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Locked into Emissions: How Mass Incarceration Contributes to Climate Change

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Abstract

The phenomenon of mass incarceration has dramatically altered the economic and infrastructural landscape of the United States. These changes have numerous implications regarding the use of fossil fuels, which are the single largest contributor to climate change. The present study argues that mass incarceration creates three social patterns that result in significant increases in industrial emissions. (1) Mass incarceration incentivizes further industrial development through the construction of new prisons and the continued maintenance of existing prisons to house prisoners. (2) The needs of the millions of individuals currently incarcerated in the United States incentivize industrial expansion through the production of goods and materials used inside prisons. (3) Incarcerated individuals are being used to reduce the cost of labor, which expands economic growth. We construct several fixed-effects panel regression models with robust standard errors predicting industrial emissions for U.S. states from 1997 to 2016 to assess how increases in the number of individuals in U.S. state, federal, and private prisons is correlated with industrial emissions over time. We find that increases in incarceration within states are associated with increases in industrial emissions, and that increases in incarceration lead to a more tightly coupled association between gross domestic product per capita and industrial emissions.

Keywords

mass incarceration, climate change, prison industrial complex, environmental sociology

Introduction

The number of individuals who are incarcerated in the United States is a source of revenue for over 3,100 private corporations (Urban Justice Center 2018). Broadly speaking, these 3,100 corporations are a part of what is known as the prison industrial complex (PIC), a set of political, bureaucratic, and economic interests that are driven by profit to increase imprisonment (Cooper et al. 2016). While the political, economic, and social implications of the PIC have been explored extensively (see Davis 2003; Davis and Barsamian 1999; Schlosser 1998), little attention has been given to the environmental consequences of the PIC.

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Pellow (2018, 2019) has demonstrated that prisons are loci for environmental injustice, exacerbating preexisting forms of social inequality such that prisoners are disproportionately exposed to environmental harm.

There are numerous reasons to suspect that the PIC also contributes to environmental harm. On one hand, incarceration works as a "locus for the coercion of demand and consumption," compelling those who would otherwise marginally participate in markets to become active, perpetual consumers (Deckard Delia 2017). The U.S. government on average spends $485 million annually on capital for incarceration, which goes toward funding construction and renovation in prisons (Henrichson and Delaney 2012). A number of corporations within the PIC are the beneficiaries of this spending and directly contribute to industrial emissions by burning fossil fuels to produce products used to build and maintain prisons (Urban Justice Center 2018).

In addition, some entities within the PIC have benefited financially from prison work programs that use prison labor to manufacture industrial equipment for private companies, state governments, and the U.S. federal government (Goodridge, Jantz, and Leslie Christian 2018). Many prison employment programs, such as the federal employment program UNICOR,[1] pay prisoners as little as $0.23 to $1.15 per hour (far below the federal minimum wages paid to non-incarcerated United States citizens) for their labor (UNICOR 2019), which helps to stimulate industrial growth by reducing the cost of labor.

The consumption of industrial goods by incarcerated people and the use of incarcerated labor for industrial development form the basis of our hypothesize that the PIC contributes to industrial emissions by perpetuating the treadmill of production (henceforth ToP) (Gould, Pellow, and Schnaiberg 2015; Schnaiberg 1980). ToP is a phenomenon that occurs when decreases in the social efficiency of natural resource use within the productive sphere increases environmental degradation. The present study seeks to explore how mass incarceration decreases the social efficiency of natural resource use within the productive sphere by exploring how changes in the percentage of people in the United States who are incarcerated accelerates states' contribution to climate change, which accelerates the global depletion of ecosystems. We use a series of fixed-effects panel regression models with robust standard errors, and unit-specific intercepts for all 50 U.S. states and the District of Columbia, as well as time dummies from 1997 to 2016 to estimate how the percent of individuals imprisoned in state, private, and federal penitentiaries is associated with industrial CO_2 emissions. We argue that as the percentage of people incarcerated increases over time, the demand to construct and maintain prisons will increase the amount of fossil fuels used in industrial development. Furthermore, we argue the increasing percentage of incarcerated people will result in more emissions from industrial processes as economic activity grows, because incarceration facilitates industrial expansion through coerced consumption of industrial goods and increased industrial activity within prisons. This process stimulates both economic activity and emissions, resulting in a tighter coupling of economic growth and industrial emissions. The goal of our study is to encourage further discussion on the environmental consequences of mass incarceration by demonstrating one way in which incarceration contributes to environmental degradation.

