Manufacturing Decline and Environmental Inequality: Metropolitan disparities in industrial air pollution in the United States

Kevin T. Smiley[1]

Acknowledgments: The author would like to acknowledge the financial support of the National Socio-Environmental Synthesis Center's grant, "Computational Environmental Justice Analysis," as well as the Social Science Research Institute at Rice University.

[1] Corresponding Author. Mailing Address: Kevin T. Smiley, Department of Sociology, State University of New York at Buffalo, 430 Park Hall, Buffalo, NY 14228. E-mail address: ktsmiley@buffalo.edu

Abstract

Disparities across metropolitan areas in chemical emissions are extensive, and not well understood. To better investigate these inter-urban inequalities, I showcase how the changing manufacturing economy relates to the production of industrial pollution. Using data on health risks from industrial air pollution in 1990, 2000, and 2010. I test to see if an indicator of change in the number of manufacturing workers in a metropolitan area from 1970 to each of the three study years is associated with greater health risks. Although a greater proportion of the population in manufacturing work in a given year is strongly linked to more toxic air in a metropolitan area, the evidence also shows that metropolitan areas that have experience a manufacturing decline since 1970 are especially associated with more toxic air. Implications focus on how the indelible imprint of manufacturing history may condition contemporary pollution levels.

Manufacturing Decline and Environmental Inequality: Metropolitan disparities in industrial air pollution in the United States

Introduction

Since the rise of heavy manufacturing in the nineteenth-century, industrial capitalism and pollution have been deeply intertwined (Foster, York, and Clark 2010). But even as industrial outputs remain essential in a capitalist-driven economy, the economy – at least in the United States – has changed. The past fifty years have witnessed a long decline of manufacturing work in the United States. In 1970, nearly one in four American workers were employed in manufacturing. In 2015, just one in twelve were manufacturing workers. This fundamental restructuring of the economy has had enormous implications for the quality and quantity of blue collar work, as well as far-reaching effects across the globe as some industries intensify automation and/or decamp for countries with less expensive workforces. The United States has consequently shifted to a postindustrial economy, one characterized by increased attention to white collar professionals and a ballooning of unstable service economy work.

Research on environmental inequality in the environmental justice tradition has long analyzed exposure to industrial pollution (e.g. Bullard 1990; Mohai, Pellow and Timmons 2009; Taylor 2014), but it has not supplied a measurable sense of how this changing industrial economy has influenced unequal pollution exposure in the United States. Instead, the link between manufacturing work and industrial pollution exposure is typically assumed to have had the same relationship, whether it is 1980 or today: more manufacturing workers in a place are linked with greater toxins (Bullard 1990; Sicotte and Swanson 2007). While a great deal of sociological research focuses on how the changing economy relates to range of social outcomes (e.g. Bell 1973; Hatton 2011; Pandian 2017; Wilson 1987), research on environmental inequality has yet to examine how these labor force changes condition toxic emissions from manufacturing facilities.

To fill this gap, I investigate how historical changes in manufacturing work connect to contemporary exposure to industrially produced toxic air. I use state-of-the-art industrial air pollution data to assess how manufacturing changes from 1970 to 1990, 2000, and 2010 are related to toxic exposures. Findings show that the presence of manufacturing workers in a metropolitan area are associated with greater exposure to toxic air. This research also shows that metropolitan areas with *declines* in manufacturing employment are associated with higher levels of pollution. In some ways, this finding is counterintuitive: more manufacturing workers is typically associated with more industrial pollution. But these findings point to a more nuanced interpretation, one that takes seriously how the historical form of the economy has an impact on present-day socio-environmental outcomes.

