016, the black female rate of incarceration falls, so a positive entry in these columns implies the factor in question is contributing to the fall in incarceration. During this period, a fall in the racial disparity explains close to 100% of the decrease in black female incarceration. The declining disparity in the south explains 57% of the decrease, while the decline in the midwest explains an additional 23%. Overall incarceration continued to rise slightly, as evidenced by the –2% contribution made by changes in the overall incarceration rate.

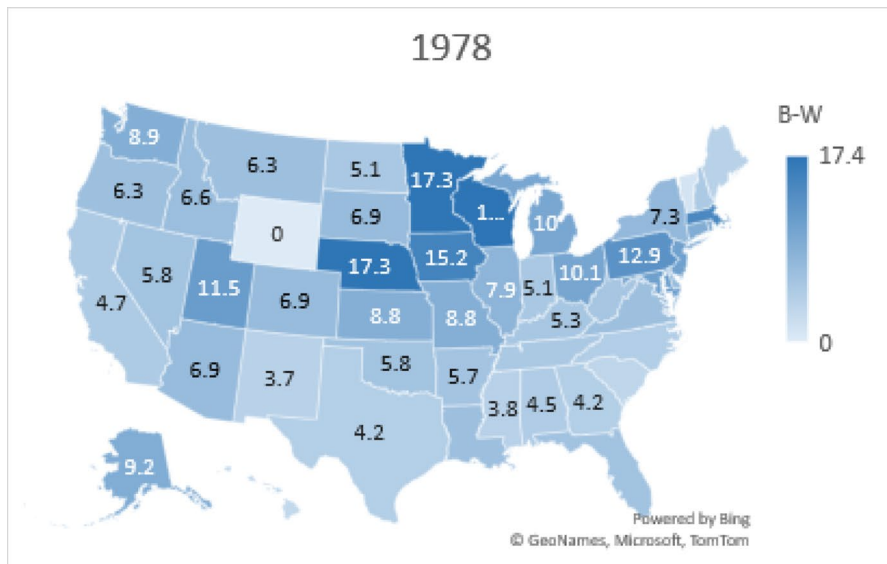
For the black male incarceration rate between 1978 and 1999, the overall pattern in the data is strikingly similar to the female decomposition for this period. The overall increase in incarceration explains more than 100% of the increase in the black male incarceration rate. Once again, the south (51%) and the midwest (23%) are drivers of this pattern. The joint contribution of increased incarceration in these two regions is 82% for females and 74% for males. Changes in the racial disparity during this period make a small positive contribution (4%) to the increase in the black male incarceration rate.

There are very different patterns for men and women over the 1999–2016 period. As with the women, reductions in the racial disparity contribute to reduced black male incarceration, but at 40%, this contribution is much lower than the 97% contribution for women. Though the magnitudes are far smaller for the men, the south and midwest make the biggest contributions in the category for both groups. For black women, changes in the overall rate of incarceration have a negligible effect, while for black men, reduced overall incarceration makes a significant (38%) contribution to the reduction in the incarceration rate.

For each table, the total contribution of a region can be found by adding the contribution of the disparity to the contribution of the overall incarceration rate. While population shares are not reported on these tables, the regional contributions track the population shares fairly closely. This suggests that the upsurge in black incarceration in the 1978–1999 period and the smaller decline from 1999 to 2016 reflect national rather than regional factors. These factors might include the crack epidemic in the 1980s and the crime bill of 1994.

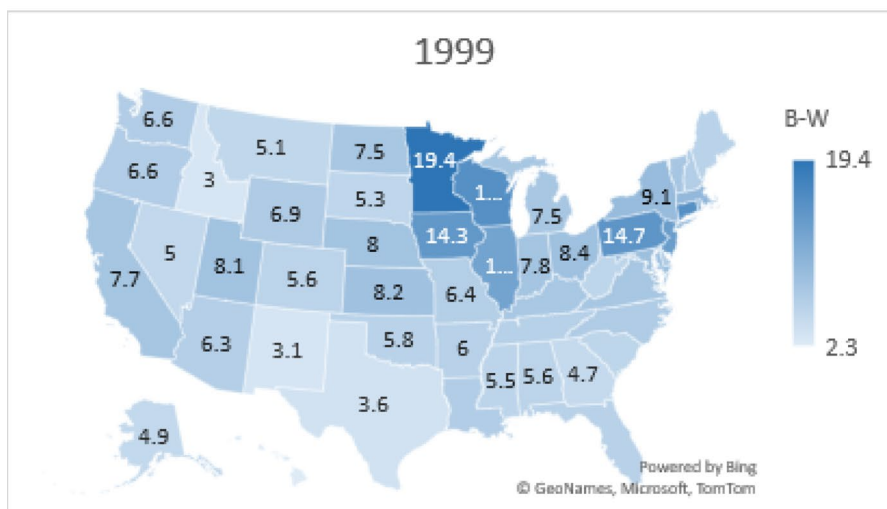
It is notable, however, that for both females and males and in both the period of rising incarceration 1978–1999, and the period of falling incarceration 1999–2016, the west consistently has made a contribution to the change in black incarceration, which exceeds its population share. Their contribution exceeds their population share (which ranges from 8 to 10%) by at least 3 percentage points and by as many as 8.3 percentage points.¹⁹

¹⁹ Results shown in our working paper reveal that this is largely driven by California. Texas also has an outsized impact on the racial disparity for both men and women. Texas has about 7% of the nation’s black population but contributed to 18% of the increase and 23% of the decrease in women’s incarceration during the 1978–1999 and 1999–2016 periods, respectively. The corresponding numbers for men are 13% and 25%



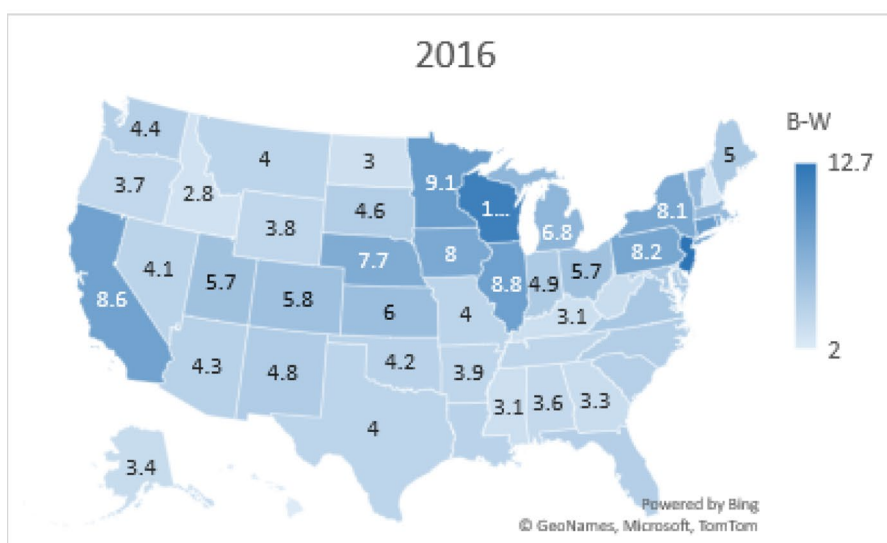
Mean	7.41
Std dev	3.99

Highest	
Massachusetts	14.4
Iowa	15.2
Minnesota	17.3
Nebraska	17.3
Wisconsin	17.4



Mean	7.41
Std dev	3.99

Highest	
Iowa	14.3
Pennsylvania	14.7
Wisconsin	15.5
Connecticut	15.5
Minnesota	19.4



Mean	5.38
Std dev	2.35

Highest	
Illinois	8.8
Minnesota	9.1
Connecticut	9.1
Wisconsin	11.7
New Jersey	12.7

Fig. 7 Male Black-White ratio by state

In summary, the run-up in black incarceration rates between 1978 and 1999 looks very similar for men and women. The reduction between 1999 and 2016 is larger for women in percentage terms and is entirely due to a fall in the racial disparity. The smaller reduction for men in this period is due to both a fall in the racial disparity and a fall in the overall incarceration rate for men. The incarceration rates for black women and black men are both higher in 2016 than in 1978, despite a reduction in the racial disparity across these 2 years. In both cases, a reduction in the racial disparity was more than offset by an increase in the overall incarceration rate.