The Political Economy of Mass Incarceration

Mass incarceration fills a void left by a shrinking welfare state onset by neoliberal policies (Wacquant 2009). While impoverished communities, particularly poor communities of color, have historically been disproportionately incarcerated in the United States, the era of mass incarceration is distinct in that it exerts a systematic influence on the livelihood of poor people in general, and young Black men in particular (Holzer, Offner, and Sorensen 2005; Western and Wildeman 2009).

In the 1970s, employment in manufacturing began to decline in the United States due to outsourcing, rising productivity, and international trade (Elwell 2004; Shapira and Teitz

2017). Harvey (2003) argued that these shifts were part of a neoliberal restructuring effort within global capitalism that saw corporate elites reduce the power of labor and revolutionary movements through various political and economic actions. This included a number of international coups in favor of regimes that were sympathetic to the labor needs of multinational corporations, and policies in the global North that reduced the size of the welfare state (Streeck 2014).

Reacting to the increased mobility of capital—itself a result of neoliberal governance approaches—local and state governments reduced taxes on capital gains and large corporations to attract private investment in municipalities (Harvey 2003; Streeck 2014), which ultimately increased state borrowing. As government revenues from taxes diminished and debt from borrowing increased, states began to cut funding for wage supplement programs to avoid fiscal crises (O'connor 2017), which disproportionately impacted poor communities of color. Individuals in communities that resisted these changes became the target of the emerging carceral state (Camp 2016).

Camp (2016) argued that the modern carceral state emerged by constructing racial enemies out of those resisting the changes of neoliberalism. This legitimized the state and enabled it to concentrate on the maintenance of order during a period of economic restructuring. In general, the rise of the carceral state under neoliberalism represents a shift in how the state responds to civil disobedience. Whereas in the past the state responded to disobedience by expanding welfare, under neoliberalism, the state uses incarceration (among other symbolically violent tactics) to respond to mass unrest by criminalizing community responses to economic shocks (Fording 2001). For example, in the early 1970s the war on drugs disproportionately targeted poor communities of color ravaged by industrial divestment (Mauer 2006). This worked by criminalizing drug use within poor Black and brown communities hurt by deindustrialization, despite the fact that rates of drug use are not significantly different across race and class (Alexander 2012; Saxe et al. 2001). Furthermore, the unequal criminalization of drug use in Black and brown communities resulted in the disproportionate use of militarized police forces, such as SWAT teams, to terrorize poor Black and brown neighborhoods (Alexander 2012).

During this same period, the American Legislative Exchange Council (ALEC) spent millions of dollars lobbying state and federal government(s) to change laws around non-violent crimes, arrestable offenses, and to extend sentencing periods for various crimes, which functioned to increase the total number of incarcerated individuals (Cooper et al. 2016). The use of mass surveillance in Black and brown communities during this period—aimed at suppressing resistance—also contributed directly to the rise of the carceral state (Thompson 2010; Wacquant 2009; Wang 2018).

In addition to the explicit criminalization and terrorization of Black and brown communities, the carceral state also targeted the broader gamut of communities heavily affected by industrial divestment (Shelden and Vasiliev 2017). This included a disproportionate number of poor white individuals as well as physically and mentally disabled people (Rembis 2014; Shelden and Vasiliev 2017; Thompson 2010). Wang (2018) described this phenomenon as *carceral capitalism*, where individuals are policed on a continuum based on "probabilistic ranking of subjects according to risk" (125). These risks are determined based on the "likelihood of criminal behavior," which justifies the surveillance of marginalized communities, and increases the probability of incarceration for individuals within such communities. While neoliberalism led to the initial acceleration of incarceration, the PIC represents a unique political-economic response to the problems of mass incarceration—one that facilitates further economic growth while also contributing to industrial emissions.

The Prison Industrial Complex's Contribution to Industrial Emissions

Beginning in the mid-1990s, a number of private corporations and politicians began to benefit financially and politically from the existence of large prison populations (Elk and Sloan 2011; Gilmore 2007; Hallinan 2003; Herival and Wright 2007; Thompson 2010, 2012). These groups poured substantial resources into lobbying for more punitive laws, fewer restrictions on the use of prison labor, and reduced regulation of private prison management. Collectively, these efforts comprise the PIC—a collection of corporations, organizations, and groups with collective interests that benefit from the existence of large prison populations.

While the PIC profits financially from mass incarceration in a multitude of ways, there are three specific forms of profit that result in increased fossil fuel use within U.S. states: (1) private contractors responsible for producing equipment used to construct and maintain prisons benefit from the increased demand for prisoner housing; (2) private corporations responsible for producing the goods used by prisoners, such as beds and clothing, benefit from the coerced consumption of an ever-growing prison population; (3) federal, state, and private industries benefit from their contracts for cheap labor provided by prisoners.