Environmental Justice and Metropolitan Manufacturing

Research in the environmental justice tradition in the United States focuses on the unequal exposures to unhealthful toxins. These inequalities are primarily structured by race: people that people of color are disproportionately exposed to environmental degradation (Mohai, Pellow, and Roberts 2009; Taylor 2014). One of the most important and well-documented forms of environmental degradation is industrial pollution. Most often, environmental justice studies of industrial pollution analyze proximity to industrial facilities (Mohai and Saha 2007; Bryant and Mohai 1992), the weight of pollutants

(Crowder and Downey 2010; Pais, Crowder, and Downey 2013), or, more recently, the health risks from chemical emissions (Ash et al. 2013; Ard 2016; Collins, Munoz and Jaja 2016; Downey et al. 2008). These studies highlight the importance of race, but also discuss manufacturing work, especially given the obvious link between manufacturing facilities and the manufacture of pollution. Findings in this line of research show that more manufacturing workers in a neighborhood are associated with greater exposure to environmental degradation (Author Cite A; Mohai and Saha 2015; Sicotte and Swanson 2007). These analyses of neighborhood differences occur alongside a body of work that takes seriously the organizational characteristics of heavy polluting manufacturing facilities (Grant et al. 2010; Grant, Trautner, and Jones 2004; Prechel 2015; Prechel and Zheng 2012).

This focus on manufacturing facilities and on the characteristics of the working population of polluted neighborhoods, however, leaves aside important questions about the cumulative effects on the metropolitan economy. More specifically, while the economic composition relating to facilities and manufacturing is often discussed in neighborhoods, little attention is paid to the differing levels of residents who work in manufacturing industries in an overall city or metropolitan area. This is despite the fact that industrial and environmental historians as well as qualitative environmental justice researchers have drawn attention to urban and regional trajectories of certain heavy polluting industries (Hall 2012; Hurley 1995; Little 2014; Author Cite B; Melosi and Pratt 2007; Pellow and Park 2002; Pratt, Melosi, and Brosnan 2014; Sicotte 2016; Spears 2014; Sze 2008), and to institutional, meso-level environmental sociological theory (Downey 2015). These lines of research highlight how present-day pollution patterns did not occur overnight; rather, they are products of lasting industrial economies, elite actions, and governmental guidance (Pellow 2002).

These industrial and environmental legacies are part of a *place tradition* that conditions social outcomes, such as exposure to pollution, in a city. Cities are where surplus capital is most often nested, and they are the exemplar of capitalist development (Harvey 1973; Castells 1977). Urban capitalist configurations are part and parcel of a wider dynamic of place, as lash-ups of actions in a community (especially by elite actors in commerce and government) in past time periods structure the future possibilities for action in that place (Molotch, Freudenberg, and Paulsen 2000). This constitutes a place tradition in which the elements of "economy, demography, politics, organizations, culture, and aesthetics… combine and endure, and in the salience and meaning that locals and outsiders given them" (Paulsen 2004, 245; see also Brown-Saracino 2015; Kaufman and Kaliner 2011; Rushing 2009; Author Cite C). Molotch, Freudenberg, and Paulsen's (2000) study that enunciated the concept of place tradition analyzed two California cities – Santa Barbara and Ventura – and how their contemporary cities emerged from historical actions about economy, urban form, and environment. They examine the relationship between environmentally intensive oil and gas industries and urban history, particularly how elite actions and community organizations pushed these theoretically similar cities in different directions (Ventura toward oil and gas industries, and Santa Barbara away from them).