The reduction in the racial disparity drives the reduction in the black female incarceration rate in the 1999–2016 period. Next, we turn to a more detailed analysis of the dynamics of the disparity over the entire 1978–2016 period.

Estimating State-Level Turning Points in the Racial Disparity

In this section, we use state-level data to estimate turning points in the racial disparity at both the state and national levels. Among other things, this analysis will potentially give us some clues as to what events (e.g., the crack epidemic) or policies (e.g., the 1994 Crime Bill) are causing the racial disparity to either turn upward or downward. Some of the state-level series on the racial disparity are erratic in the sense that there may be large jumps up in the disparity followed immediately by a large jump down or vice versa. Such short-run fluctuations make it desirable to first smooth data before estimating turning points at the national level and local maxima or minima. Moreover, the actual breaks in the data tend to be gradual. We employ the Fourier series approximation (Enders and Lee 2012) in our analysis for both of these reasons. The Fourier approximation for the racial disparity may be expressed as:

$$r_t^i = a_0 + b_0 t + \sum_{k=1}^n a_k \sin\left(\frac{2\pi k t}{T}\right) + \sum_{k=1}^n b_k \cos\left(\frac{2\pi k t}{T}\right) + e_t, \quad (1)$$

where a_0 is the intercept, b_0 is the slope of the time trend, $k = 1, \dots, n$ are the frequencies of the trigonometric terms, a_k and b_k ($k = 1, \dots, n$) are amplitude parameters, and e_t is the error term. The value of k is the number of sine and cosine cycles (i.e., the frequency) over the sample period. We use the Akaike information criterion (AIC) to select the most

appropriate number of cumulative frequencies n , up to a maximum of $n = 3$.²⁰

We first employ Eq. (1) to estimate the smoothed trend of each of the aggregate female and male racial disparities shown in Fig. 1. The AIC selection gives the optimal value of the number of cumulative frequencies as $n = 2$ for both female and male regressions. The estimated equations for females and males may be found in the appendix. The fitted values from these estimations are shown as smoothed curves in red color in Fig. 8a and b, along with the plots of the corresponding female and male disparities, respectively. It seems clear that the national trend of both female and male disparities is downward sloped from the mid-1990s. Looking at the fitted values, we observe that the female disparity shows a short u-shaped pattern from the early 1980s to the mid-1990s, reaching a local maximum of 6.9 in 1994. Subsequently, the female disparity decreased until the end of the sample period. The male disparity shows a similar pattern. The fitted smoothed curve shows the overall trend more clearly. It takes a mild u-shape trend from the 1980s to the mid-1990s until reaching a global maximum of 7.5 in 1996.²¹ Since then, it also exhibits a sustained gradual decrease, while the decrease is not as large as that of the female disparity.

We next estimate Eq. (1) at the state level.²² Then, we use the fitted values in each of the regression results to estimate local maxima and minima at the state level. The estimated values of the cumulative frequencies (n) are given in Table 2, along with the results on the global maxima and minima. At the bottom of Table 2, we provide a summary of global minima and maxima (Table 3). The global maximum racial disparity for women is reached before 2000 in almost all states. The exception is New Mexico, for which it occurred in 2003.

Conversely, only New Mexico (in 1984) and California (in 1986) have a global minimum for women before 2000. Thirty-one of the forty-four states used in our analysis for women have a global minimum in the last year of our sample, 2016. For men, the pattern is similar, though not quite as dramatic. The global maxima are concentrated in the years prior to 2000, and 26 states have a global minimum for men in the last year of the sample. These data indicate

²¹ The actual value of the male disparity has a global maximum of 7.9 in 1995.

²² In the estimation of the Fourier functions, we have used 44 states for female disparities while excluding ME, MT, NH, ND, SD, VT, and DC due to missing observations in some periods. For male disparities, we have used 49 states, excluding VT and DC. We perform estimations on states when the number of missing observations is one or two. We have interpolated their values with 5-year averages of nearby observations. When there are more than two missing observations, the states are excluded from our estimation. Except for DC, the excluded states generally have low black populations.

²⁰ Enders and Lee (2012) and Enders and Jones (2014) show that a small value of n (less than or equal to 3) typically works well in econometric applications. AIC is computed as $-2 \log(\text{likelihood})/T + 2*(\# \text{ regressors})/T$. We select the model with the smallest value of AIC.

Table 1 Decomposition of the change in the black women and men's imprisonment rate

Region	1978–1999				1999–2016			
	Female		Male		Female		Male	
	Disparity	Overall	Disparity	Overall	Disparity	Overall	Disparity	Overall
Midwest	–3.2%	24.3%	–0.5%	23.4%	23.3%	–8.1%	12.1%	–1.9%
Northeast	–0.9%	17.3%	1.3%	18.1%	10.3%	4.9%	6.1%	10.4%
South	–4.8%	57.6%	1.3%	51.0%	56.5%	–7.6%	20.8%	18.9%
West	–0.4%	15.0%	1.7%	11.4%	7.0%	9.0%	0.9%	10.2%
Sum	–9.4%	114.2%	3.8%	103.8%	97.0%	–1.8%	39.8%	37.6%

The sum excludes the District of Columbia

that broad-based declines have occurred in the racial disparity for both women and men.

In Fig. 9, we exhibit the plots of the fitted values of two states, California and Florida.²³ We take the example of California since the trend of both female and male disparities in California runs counter to the national trend. In contrast, Florida shows typical patterns of the national trend. The disparity for females in California fluctuates over time but ends slightly higher than where it begins. This pattern runs counter to the sharp drops observed in most other states. It has been previously noted by Enders et al. (2019) that California also runs counter to the national results for men. The disparity for men in California does not fluctuate much until it begins a sustained rise in the early 1990s. Then, the upward trend lasts until the end of our sample.

California is an outlier for both women and men, and in each case, its outcomes are worse than the national outcomes. We cannot provide a conclusive test on the effects of the provision, but it is notable that California passed a three-strikes law in 1994. While 24 states enact three-strike laws in the 1993–1995 period, the effects of this provision in California were particularly pronounced. Shepherd (2002, pp. 159–60) argues that California was the *only* state that applied the law with regularity, while citing Zimring et al. (1999) who find that 90% of all individuals sentenced under the law were sentenced in California.