The Increased Demand for Prison Construction

The PIC encourages demand for goods used to construct and maintain prisons by transforming socioeconomic crises into economic opportunities; this phenomenon is known as *Disaster Capitalism* (Klein and Peet 2008). Specifically, the socioeconomic conditions that lead to mass incarceration often benefit private corporations who receive state and federal funds to house prisoners. For example, after inmate populations in New York had fallen to record lows in the early 1970s, harsh drug laws doubled the prison population within a decade—creating a crisis of overcrowding. In response, the state turned to its Urban Development Corporation—which had the authority to issue bonds without voter approval—to finance a 12-year, $7-billion project to construct new prisons and prison cells across the state (Schlosser 1998).

Across the United States, mass incarceration increases the use of industrial equipment by generating a demand for the construction of prisons. Between 1980 and 2004, 936 prisons were built in the United States, as compared with the 711 prisons built between 1811 and 1979 (Lawrence and Travis 2004). Federal and state governments fund the construction of many new prisons by issuing bonds to private investors. These investors create profits by collecting interest from these bonds and entering into contracts with private prison operators, who in turn create profits by reducing the per diem cost of housing incarcerated people (Henrichson and Delaney 2012). The materials and processes involved in the construction of new prisons, as well as the renovation of existing prisons, require substantial amounts of fossil fuels (Huling 2002). The outcome of this is an overall increase in states' use of fossil fuels.

Increased Demand for Goods Necessary for Day-to-Day Living within Prison

Housing people in prison requires the consistent provision of numerous goods and services, many of which are necessary for day-to-day living, and are produced using fossil fuels. The United States spends over $80 billion per year on prisons and more than half of this money is spent on transactions with the thousands of private corporations that provide services to and within prisons (Urban Justice Center 2018). Prisoners require beds, clothing, hygiene products, and furniture among other goods, which are produced by private corporations with the explicit aim of profiting from prison populations. The production of clothing and other textiles, some of which are used exclusively within prisons, rely on carbon intensive processes that contribute to climate change (Kerr and Landry 2017). Private corporations in the United States are responsible for producing these materials for prisoners, who represent to these corporations a source of revenue. For example, privately traded prison supply companies manufacture and distribute mattresses, uniforms, hygiene products, and other items for prisons around the United States. These companies have continuously expanded their production over time in response to a growing demand brought about by consistent increases in the size of the incarcerated population (Gargan 2016).

Prison Labor Used for Industrial Production

The use of prison labor to produce industrial goods also contributes to industrial development and, as a result, industrial emissions. Prison labor is used to subsidize federal expenditures by creating a monopoly on government contracts for textile production (Reynolds 1997). For example, UNICOR, a federal work program, touts fair wages and recidivism reduction, while their program's explicit intention is to extract labor to navigate budgetary challenges abundantly clear in their annual reports. As they state, "[i]n fiscal years of 2018 and beyond, [Federal Prison Industries] will continue to face the challenge of shrinking federal budget and the resulting decline in discretionary spending" (UNICOR 2017). In reaction to these budgetary challenges, UNICOR devised a five-year plan to increase their workforce by 4,000 workers with the goal of growing sales by 8 percent in 2018 and 5 percent per annum through 2022 (UNICOR 2017). Programs such as UNICOR work with federal and local lawmakers to mandate government agencies purchase goods from federal prison factories (Helfenbein 2017). This is especially true in the textile industry, where Federal Prison Industries (FPI) sold over $126 million in clothing and textiles during the 2017 fiscal year, the majority of which went to the Department of Defense (UNICOR 2017). The United States textile industry is the fifth largest emitter of CO_2 within the United States (Energy Information Association [EIA] 2018). Furthermore, prison labor acts to incentivize private sector companies who may be tempted to move their production abroad or who already have done so to open factories in the United States. This is done by enticing companies to take advantage of cheap domestic prison labor within the United States, while protecting such companies from the highly-politicized and unsavory optics associated with moving production processes abroad (Weiss 2001). States-level political elites and industry actors have also benefited from prison labor via the indirect suppression of wages. Access to prison labor has been used as a point of leverage in neoliberal efforts to dismantle labor unions, and to eliminate collective bargaining rights for private sector workers more broadly (Thompson 2012). This is especially true in Virginia, Ohio, New Jersey, Florida, and Georgia, where state inmates have been paid not in dollars, but in time off their sentences (UNICOR 2017). We note that a number of recent studies have found that union participation suppresses CO_2 emissions (Alvarez, McGee, and York 2019; Hyde and Vachon 2019). Considering as much, we argue that the use of incarcerated labor to undermine unions may also reduce the tendency of U.S. unions to curb emissions.

The Treadmill of Mass Incarceration

Mass incarceration and the PIC are part of the "Treadmill of Production" (Gould et al. 2015; Schnaiberg 1980). ToP is a recurring pattern of relations between capital, labor, and the state that perpetuates production through increased resource extraction on an ever-expanding scale. Many elements of ToP directly correspond to the political economic circumstances discussed above, offering further insights into the relationship between the PIC and emissions.

In general, ToP analyzes the relationship between capital, labor, and the state as follows—as investments of capital into research and technology that reduce labor time increase, positions available to laborers decrease. In response, laborers turn to the state to implement policies that expand economic opportunities for workers. Similarly, investors look to the state to support private capital accumulation through increased spending and deregulation. Because of these dynamics, capital, labor, and the state are caught in a "treadmill of production," where surplus generated by increased production through resource extraction is continually used to support and maintain the needs of capital investment, labor, and the state.

Under ideal conditions of the treadmill, increased production is met with increased consumption, new investment in physical capital, and a redistribution of excess surplus by the state into wage supplement programs, such as unemployment and social security. However, Schnaiberg (1980) acknowledged that the ideal conditions of the treadmill are not always realized, which creates tensions between each facet of the treadmill. For example, wage supplement programs alleviate tension between capital and labor by lifting people out of poverty, putting more money into the hands of consumers, and increasing consumption (Danziger, Haveman, and Plotnick 1981). However, they also pressure employers to increase wages to incentivize work for entry-level employees, which raises the cost of production (Piven and Cloward 1993). Under neoliberalism, the state facilitates the accumulation of capital at the expense of labor (Harvey 2003). Specifically, taxes on capital are reduced, limiting the state's ability to fund wage supplement programs. The carceral state represents a shift in the balance between capital and labor. With limited taxes to fund wage supplement programs, the state uses violence to facilitate the accumulation of capital (Kohler-Hausmann 2015).

Stretesky, Long, and Lynch (2013) expand ToP by acknowledging the dialectical relationship between crime and ecology. Building on social disorganization theories in criminology, which claim that crime is the result of penurious economic conditions, poor social bonds, and changing cultural values (Sampson and Groves 1989; Shaw and McKay 1942), Stretesky et al. (2013) argued that expanding the treadmill can also cause social disorganization. Specifically, they contend that moments of social disorganization "often stem from exploitative relationships between the ecology and the economy, such as the rapid extraction of natural resources, armed conflict over natural resources, and the potential impacts of pollution on humans that weakens social bonds to conventional institutions" (Stretesky et al. 2013, p. 92). In the context of the present study, economic restructuring sparked by neoliberal policies—which shifted a large portion of industrial production in the United States to the global South (Harvey 2003)—in addition to reduced funding for wage supplement programs (Korteweg 2003)—which served to stabilize economic conditions in the past—led to social disorganization in communities that were made to be economically reliant on industrial production and the welfare state. These structural changes created the conditions for mass incarceration, and the carceral state emerged in reaction to this social disorganization.

Mass incarceration intercedes in the treadmill by alleviating many of the tensions that drive treadmill expansion, particularly under neoliberalism. In this way, it also creates space for the logic of accumulation that characterizes the treadmill process, allowing it to continue unhindered. This process is facilitated by the state, which alleviates the tension between labor and capital through enhanced policing tactics that target the communities and individuals most harmed by capital's divestment from labor and reduced wage supplements from the state (Camp 2016; Fording 2001). As rates of incarceration increase over time, prisons and incarcerated people become a site for capital investment through expanded resource extraction (Deckard Delia 2017). Mass incarceration creates an increasing number of individuals in need of food, housing, and other amenities necessary for day-to-day living, which are provided through processes of capital investment within the PIC. Government spending on incarceration, around $30,000 per prisoner per year, stimulates a much more reliable source of demand than expenditures on wage-supplement programs (Deckard Delia 2017). As Deckard (2017) wrote, "it [spending on incarceration] is compulsory, dependable and efficient, and [it comes] without the wage inflationary consequences that previous forms of public expenditure on the impoverished created" (p. 5).