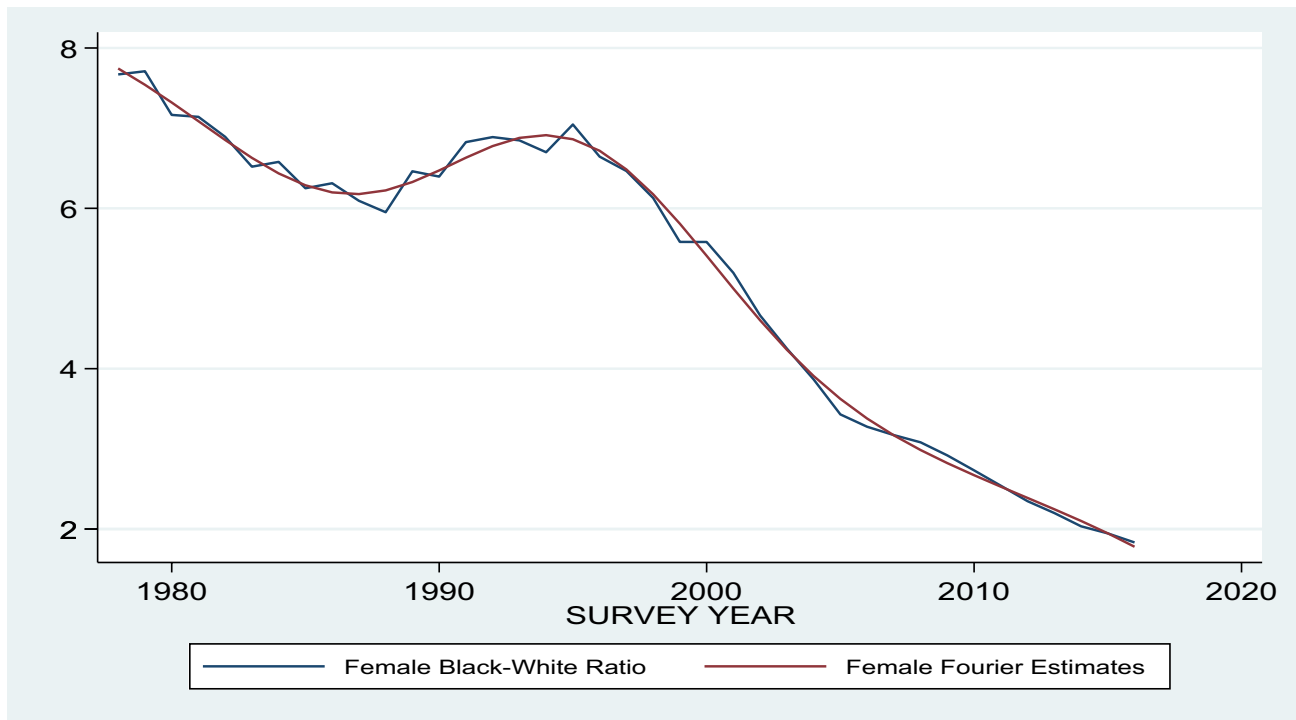
California aside, the data suggest the forces affecting the racial disparity for black women and men are national in scope. Appendix Table 8 gives the correlation between the national trend and each of the state-level disparities. For black females, the correlation coefficients are negative for only two states, California and New Mexico. The correlation for black males is also negative in California and New Mexico. Thus, only two states are running so strongly counter to the national trends so as to generate a negative correlation with the national racial disparity.

Next, we turn to the local maxima and minima for disparities at the state level. We designate a particular year as a local maximum only if it is larger than the three preceding and three succeeding fitted values of the racial disparity. Local minima are designated in an analogous manner. The results in Table 4 present up to three local maxima and minima of each of the female and male disparities. Note that local minima are followed by upturns and therefore herald increases in the racial disparity, while the opposite holds for local maxima. At the bottom of Table 4, a summary table aggregates the information for the local maxima and minima (Table 5). For both females and males, the minima far exceed the maxima in the 1980s. For women, the ratio is 2 to 1, and for men, it is almost 3 to 1. The timing of the upturns in the racial disparity is consistent with the crack epidemic having a racially disparate impact.²⁴ By the 1990s, maxima greatly outnumber minima for both males and females. This is likely driven by the waning of the crack epidemic.

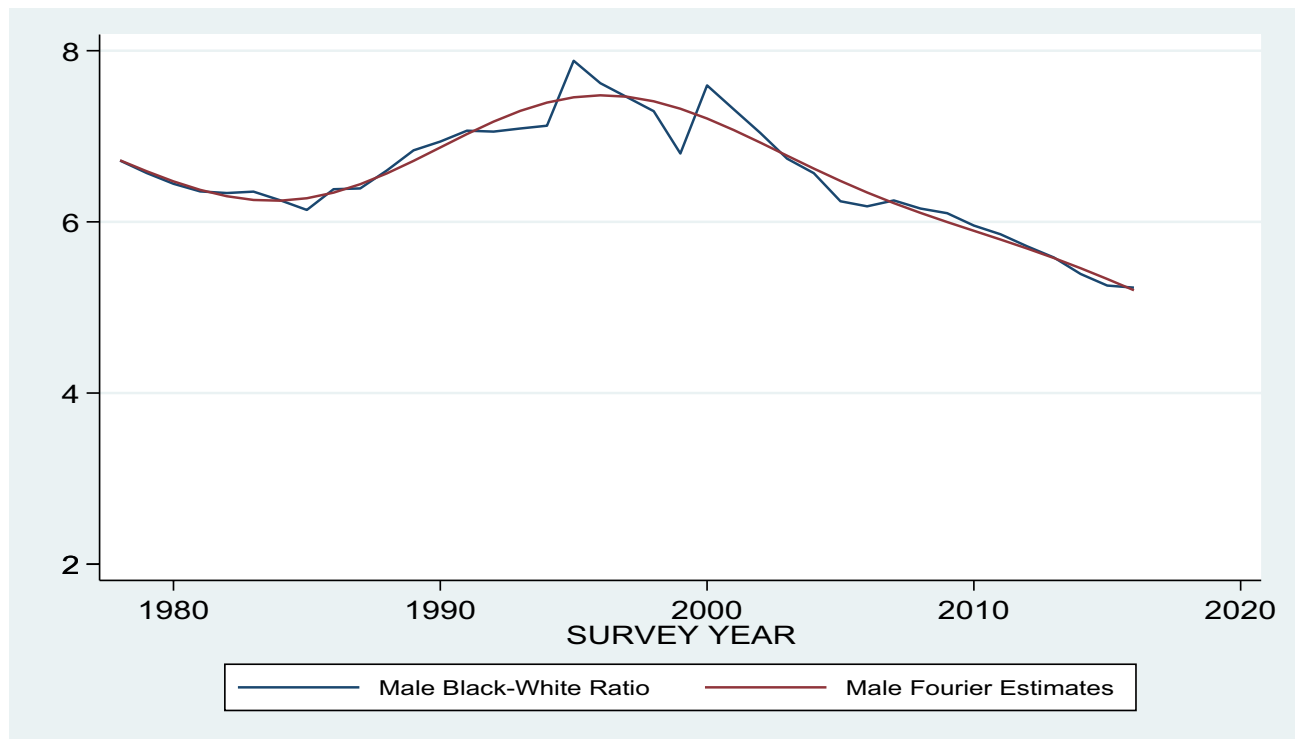
To obtain some insight into the role of the 1994 Crime Bill, we also present a summary table for the 10 years prior to the bill (1984–1993) and the 10 years after the bill (1995–2004). For both men and women, the earlier period is marked by an approximately equal number of upturns and downturns in the disparity. For women, this continues to hold in the ten years after the bill is enacted. There are many fewer turning points for women in this period. There are 16 states where the racial disparity for women turns down in 1990–1994, where the decline lasts through the end of the sample. Thus, the downturn for females precedes the bill but continues strongly after the bill, giving us no evidence that the bill worsens the racial disparity. For men, downturns in the disparity outnumber upturns by a 3–1 margin during the 10 years after the bill is passed. Thus, the dominant response at the state level following the passing of the crime bill is for the racial disparity to decline. While we do not view the crime bill as causing the subsequent decline in the racial

²³ A not-for-publication appendix includes the actual and fitted values of the female disparity for all 44 states that we estimate.