In addition to imprisoning the individuals most heavily affected by capital's labor cost reduction strategies, incarceration circumvents the contradictions embedded in the treadmill by reducing the need for investment into labor saving processes, and it does so by providing industries with cheap labor. Low cost prison labor is increasingly being used in industrial manufacturing (see Goodridge et al. 2018). Unlike contract-based wage-labor rendered by choice, prison labor is coerced and less protected by the state. This allows surplus to be extracted from prison labor more efficiently than from wage-labor. In sum, mass incarceration refashions the relationships between the facets of the treadmill by suppressing the contradictions derived from capital accumulation, while simultaneously perpetuating the ToP in creating a space for new, more reliable forms of capital investment.

Modeling Approach/Research Question

The goal of our modeling approach is twofold: (1) analyze how the PIC contributes to industrial emissions directly by measuring the association between emissions and the percentage of people in prisons and (2) analyze how incarceration influences the relationship between economic development and emissions. In general, this approach is intended to assess the degree to which incarceration increases or decreases the social efficiency of natural resource use. To capture the essence of ToP, CO_2 emissions from industrial production are used to measure the social efficiency of natural resource use. The logic underlying this choice is as follows: fossil fuels are a natural resource that, when burned during industrial development, contribute to climate change through the emission of CO_2, and as a result accelerate the depletion of ecosystems (Turner 2018). As Gould, Pellow, and Schnaiberg (2004) noted, "decreased social efficiency of natural resource utilization produced . . . a shift towards vastly increased rates of ecosystem depletion." In this sense, any significant, positive association between incarceration and emissions constitutes a decrease in the social efficiency of natural resource use through the perpetual depletion of ecosystems via climate change.

With respect to the first component of our modeling approach, we hypothesize that as the percentage of incarcerated people within states increases over time, demand for goods used in prisons will increase, which will in turn augment the amount of fossil fuel burned to produce these goods, leading to an overall increase in the amount of CO_2 emitted from industrial production within states. With respect to the second component of our modeling approach, we hypothesize that as the percentage of incarcerated people increases within states, the cost of producing industrial goods will decrease due to the increased supply of prison labor. As a result, the overall productive capacity of states will increase, which will increase industrial production. This will lead to an overall increase in fossil fuel use from industrial production, and will augment the association between gross domestic product (GDP) per capita and industrial emissions per capita.

The logic of the latter component of our approach is in line with previous studies that have explored the decoupling of economic growth and emissions (McGee and Greiner 2018; Thombs 2020; York and McGee 2017). Similar to these studies, our goal is to assess if changes in socioeconomic activity (in this case the percentage of individuals housed in prisons) de/couples the association between GDP per capita and emissions. In these models, decoupling refers to an outcome where the association between GDP per capita and emissions decreases when it exists in the social context of a state where a greater number of individuals have been incarcerated. Conversely, coupling refers to an outcome where the association between GDP per capita and emissions increases when that association is set in a social context where more individuals have been incarcerated.

Data and Methods

We constructed fixed-effects panel regression models with robust standard errors that account for clustering in 50 states and the District of Columbia from 1997 to 2016. We chose years within states as our unit of analysis because state-level data provide the most reliable and robust estimates of CO_2 emissions and rates of incarceration. Furthermore, mass incarceration is a phenomenon specific to the United States (see discussion above) that has accelerated over time within states more than it has accelerated across states. Our model includes fixed-effects estimators for states/political units and years. Such an approach allows for the control of a number of contemporaneous (e.g., year to year change in the cost of goods) and extemporaneous (e.g., number of previously existing industrial facilities, or long term state specific policies) factors that are not possible to include in analyses with the currently existing data. As such, our model is set up to capture how incarceration is associated with changes in emissions over time within states (and the District of Columbia) because much of the variation within our variables of interest appear to be structured this way. We also note that the approach used in this study is in line with previous studies of inequality and emissions that have used similar units of analysis (see Jorgenson, Schor, and Huang 2017).

In line with the STIRPAT (Stochastic Impacts by Regression on Population, Affluence, and Technology) tradition, we transformed of all our variables into natural log form. As a result, our model is multiplicative as opposed to additive (York, Rosa, and Dietz 2003). In addition, converting our variables to natural log form allows our coefficients to express the elastic relationship between our independent variables and our dependent variables, meaning their relationship is expressed in relative proportions (i.e., our coefficients express the relative association between a percent change in our dependent variable and a 1 percent increase in our independent variables). We chose to use GDP per capita in chained dollars, as our models assess change over time and chained dollars allow for a more accurate assessment of economic growth. In additional robustness checks, we created dummy codes for states that have cap and trade policies, as well as for states with private prisons, to serve as state-level controls that account for political factors that vary across states. These data were created by identifying which states either have cap and trade policies or allow private prisons to operate. We then created a dummy code for each unit (year within specific states) that either identified the state as having cap and trade/private prisons or not. When these variables are included, our standard errors increase; however, none increase above a p value of .05. Furthermore, the coefficients for these dummy codes all had p values above .05, meaning private prisons and cap and trade did not substantially change industrial emissions in the years measured within our models. We also explored if the relationship between incarceration and industrial emissions changed substantively in states with cap and trade or in states with private prisons by interacting these dummy codes with our variable for incarceration. We found that there is no statistically significant difference in the relationship between incarceration and emissions between states with cap and trade policies, neither is there a statistically significant difference in this same relationship within states that allow private prisons.

We do not control for the age structure of the population, since our data on employment are a more accurate assessment of the size of the working population, which is one of the primary intentions behind controlling for this variable. We did not include a control for urbanization in the models presented here because we could not find consistent, reliable data on urbanization at the state level from 1997 to 2016. Specifically, the data for the percentage of the urban residents are only available in the year 2000 and from 2010 to 2016. Robustness checks that incorporated these data into our models found that the limited sample size (2000 and 2010–2016 as opposed to 1997–2016) increased our standard errors; however, controlling for urbanization did not substantially change the magnitude or direction of the coefficients of interest in any models.

Each of our models use states as the unit of analysis and include unit-specific intercepts as well as time dummies to control for general period effects. Our panels are balanced. Our modeling approach controls for any effects that are constant over the span of time examined for each state, such as geographic and geological characteristics, and any effects that are constant across states for a given point in time. Fixed-effects allows us to estimate how changes in our independent variable correlate with changes in our dependent variable. The benefit of this approach is that it controls for any unobserved time-variant and time-invariant factors not directly accounted for in our models. As a result, we only include variables in our models that are sourced from reliable data, and that have been shown to be associated with emissions. All reports of statistical significance are based on a .05 alpha level with a two-tailed test.

Dependent Variables

All of our models use CO_2 emissions from industrial production (all in million metric tons) as a dependent variable. The data for this variable were obtained from the Energy Information Association (EIA) in December of 2018. According to the EIA (2018) "state-level emissions estimates are based on energy consumption data for the following fuel categories: three categories of coal, natural gas, and ten petroleum products including—asphalt and road oil, aviation gasoline, distillate fuel, jet fuel, kerosene, hydrocarbon gas liquids (HGL), lubricants, motor gasoline, residual fuel, and other petroleum products." Industrial emissions measure both combustion and process emissions from industrial development. This includes the consumption of asphalt and road oil, for which emissions are calculated based on the state where asphalt and road oil were consumed. While a number of greenhouse gases are known to contribute to the geophysical phenomena of climate change, here we choose to focus on CO_2 emissions from industrial processes because (1) no other greenhouse gases contribute so greatly to the threat of global climate change as carbon dioxide emissions borne from socioeconomic processes (IPCC 2014), (2) no other greenhouse gases emissions are as extensively estimated as CO_2 (i.e., it offers the greatest data coverage), and (3) no other greenhouse gas emissions are as intimately bound up with the industrial processes that are impacted by the growing PIC as CO_2.

Independent Variables

Our main indicator variable in this analysis is the percent of incarcerated individuals in state, federal, and private prisons. These data were obtained from the Bureau of Justice Statistics (2018) National Prisoner Statistics (NPS). NPS excludes data on people held in local jails and in other jurisdictions. Our data for the number of incarcerated individuals in the District of Columbia stop after 2001. After 2001, responsibility for sentenced prisoners from the District of Columbia was transferred to the Federal Bureau of Prisons (Bureau of Justice Statistics 2018).

Each of our models incorporate a number of independent variables. In line with the STIRPAT tradition, we control for the total population of each state using data from the U.S. Census Bureau (2018) and GDP per capita (measured in millions of 2012 dollars) of each state using data from the Bureau of Economic Analysis (BEA 2018). We also control for other variables that have been found to be significantly associated with emissions at the state level, such as the percentage of individuals who are employed (BEA 2018), and the percentage of GDP from manufacturing (BEA 2018). Finally, we control for the percent of the population that is below the poverty line (U.S. Census Bureau 2018) because people in poverty are more likely to be incarcerated.