²⁴ On the racially disparate impact of the crack epidemic, see Fryer et al. (2013), Evans et al. (2016), and Bjerck (2017)



(a) Female



(b) Male

Fig. 8 Fourier estimates of aggregate disparity data

Table 2 Structural change points in the fitted values of the racial disparity (global Max and Min)

Region	State	Female					Male				
		Global date	Max value	Global date	Min value	freq	Global date	Max value	Global date	Min value	freq
1	IA	1992	25.1	2014	5.3	3	1994	16.6	2016	7.8	3
1	IL	1996	12.6	2016	3.2	2	1995	13.5	1978	8.0	3
1	IN	1983	10.9	2014	1.5	3	1996	8.4	1978	4.7	3
1	KS	1990	13.7	2016	3.3	2	1995	9.7	2016	6.2	3
1	MI	1978	18.1	2012	3.8	2	1978	10.3	2008	6.5	3
1	MN	1978	30.2	2016	1.8	2	1995	22.0	2016	9.3	3
1	MO	1978	8.7	2016	0.8	3	1978	9.6	2016	3.7	3
1	NE	1990	21.3	2016	3.5	2	1978	16.1	2013	7.5	3
1	OH	1978	14.9	2016	1.5	3	1978	9.7	2016	5.3	2
1	WI	1978	26.7	2016	2.6	2	1978	17.2	2016	11.2	3
2	CT	1978	15.7	2016	3.1	1	1991	18.3	1978	8.8	2
2	DE	1992	10.6	2012	1.1	3	1992	9.7	2013	4.5	3
2	MA	1978	18.2	2016	0.9	2	1978	14.6	2016	5.9	3
2	ME	-					1996	18.5	1978	2.6	1
2	NH	-					1994	8.1	2016	2.0	2
2	NJ	1978	12.7	2016	4.5	1	2003	16.4	1978	10.8	2
2	NY	1978	9.0	2016	2.7	3	2004	12.1	1993	5.0	3
2	PA	1987	13.7	2016	2.6	3	1995	16.3	2016	8.6	3
2	RI	1978	21.1	2016	0.9	3	1992	11.9	2014	7.7	1
3	AK	1978	10.6	2016	0.6	2	1978	7.0	2016	2.5	3
3	AL	1992	4.8	2016	1.0	3	1996	5.9	2016	3.7	3
3	AR	1993	6.4	2013	1.2	3	1994	7.1	2016	4.0	3
3	FL	1978	9.5	2016	1.3	3	1991	7.9	2011	3.9	3
3	GA	1991	4.4	2016	1.1	2	1992	5.6	2016	3.4	3
3	KY	1989	9.2	2015	0.8	1	1997	7.5	2016	2.9	3
3	LA	1988	7.4	2016	1.3	3	1996	7.3	2016	4.3	3
3	MD	1978	12.4	2016	1.3	3	1978	11.3	2016	4.7	3
3	MS	1993	3.8	2016	1.0	2	1996	5.6	2015	3.3	3
3	NC	1978	5.3	2016	0.9	2	1996	7.3	1981	4.2	3
3	OK	1992	10.2	2016	1.7	3	1994	6.8	2016	4.0	3
3	SC	1993	4.6	2016	1.2	2	1997	5.7	1979	3.2	3
3	TN	1978	4.3	2016	1.0	2	1998	5.8	2016	3.8	3
3	TX	1994	8.7	2014	2.0	3	1992	8.8	1981	4.0	3
3	VA	1978	7.5	2016	1.5	2	1995	8.0	2016	5.1	2
3	WV	1978	11.6	2016	0.7	1	1978	5.7	2016	3.0	2
4	AZ	1978	9.3	2016	1.7	3	1978	7.5	2016	4.3	3
4	CA	1998	6.2	1986	3.9	2	2013	8.6	1990	4.4	3
4	CO	1989	11.1	2016	3.2	3	2003	8.0	1984	5.6	3
4	HI	1978	12.2	2016	0.2	2	1992	2.9	2015	2.0	3
4	ID	1978	41.8	2016	-2.8	2	1981	7.4	2003	2.6	3
4	MT	-					1981	8.0	2013	3.4	3
4	ND	-					1997	7.1	1988	1.9	3
4	NM	2003	8.3	1984	2.8	1	2004	8.5	1994	2.7	3
4	NV	1981	12.5	2011	1.9	2	1987	7.0	2016	3.6	3
4	OR	1978	27.4	2016	3.4	2	1991	9.3	2016	3.6	2
4	SD	-					1991	10.0	2011	3.7	1
4	UT	1981	40.0	2013	-0.3	3	1985	12.6	2016	5.5	2
4	WA	1979	20.5	2013	2.5	3	1978	8.9	2016	4.3	1

Table 2 (continued)

Region	State	Female					Male				
		Global date	Max value	Global date	Min value	freq	Global date	Max value	Global date	Min value	freq
4	WY	1988	18.9	2014	1.3	2	1995	7.0	2016	3.4	1

Region: 1 = Midwest, 2 = Northeast, 3 = South, 4 = West

Table 3 Summary — global maxima and minima

	Female		Male	
	Minima	Maxima	Minima	Maxima
1978–1989	2	29	10	15
1990–1999	0	13	3	29
2000–2016	42	1	36	5
2016	31	0	26	0

disparity, we conclude, as do Enders et al. (2019), that there is no prima facie evidence that the 1994 Crime Bill exacerbated the racial disparity in imprisonment.²⁵

One difficulty in drawing inferences about the effects of the Crime Bill is that the policy effects emanating from the bill were not all immediate. For example, the COPS program provided grants for the hiring of police officers from 1994 until the early 2000s. The gradual roll-out of the grants makes it difficult to assess the effect of this program on the timing of upturns and downturns in the racial disparity. The COPS program is estimated to have had a small effect on reducing crime (Evans and Owens 2007 and GAO 2005), so it is unlikely to have had an outsized influence on the racial disparity in imprisonment.

The 1994 bill also incentivized states to adopt truth in sentencing laws which require violent offenders to serve at least 85% of their original sentence. The adoption date by state varied, with some adoptions occurring prior to the 1994 bill. Using the information from GAO (1998), Table 6 shows the year truth-in-sentencing laws came into effect for 27 states which met the guidelines set out in the 1994 bill. Based on Table 4, for each state, we compute the upturns (Min) and downturns (Max) for the female racial disparity for the 10 years before and after the law taking effect. Turning points which occur in the year the law takes effect are not counted. Summing across the states, we find that there are 10 upturns and 14 downturns in the racial disparity for females during the 10 years prior to the adoption of

a truth-in-sentencing law. The corresponding figures during the 10 years after adoption, there are 2 upturns and 6 downturns. For states which did not have a truth-in-sentencing law that conformed with the federal guidelines (the 22 states not separately listed), we made analogous calculations. We use 1995 to define the pre and post periods, where 1995 is the median year the law becomes effective for the states listed in the table. The corresponding figures are 10 upturns and 11 downturns during the 10 years prior to 1995 and 5 upturns and 7 downturns during the 10 years post 1995. In Table 7, we perform the same computations for the male disparity, finding 10 upturns and 11 downturns during the 10 years prior to the adoption and 3 upturns and 12 downturns during the 10 years subsequent to the adoption of truth-in-sentencing laws. For the nonadopters, the corresponding figures are 12 upturns and 13 downturns during the 10 years prior to 1995 and 5 upturns and 7 downturns during the 10 years subsequent to 1995.