Results

Table 1 shows the descriptive statistics of all the variables used in our analysis in their raw form (i.e., prior to their log transformation). The results from our analysis are presented in Table 2. In Model 1 of Table 2, both population and GDP per capita are found to be associated with increases in emissions, and are significantly different from zero. These results are consistent with the findings of previous research (Jorgenson et al. 2017; York et al. 2003). The independent variables for poverty, employment, and manufacturing as a percent of GDP are not found to be significantly different from zero in Model 1, which indicates that

Table 1. Descriptive Statistics—1,001 Observations in 50 States.

Covariates	Mean	Median	*SD*	Max.	Min.
Industrial emissions (million metric tons)	19.04	11.30	30.07	238.80	0.10
GDP per capita (millions of 2012 U.S. dollars)	$0.048	$0.046	$0.010	$0.148	$0.005
Incarcerated population (percent of total)	0.422	0.404	0.165	1.517	0.111
Total population	4,226,018	5,977,525	6,588,466	39,300,000	489,451
Employed population (percent of total)	62.46	62.90	4.65	73.10	42.70
Impoverished population (percent of total)	40.45	40.15	5.55	62.25	22.78
Manufacturing (percent of GDP)	12.13	11.47	5.54	37.43	0.358

Note. All emissions are reported in million metric tons. GDP measures are reported in millions of 2012 U.S. dollars. *SD* = standard deviation; GDP = gross domestic product.

Table 2. Fixed-Effects Regression Model with Robust Standard Errors of the Relationship between Prison Population, Economic Size, and Industrial Emissions from 1997 to 2016.

Covariates	Model 1	Model 2
Incarcerated population	0.480***	2.008**
(percent of total)	(.128)	(.692)
GDP per capita	0.748**	1.283***
(millions of 2012 U.S. dollars)	(.247)	(.379)
Total population	0.555*	0.567*
	(.235)	(.215)
Employed population	0.205	0.366
(percent of total)	(.639)	(.616)
Impoverished population	−0.066	−0.017
(percent of total)	(.214)	(.209)
Manufacturing	0.053	0.060
(percent of GDP)	(.091)	(.092)
Incarcerated population × GDP	–	0.484*
		(.212)
R^2 within	.323	.334
N/political units	1001/51	1001/51

Note. Standard errors in parentheses. Political unit groups include the 50 U.S. states and the District of Columbia. GDP = gross domestic product.
*$p < .05$. **$p < .01$. ***$p < .001$ (two-tailed tests with 0 as null hypothesis).

they are not significantly associated with industrial emissions. In models not shown here, we estimated the association between incarceration and industrial emissions without these variables and found the results to be substantively unchanged. Model 1 in Table 2 also shows that incarceration is positively associated with industrial emissions. Specifically, each one unit increase in incarceration is associated with a .481 percent increase in industrial emissions.

Model 2 in Table 2 includes the same variables as Model 1, but also interacts percent incarceration and GDP per capita. Here the interaction of percent incarceration and GDP per capita is positive and significant. This

Table 3. Estimated GDP Per Capita Slope Coefficients for Table 2, Model 2.

Incarcerated population values	GDP per capita
1st percentile	0.158
(0.09%)	(.291)
25th percentile	0.495*
(.196%)	(.226)
Median	0.730**
(.319%)	(.232)
75th percentile	0.889***
(.444%)	(.260)
99th percentile	1.114***
(.705%)	(.322)

Note. Standard errors in parentheses. Model 2 coefficients represent the estimated association between GDP and industrial emissions, conditional on incarcerated population as a percent of the total. GDP = gross domestic product.
*$p < .05$. **$p < .01$. ***$p < .001$ (two-tailed tests with 0 as null hypothesis).

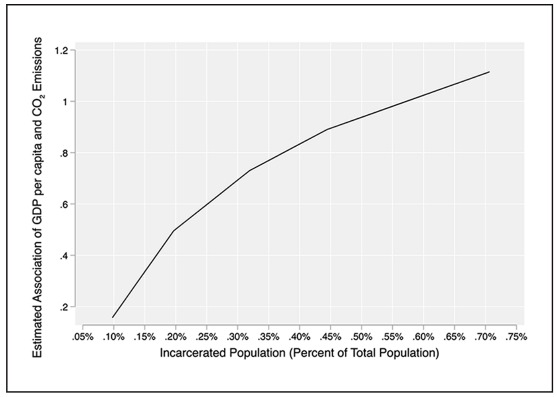

Figure 1. Figure 1 displays the estimated association of GDP per capita to CO_2 emissions (vertical axis) conditioned upon the percent of the population that has been incarcerated (horizontal axis).

indicates that the associations of these two variables with industrial emissions are intertwined—meaning that the association between GDP per capita and emissions is conditioned upon the percent of the population that is incarcerated, and that incarceration's association to emissions is conditioned upon the value of GDP per capita. In general, this finding suggests that the association between GDP per capita and industrial emissions is higher in those contexts where a higher proportion of the population is incarcerated.