Truth-in-sentencing laws were a significant component of the 1994 Crime Bill, and as with the bill itself, we find no prima facie evidence that the adoption of these laws worsened the racial disparity in imprisonment. To the extent an association is visible, there seems to be mild evidence that downturns in the racial disparity become more common relative to upturns subsequent to the adoption of a truth-in-sentencing law.

The overall pattern for women and men is strikingly similar. Disparities turn upward in the 1980s and downward in the 1990s. The breadth of these changes is similar. As noted previously, the run-up in incarceration rates for black men and black women between 1978 and 1999 is driven entirely by increases in overall incarceration in the USA. The key difference between black men and black women, which is not reflected in Table 4, is the magnitude of the change in the disparity. From the 1990s onward, the reduction in the disparity for black women far outstrips the reduction for black men.

Welfare reform is a policy change in the 1990s which might affect women differently than men. However, this occurs in 1996, and many of the downturns for women in the 1990s predate this. In fact, as noted above, there are 16 states where the disparity for women turns down in the 1990–1994 period without ever turning upward in the remainder of the sample. These downward movements clearly predate welfare reform. Thus, welfare reform did

²⁵ Of course it is not possible to rule out the possibility that the racial disparity would have fallen even faster absent the crime bill, so our conclusions about the effect of the bill are necessarily tentative. However, the timing and the magnitude of the fall in the female disparity make it very unlikely that the crime bill is placing significant upward pressure on the disparity.

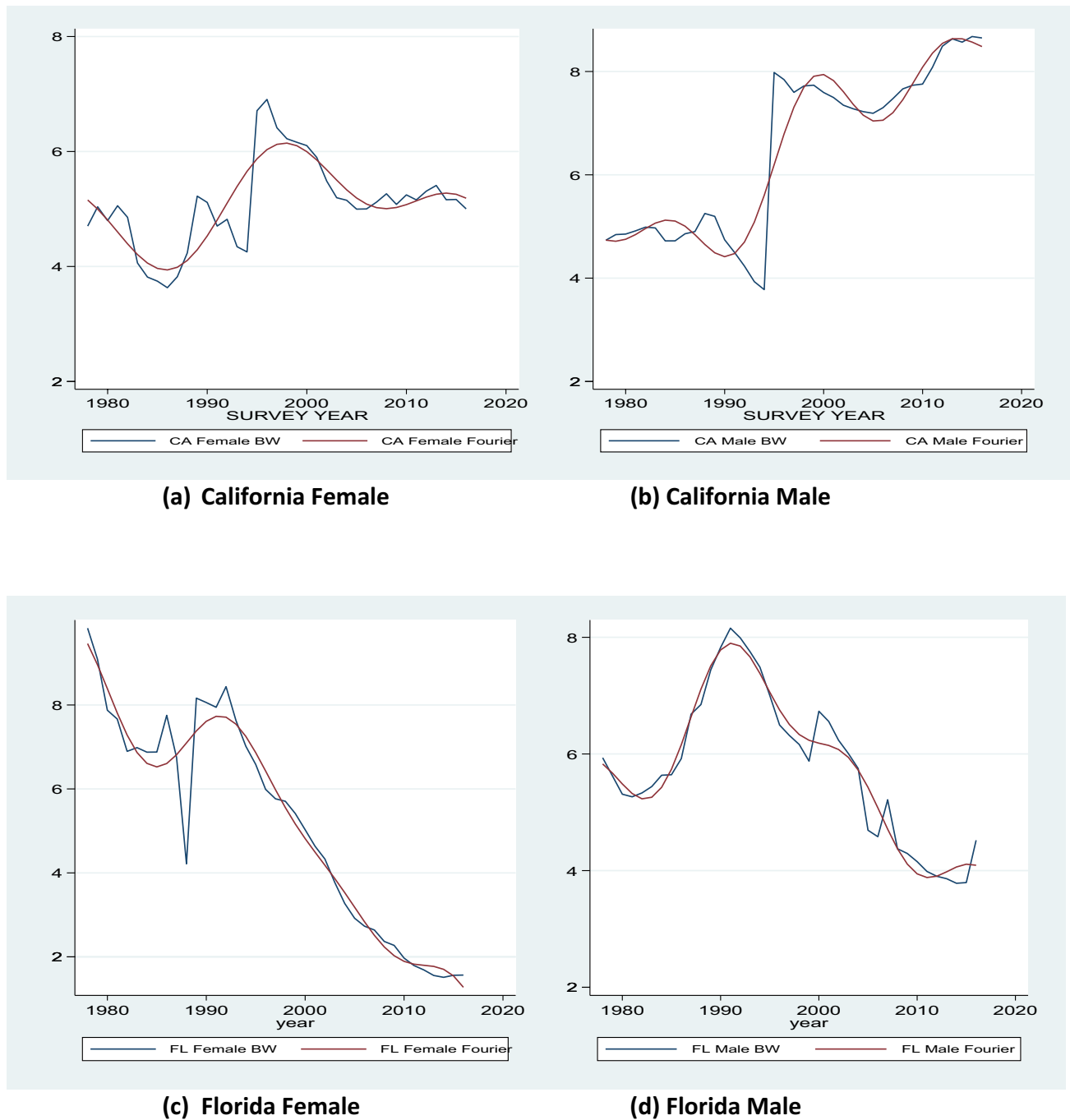


Fig. 9 Fourier estimates in two states

not initiate the decline for women, though it may possibly have had a role in sustaining it. Similarly, there is a 1990’s increase in Medicaid eligibility for individuals born after September 30, 1983, which primarily affected black children. Arenberg et al. (2020) find that black children born right after the cutoff were 5% less likely to be incarcerated by age 28. However, this would not have

had an impact on incarceration until the late 1990s, well after the downturn begins.

Imprisonment for drug crimes clearly plays a role in the run-up of the racial disparity from the mid-1980s to the mid-1990s as well as in the subsequent decline. Among the incarcerated, in 1985, 9.4% of whites and 7.9% of blacks were imprisoned for drug crimes. By 1995, the respective

Table 4 Structural change points in the fitted values of the racial disparity (local Max and Min)

Region	State	Female disparity		Male disparity	
		Local Min dates	Local Max dates	Local Min dates	Local Max dates
1	IA	1985, 2002	1992, 2005	2005	1994, 2009
1	IL	1985	1996		1995
1	IN	1992	1983, 1996		1996
1	KS	1981	1990	1986	1995
1	MI	2012		2008	
1	MN	1984, 2007	1991, 2010	1986, 2005	1982, 1995, 2010
1	MO	1985	1992	1985	1992
1	NE	1982, 2005	1990, 2011	1988, 2002, 2013	1992, 2007
1	OH	1984	1990	1984	1994
1	WI	1987	1994	1988	1996
2	CT				1991
2	DE	1985, 2012	1992	1985, 2001, 2013	1992, 2005
2	MA	2006	2011	1984	1990
2	ME				1996
2	NH			1983, 2006	1994, 2009
2	NJ	1986	1992	1990	1985, 2003
2	NY	1991	2001	1993	2004
2	PA		1987	1985	1982, 1995
2	RI	1982, 1995, 2008	1987, 2000, 2013		1992
3	AK	1986, 2006	1995, 2011	1985, 2008	1997, 2012
3	AL	1986	1992		1996
3	AR	1986, 2002, 2013	1993, 2006	1986	1994
3	FL	1985	1991	1982, 2011	1991
3	GA	1981	1991	1982, 2007	1992, 2012
3	KY		1989	1989	1985
3	LA	1997, 2010	1988	1987	1981, 1996
3	MD	1986	1991	1985	1993
3	MS	1982	1993		1996
3	NC	1985	1994	1981	1996
3	OK	1984	1992	1982, 2004	1994, 2009
3	SC	1981	1993	2005	1997, 2008
3	TN	1986	1995	1986	1998
3	TX	1986	1994	1981	1992
3	VA	1985	1993	1983	1995
3	WV			1985	1995
4	AZ	1984	1990	1995, 2011	2003
4	CA	1986, 2008	1998	1990, 2005	1984, 2000, 2013
4	CO	1981, 1995	1989, 1998	1984, 1994	1990, 2003
4	HI	1991, 2004	1995, 2011	1986, 2001	1992, 2007
4	ID	1990, 2005	1996, 2011	1991, 2003, 2013	1981, 1995, 2009
4	MT			1989, 2002, 2013	1981, 1994, 2007
4	ND			1988, 2004	1982, 1997, 2008
4	NM	1984	2003	1984, 1994	1988, 2004
4	NV	2011	1981	2006	1987, 2011
4	OR	2009	2013	1981	1991
4	SD			2011	1991
4	UT	1989, 2002, 2013	1981, 1993, 2006		1985
4	WA	1990, 2013	1994		

Table 4 (continued)

Region	State	Female disparity		Male disparity	
		Local Min dates	Local Max dates	Local Min dates	Local Max dates
4	WY	2003	1988, 2005		1995

Region: 1 = Midwest, 2 = Northeast, 3 = South, 4 = West

Table 5 Summary local maxima and minima

	Female		Male	
	Minima	Maxima	Minima	Maxima
1981–1989	29	9	29	12
1990–1999	8	31	7	38
2000–2013	20	15	23	21
1984–1993	27	25	25	20
1995–2004	8	11	8	25

figures for whites and blacks are 18.2% and 27.3%.²⁶ For both groups, there is a sharp increase in imprisonment for drug crimes, but for black Americans, the increase is substantially greater. In particular, the number of black persons imprisoned for drug crimes grows by 707% during this period, while for whites, the figure is 306%. By 2016 among the incarcerated, 15.1% of whites and 14.3% of blacks are imprisoned for drug crimes reducing this category as a source of disparity in imprisonment.²⁷ It seems clear that the waxing and waning of the crack epidemic along with the rise of the opioid epidemic are helping to drive changes in the racial disparity over time. The data above combines both men and women, but the effect on women is especially pronounced. As documented by Sabol et al. (2019, p. 11), black women experience a 84.5% reduction in their imprisonment rate for drug crimes from 2000 to 2016, while white women experience a 58.5% increase in the imprisonment rate for these crimes.

There are other factors that may explain the downturn in the racial disparity in the 1990s. Beginning in the early 1990s, there is a sustained fall in crime. For the 2000–2016 period, Sabol et al. (2019) present evidence that rates of offending fell more among the black population than the white population and that this contributed

Table 6 Structural change in the female disparity and truth in sentencing laws

State	Year effective	10 years prior ^a		10 year post ^a	
		Min	Max	Min	Max
Arizona	1994	1	1	0	0
California	1994	1	0	0	1
Connecticut	1996	0	0	0	0
Delaware	1990	1	0	0	1
Florida	1995	1	1	0	0
Georgia	1995	0	1	0	0
Iowa	1996	0	1	1	1
Kansas	1993	0	1	0	0
Louisiana	1997	0	1	0	0
Maine	1995	—	—	—	—
Michigan	1994	0	0	0	0
Minnesota	1993	1	1	0	0
Mississippi	1995	0	1	0	0
Missouri	1994	1	1	0	0
New Jersey	1997	0	1	0	0
New York	1995	1	0	0	1
North Carolina	1994	1	0	0	0
North Dakota	1995	—	—	—	—
Ohio	1996	0	1	0	0
Oklahoma	1998	0	1	0	0
Oregon	1995	0	0	0	0
Pennsylvania	1911	—	—	—	—
South Dakota	1996	—	—	—	—
Tennessee	1995	1	0	0	0
Utah ^b	1985	0	1	1	1
Virginia	1995	1	1	0	0
Washington	1990	0	0	0	1
Sum		10	14	2	6
Other states	1995 ^c	10	11	5	7

Source for columns 1 and 2: GAO (1998, Fig. 1). ^aAny Max or Min in the year the policy is made effective is not counted in these columns. Two Min and two Max occur in the year the policy is made effective. ^bWe only have 7 years of prior data for Utah because the enactment date is 1985. ^cFor nonadopters, the pre and post period is relative to 1995, which is the median year truth-in-sentencing laws become effective

²⁶ See Table 13 in Mumola and Beck (1997). This same table provides the figures, by race, on the percentage growth in prisoners serving time for drug crimes.

²⁷ See Table 13 in Carson (2018). Note that because blacks have a higher imprisonment rate than whites, even if the two groups have the same percentage in prison due to drug crimes, this is still consistent with a higher per capita imprisonment for drug crimes for black Americans.

to a reduced racial disparity in imprisonment. To the extent that COPS grants reduced crime, they may have been a contributing factor in the reduction of the racial

Table 7 Structural change in the male disparity and truth in sentencing laws

State	Year effective	10 years prior ^a		10 year post ^a	
		Min	Max	Min	Max
Arizona	1994	0	0	0	1
California	1994	1	1	0	1
Connecticut	1996	0	1	0	0
Delaware	1990	1	0	0	1
Florida	1995	0	1	0	0
Georgia	1995	0	1	0	0
Iowa	1996	0	1	1	0
Kansas	1993	1	0	0	1
Louisiana	1997	1	1	0	0
Maine	1995	0	0	0	1
Michigan	1994	0	0	0	0
Minnesota	1993	1	0	0	1
Mississippi	1995	0	0	0	1
Missouri	1994	1	1	0	0
New Jersey	1997	1	0	0	1
New York	1995	1	0	0	1
North Carolina	1994	0	0	0	1
North Dakota	1995	1	0	1	1
Ohio	1996	0	1	0	0
Oklahoma	1998	0	1	1	0
Oregon	1995	0	1	0	0
Pennsylvania	1911	--	--	--	--
South Dakota	1996	0	1	0	0
Tennessee	1995	1	0	0	1
Utah ^b	1985	0	0	0	0
Virginia	1995	0	0	0	0
Washington	1990	0	0	0	0
Sum		10	11	3	12
Other states	1995 ^c	12	13	5	7

Source for columns 1 and 2: GAO (1998, Fig. 1). ^aAny Max or Min in the year the policy is made effective is not counted in these columns. Two Min and two Max occur in the year the policy is made effective.

^bWe only have 7 years of prior data for Utah because the enactment date is 1985. ^cFor nonadopters, the pre and post period is relative to 1995, which is the median year truth-in-sentencing laws become effective

disparity. Coincident with the fall in crime in the 1990s are improvements in black Americans' economic outcomes. Between 1992 and 2000, the black unemployment rate falls from 14.2 to 7.6%, and the poverty rate falls from 33.4 to 22.5%. While both of these rates rise during subsequent recessions, both achieve new lows during the recovery from the Great Recession.

It is beyond the scope of this paper to precisely estimate the contributions of each factor above to the fall in the racial disparity, but it is clear that there are a broad array of factors dating to the 1990s which are plausibly contributing to the decline in the racial disparity in imprisonment.

Conclusion

We analyze incarceration rates and the racial disparity in imprisonment for black women and black men between 1978 and 2016. There is a good deal in common between the two groups. The racial disparity is initially high and of similar magnitude for both groups. Black women and black men each experienced a very large increase in imprisonment between 1978 and 1999. While the imprisonment rate subsequently falls for both groups, the drop is much steeper for black women than for black men. Moreover, the fall for black women can be completely attributed to a fall in racial disparity. The smaller reduction experienced by black men is due to a fall in the racial disparity and a fall in the overall incarceration rate for men.