Table 3 helps to interpret the findings in Model 2, indicating the estimated association between GDP per capita and emissions at the 5th, 25th, 50th, 75th, and 95th percentiles of incarceration. Upon examining Table 3, it is clear that the association between GDP per capita and emissions increases as the rate of incarceration increases, and that this association is significant at the 25th, 50th, 75th, and 95th percentiles of incarceration. For instance, according to the results of Model 2, in a state where the rate of incarceration is equivalent to the median (.319 percent of its population), a 1 percent increase in GDP per capita is associated with a .730 percent increase in industrial emissions. Yet, in a state at the 95th percentile of incarceration rates (.706 percent of its population), GDP per capita has an elastic relationship with industrial emissions (i.e., a 1 percent increase in GDP per capita is associated with a 1 percent increase in emissions). Figure 1 further illustrates the findings of Model 2. Looking to Figure 1, we note that the elasticity coefficient for GDP per capita is higher in state-years where incarceration is higher. This indicates that incarceration leads to a tighter coupling between GDP per capita and industrial emissions.

Discussion and Conclusion

Although mass incarceration accounts for a small percentage of states' overall population, our findings suggest that increases in incarceration are significantly associated with increases in industrial emissions, as well as a tightening of the association between economic growth and industrial emissions within individual states over time. It should be noted that our models only assess how incarceration influences changes in industrial emissions from year-to-year. Thus, in a broader context we argue that mass incarceration is escalating the treadmill of production that characterizes the maintenance, expansion, and intensified use of infrastructure that contributes to climate change. Theoretically, these findings support our hypothesis that mass incarceration is part of the ToP—a cycle of economic development that continually uses more natural resources to support capital accumulation (Gould et al. 2015; Schnaiberg 1980). As incarceration increases, actors within the PIC are able to generate higher profits by producing more of the goods used to build and maintain prisons, and industrial firms are provided with an ever-larger U.S. labor source that offers globally competitive wage costs.

The relationship between mass incarceration and the PIC is most likely one of historical contingency, where mass incarceration develops as a state response to social change perpetuated by neoliberalism, and the PIC develops as an economic response to mass incarceration. These structural changes are indicative of the dialectical pattern noted by Stretesky et al. (2013) between ecological disorganization and social disorganization. To this end, one can understand the relationship between mass incarceration, the PIC, and the environment as the result of converging social patterns that are linked through a number of historical contingencies. Clearly, it is not a natural law that growth in incarceration will increase industrial emissions. However, historically, industrial manufacturing has exploited workers, consumers, and the environment by continually reducing the cost of labor, increasing the demand of industrial goods, and increasing the use of fossil fuels. Incarceration allows these patterns to continue unabated, and in many instances provides the tools necessary to accelerate the pace at which such patterns recur. The state helps to facilitate the exploitation of workers by providing cheap competitive labor to industrial manufacturers, while also supporting the accumulation of capital through the creation and exploitation of an ever-increasing captive consuming class (Deckard Delia 2017). Industrial manufacturers must continually use more fossil fuels to produce these goods, resulting in increases in emissions over time.

It should be noted that our explanations for these findings are strictly theoretical, though we argue that they fit within the conceptual framework outlined above as well as could be expected from any theoretical lens. In a strict, empirical sense, all we can truly say is that incarceration is associated with higher emissions. We believe that only further study can help to properly identify the feasibility of the mechanisms that we propose underlie these trends. There are additional implications behind our results that future research should explore. As one reviewer noted, it is possible that there is a connection between the policies passed that support the PIC and policies that make it easier to emit industrial emissions (e.g. environmental deregulation). Thus, future research exploring how policies that have supported mass incarceration correspond with the rejection or enactment of environmental legislation would prove beneficial. For future researchers, the task at hand is to further explore this phenomenon as our knowledge of the social processes underlying the PIC deepens and more data, such as the proportion of state GDP drawn from the PIC, become available. To this end, we hope that our findings set a precedent and provide motivation for assessing the relationship between mass incarceration, the PIC, and climate change.

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1. UNICOR is a Federal Prison Industry program (operating under the trade name UNICOR). It was established in 1934 by an Executive Order issued by President Franklin D. Roosevelt. On January 1, 1935, FPI officially began operations as a wholly-owned corporation of the United States Government (UNICOR 2019).

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