The overall dynamics of the racial disparity look similar for black women and black men. The 1980s are marked by upturns in the racial disparity, and the 1990s by downturns. The upturns are likely associated with the crack epidemic and the downturns with the waning of this epidemic. In addition, the rise of the opioid epidemic appears to be important as it has a disparate impact on the imprisonment of white women. As do Enders et al. (2019), who examine black males only, we find no prima facie evidence that the 1994 Crime Bill exacerbated the racial disparity in imprisonment. For both women and men, the south plays a large role in the upturn in incarceration between 1978 and 1999 as well as in the downturn between 1999 and 2016. However, this contribution is largely in line with the large proportion of the black population which lives in the south. California is an outlier for both men and women, and both groups see outcomes that are worse than those observed in the country at large. While the country as a whole has a very large reduction in the racial disparity for women, California does not. The racial disparity for men in California rises sharply from the early 1990s until the end of our sample, a period during which the disparity for men was generally falling.

Beginning in the 1990s, there are widespread reductions in the racial disparity for both black women and

black men. The main difference between the groups is that the magnitude of the reduction is much deeper for women than for men. A key question for future research is to answer why this divergence in outcomes for black women and black men emerges in the 1990s.

Appendix

In this appendix, we provide details on the decomposition performed in “Decomposition Analysis” section. We also provided the estimated equations from the Fourier analysis used to fit the female and male disparity at the national level in “Estimating State-Level Turning Points in the Racial Disparity” section. Note that all of the equations for the decomposition analysis are reproduced from Enders et al. (2019). Since the equations describing the decompositions for males and females would be identical except for the “M” or “F” subscript, in what follows these subscripts are omitted.

Consider first how the state-level black incarceration rates aggregate to form the national rate:

$$B_N^t = \sum_{i=1}^{50} S_i^t B_i^t, \tag{A1}$$

where B_N^t is the national black incarceration rate in year t , and S_i^t is state i 's share of the national black population. We are interested in how changes in state i 's black incarceration rate contribute to the national rate over a given time period, say, 1978–1999. However, the weights S_i also change. This raises the question of whether to use the weight from 1978 or 1999 when measuring the effect of B_i on B_N . Enders et al. (2019) resolve this by using the average weight as follows:

$$B_{N_i}^{1999-1978} = (0.5)(B_i^{1999} - B_i^{1978})(S_i^{1999} + S_i^{1978}). \tag{A2}$$

The contribution of state i to the national change between 2016 and 1999 can be expressed in an analogous manner. The changes in the national black incarceration rate can be exactly decomposed into changes in B_i and changes in S_i :

$$B_N^{1999} - B_N^{1978} = 0.5 \sum_{i=1}^{50} [(B_i^{1999} - B_i^{1978})(S_i^{1999} + S_i^{1978}) + (S_i^{1999} - S_i^{1978})(B_i^{1999} + B_i^{1978})]. \tag{A.3}$$

This is shown for changes between 1978 and 1999, but the analogous equation holds for 1999 and 2016. Because they are not of independent interest, we do not report the effect of changes in S on the national black incarceration rate in the main body of the paper.

The next step is to decompose changes in B_i into three different components of state i 's changes in (i) its overall incarceration rate, A_i , (ii) its racial disparity, $r_i = B_i/W_i$, and (iii) the ratio of black persons, x_i , which is defined as the number of black persons (either male or female) in state i divided by the sum of black plus white persons (either male or female) in that state. Here, the overall incarceration rate is the weighted average of the black and the white rate:

$$A_i^t = x_i^t B_i^t + (1 - x_i^t) W_i^t. \tag{A4}$$

We solve for B_i^t , while noting $W_i^t = B_i^t/r_i^t$, to obtain the following:

$$B_i^t = \frac{r_i^t A_i^t}{r_i^t x_i^t + 1 - x_i^t}. \tag{A5}$$

Equation (A5) expresses the black incarceration rate in state i as a function of the overall incarceration rate, the racial disparity, and the black population share in that state.

A key issue is that if we want to use (A5) to estimate how changes in r , x , and A affect B , we need to decide whether to use the initial or final values of r , x , and A . Enders et al. (2019) resolve this by doing the estimate each of the four possible ways and then taking the average. Using the years 1978 and 1999 as our example, we compute the contributions to the change in B_i by the overall incarceration rate, $A_{Bi}^{1999-1978}$, by the racial disparity, $r_{Bi}^{1999-1978}$, and by the demographic weights $x_{Bi}^{1999-1978}$ as follows:

$$r_{Bi}^{1999-1978} = 0.25 \left(\frac{r^{1999} A^{1978}}{r^{1999} x^{1978} + 1 - x^{1978}} - \frac{r^{1978} A^{1978}}{r^{1978} x^{1978} + 1 - x^{1978}} + \frac{r^{1999} A^{1999}}{r^{1999} x^{1978} + 1 - x^{1978}} - \frac{r^{1978} A^{1999}}{r^{1978} x^{1978} + 1 - x^{1978}} + \frac{r^{1999} A^{1978}}{r^{1999} x^{1999} + 1 - x^{1999}} - \frac{r^{1978} A^{1978}}{r^{1978} x^{1999} + 1 - x^{1999}} + \frac{r^{1999} A^{1999}}{r^{1999} x^{1999} + 1 - x^{1999}} - \frac{r^{1978} A^{1999}}{r^{1978} x^{1999} + 1 - x^{1999}} \right) \tag{A.6}$$

$$A_{Bi}^{1999-1978} = 0.25 \left(\frac{r^{1978}A^{1999}}{r^{1978}x^{1978} + 1 - x^{1978}} - \frac{r^{1978}A^{1978}}{r^{1978}x^{1978} + 1 - x^{1978}} + \frac{r^{1999}A^{1999}}{r^{1999}x^{1978} + 1 - x^{1978}} - \frac{r^{1999}A^{1978}}{r^{1999}x^{1978} + 1 - x^{1978}} + \frac{r^{1978}A^{1999}}{r^{1978}x^{1999} + 1 - x^{1999}} - \frac{r^{1978}A^{1978}}{r^{1978}x^{1999} + 1 - x^{1999}} + \frac{r^{1999}A^{1999}}{r^{1999}x^{1999} + 1 - x^{1999}} - \frac{r^{1999}A^{1978}}{r^{1999}x^{1999} + 1 - x^{1999}} \right) \tag{A.7}$$

$$x_{Bi}^{1999-1978} = 0.25 \left(\frac{r^{1978}A^{1978}}{r^{1978}x^{1999} + 1 - x^{1999}} - \frac{r^{1978}A^{1978}}{r^{1978}x^{1978} + 1 - x^{1978}} + \frac{r^{1999}A^{1978}}{r^{1999}x^{1999} + 1 - x^{1999}} - \frac{r^{1999}A^{1978}}{r^{1999}x^{1978} + 1 - x^{1978}} + \frac{r^{1978}A^{1999}}{r^{1978}x^{1999} + 1 - x^{1999}} - \frac{r^{1978}A^{1999}}{r^{1978}x^{1978} + 1 - x^{1978}} + \frac{r^{1999}A^{1999}}{r^{1999}x^{1999} + 1 - x^{1999}} - \frac{r^{1999}A^{1978}}{r^{1999}x^{1978} + 1 - x^{1978}} \right) \tag{A.8}$$

We can use analogous expressions to compute $A_{Bi}^{2016-1999}$, $r_{Bi}^{2016-1999}$, and $x_{Bi}^{2016-1999}$. The decomposition of changes in B_i is not exact. We can use (A.3)–(A.8) to show that:

$$r_{Bi}^{1999-1978} + A_{Bi}^{1999-1978} + x_{Bi}^{1999-1978} - (B_i^{1999} - B_i^{1978}) = (0.25)(A^{1999} - A^{1978})(x^{1999} - x^{1978})Z, \tag{A.9}$$

where $Z = \frac{r^{1999}(r^{1999}-1)}{(r^{1999}x^{1978} + 1 - x^{1978})(r^{1999}x^{1999} + 1 - x^{1999})} - \frac{r^{1978}(r^{1978}-1)}{(r^{1978}x^{1978} + 1 - x^{1978})(r^{1978}x^{1999} + 1 - x^{1999})}$.

We denote the term on the right-hand side of (A.9) as the remainder. Note that this term can either be positive or negative. On average, the absolute value of the remainders are a small percentage of the total change in imprisonment in a given state. There are a few states with large remainders, but those have very little influence on the aggregate results. For women, the average absolute value of the remainders are 4.25% and 2.66% for

the 1978–1999 and 1999–2016 periods respectively. For men, the percentages are 0.84% and 1.41% respectively.

We convert the absolute changes computed above into percentage changes. For example, $(B_{Ni}^{1999-1978}/B_N^{1999-1978})x100$ is the percentage contribution of the increase in black incarceration in state i to the national increase and $(r_{Bi}^{1999-1978}/B_{Ni}^{1999-1978})x100$ is the percentage contribution of changes in the racial disparity in state i to the overall increase in incarceration in state i both for the 1978–1999 period. The product of these two terms is $(r_{Bi}^{1999-1978}/B_N^{1999-1978})x100$, which is the percentage contribution of the change in the racial disparity in state i to the national increase in black incarceration between 1999 and 1978. These figures are then summed across states to obtain the regional contribution and sum over all regions to obtain the national contribution. These are the figures reported in Table 1. The contributions of A and x are derived in an analogous manner, as are the contributions of each of these variables in the 1999–2016 period. Because they are not of independent interest, the effects of changes in x are not reported in Table 1.

Equations (A10) and (A11) provide the estimates from the Fourier analysis in “Estimating State-Level Turning Points in the Racial Disparity” section for the female and male racial disparity at the national level. The estimation result for female disparities is given as:

$$r'_i = 8.32 - 0.16t - 0.04\sin\left(\frac{2\pi t}{T}\right) - 0.83\cos\left(\frac{2\pi t}{T}\right) - 0.15\sin\left(\frac{2\pi 2t}{T}\right) + 0.49\cos\left(\frac{2\pi 2t}{T}\right) \tag{A6}$$

(86.9) (–33.1) (–0.59) (–26.8) (–3.48) (15.9)

where t -statistics are given in parentheses. The result for male disparities is obtained as:

$$r'_i = 7.38 - 0.04t - 0.36\sin\left(\frac{2\pi t}{T}\right) - 0.72\cos\left(\frac{2\pi t}{T}\right) - 0.10\sin\left(\frac{2\pi 2t}{T}\right) + 0.19\cos\left(\frac{2\pi 2t}{T}\right) \tag{A7}$$

(69.4) (–8.25) (–4.83) (–18.1) (–1.96) (4.85)

Table 8

Table 8 Correlation between the fitted national factor and state-level racial disparities

Region	State	Female			Male		
		Whole	Disparities		Whole	Disparities	
			Before	After		Before	After
			1994	1994		1994	1994
1	IA	0.79	-0.15	0.94	0.88	0.66	0.97
1	IL	0.70	0.09	0.98	0.75	0.63	0.99
1	IN	0.93	0.35	0.95	0.71	0.48	0.97
1	KS	0.92	-0.39	0.97	0.92	0.60	0.96
1	MI	0.92	0.84	0.99	0.53	-0.36	0.89
1	MN	0.92	0.07	0.95	0.90	0.74	0.94
1	MO	0.93	0.45	0.99	0.77	0.56	0.97
1	NE	0.89	-0.31	0.90	0.51	-0.12	0.80
1	OH	0.98	0.53	0.99	0.93	0.77	0.99
1	WI	0.95	0.78	0.99	0.80	0.14	0.96
2	CT	0.95	0.36	0.99	0.77	0.42	0.99
2	DE	0.92	-0.23	0.96	0.86	0.83	0.91
2	MA	0.89	0.94	0.98	0.69	0.38	0.96
2	ME	-			0.24	0.51	0.33
2	NH	-			0.75	0.87	0.92
2	NJ	0.83	0.11	0.90	-0.15	0.36	0.07
2	NY	0.39	0.90	0.51	-0.48	-0.23	-0.39
2	PA	0.93	-0.58	0.99	0.95	0.69	0.98
2	RI	0.71	0.31	0.45	0.45	0.04	0.43
3	AK	0.77	0.64	0.95	0.56	0.33	0.95
3	AL	0.97	0.08	0.99	0.92	0.73	0.98
3	AR	0.86	-0.11	0.94	0.89	0.68	0.96
3	FL	0.96	0.47	0.99	0.88	0.85	0.92
3	GA	0.90	-0.65	0.95	0.87	0.89	0.92
3	KY	0.77	-0.08	0.98	0.89	0.17	0.98
3	LA	0.84	-0.72	0.87	0.95	0.64	0.99
3	MD	0.94	0.90	0.93	0.82	0.35	0.97
3	MS	0.84	-0.41	0.96	0.90	0.60	0.98
3	NC	0.89	0.17	0.99	0.56	0.88	0.98
3	OK	0.85	-0.22	0.96	0.89	0.92	0.87
3	SC	0.71	-0.72	0.99	0.10	0.81	0.84
3	TN	0.81	0.39	0.93	0.63	0.68	0.89
3	TX	0.72	-0.36	0.98	0.72	0.80	0.85
3	VA	0.92	0.18	1.00	0.85	0.91	0.98
3	WV	0.80	0.52	0.96	0.88	0.35	0.96
4	AZ	0.91	0.40	0.89	0.10	-0.25	0.04
4	CA	-0.30	0.31	0.60	-0.52	-0.68	-0.51
4	CO	0.78	-0.54	0.92	-0.10	0.57	0.01
4	HI	0.60	0.79	0.55	0.52	0.21	0.66
4	ID	0.62	0.83	0.77	0.16	-0.69	0.52
4	MT	-			0.42	-0.32	0.69
4	ND	-			0.13	0.14	0.70
4	NM	-0.46	-0.03	0.24	-0.45	-0.43	-0.33
4	NV	0.85	0.55	0.94	0.54	-0.08	0.90
4	OR	0.89	0.80	0.89	0.81	0.64	0.97
4	SD	-			0.33	0.45	0.85
4	UT	0.81	0.39	0.85	0.65	-0.51	0.92
4	WA	0.93	0.78	0.99	0.72	-0.19	0.95
4	WY	0.57	-0.44	0.83	0.84	0.44	0.95

Region: 1 = Midwest, 2 = Northeast, 3 = South, 4 = West

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Author Contribution Souto put the data together and transformed the data. She did the decomposition computations. Lee did the Fourier analysis and did most of the work writing up this analysis. Pecorino developed the decomposition method in a previous paper. He did most of the initial writing outside of the results sections. By the end, all authors went through the paper and made contributions to the writing in all sections, and all authors made suggestions about the presentation of the data and how it was analyzed.

Data Availability The data used in this paper are all publicly available. The authors will make their data file available upon request.

Declarations

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