These theoretical perspectives have empirical roots in place-based studies of industrial and environmental histories by showcasing how investments in certain industries at one time, especially during America's industrial halcyon period in the midtwentieth century, shape present-day pollution. While a full accounting of environmental histories is beyond the scope of this article (see Hall 2012, Pellow and Park 2002; Sicotte 2016 for some examples), two examples of metropolitan economies – one large, one small – illustrate this point. The Chicago metropolitan area is characterized by a steady decline in manufacturing work, from nearly one million workers in 1970 to 582,659 in 2010. Data on health risks from industrial pollution (see a full methodology below) showcase that Chicago nonetheless ranks as highly polluted: 83 percent of Chicago area neighborhoods in 2010 would rank among the most polluted 25 percent of neighborhoods in metropolitan America. This toxic legacy operates through Chicago's role as a manufacturing entrepôt of the "Great West" during the nineteenth century and well into twentieth century (Cronon 1991), and the historical consequences have been uneven for people of color (Pellow 2002). A second example is the Anniston-Oxford, Alabama metropolitan area, which saw the number of manufacturing jobs modestly increase from 1970 to 1990 (from 10,483 jobs to 10,847) before decreasing 17 percent from 1970 levels by 2010. Like Chicago, Anniston is a highly polluted place despite these drops in manufacturing work: not only would all of the metropolitan area's neighborhoods rank among the most polluted quarter of American metropolitan neighborhoods in 2010, the median neighborhood in Anniston ranks in the 97th percentile nationally. Research on the environmental history of the city of Anniston (Spears 2014) details how decades of chemical manufacturing at agrochemical facilities and at a local military installation has had a lasting imprint on the culture and politics of the city. In both Chicago and Anniston, manufacturing work has declined at the same time that industrial pollution levels remain high compared to other urban areas. That these two cities also share a manufacturing past

– Chicago's rich history as a gateway to the Midwest, and Anniston's decades-long connection to the chemical sector – indicates how the political culture of places shapes present-day socio-environmental contexts.

Although these two cases and the theoretical perspective on place tradition prompt research questions about how manufacturing change may relate to disparities in industrial air pollution exposure, no research has investigated changing manufacturing work in metropolitan areas, and, further, research to date has had limited success to identifying the roots of these inequalities. One area of analysis concerns residential segregation, namely that urban areas with greater residential segregation also have more pollution and accentuated racial inequalities in toxic exposure. Research generally supports this proposition (Morello-Frosch and Jesdale 2006; Smith 2009), although it may depend on the residential segregation measure under analysis (Ard 2016; see also Downey 2007; Kravitz-Wirtz et al. 2016). A second area similarly concerns racial inequality, such as racial income inequality or the percentage of minorities in a residential area. Neither of these have been found to be associated with environmental inequality (Downey 2007; Downey et al. 2008; Ard 2016). Finally, the overall levels of metropolitan pollution have been shown to be associated with attenuated racial inequalities (Ash et al. 2013). Yet, across these studies, we have little measurable sense of why disparities in industrial pollution in metropolitan areas have emerged, and how that might be related to patterns of racial inequalities.

By contrast, a place tradition perspective suggests that historical economic patterns condition contemporary pollution patterns. No previous quantitative study of industrial pollution exposure has tested for historical economic patterns, although, as has been noted, qualitative and historical research emphasizes both of these areas. The argument synthesized from this work submits that the historical composition of the economy may be just as important to levels of industrially produced environmental degradation as the contemporary economy. This dynamic is put in play because the historical economy was relatively more industrial than the today's economy, and because that industrial emphasis structures the realm of the possible in the present day. It does so by constituting a place tradition, one that renders capitalist developments and attendant environmental degradation across time as endogenous to the urban area's politics and culture.

Data and Methods

The primary premise of this paper is to investigate how urban industrial histories intertwine with pollution exposure. By analyzing the presence of manufacturing workers in metropolitan areas, overall exposures across metropolitan areas are examined, as are patterns of racial inequalities within these areas. In doing so, the goal is to test to see if the changing industrial economy is linked to industrial air pollution, and, if so, link these changes to theoretical offerings about preexisting place traditions.

To accomplish this, I utilize spatial multilevel models that foreground the importance of the metropolitan context in shaping local neighborhood contexts. Because data is drawn from multiple time points, I standardize the definition and boundaries of metropolitan areas and census tracts using 2010 delineations (Logan, Xu, and Stults 2014).[1] While this decision inflates the geographic extent of 1970 metropolitan areas, for the later years (1990, 2000, and 2010) it takes into account commuting patterns across counties, which are the patterns that form the basis for the geographic boundaries of metropolitan areas. Using 1970 metropolitan boundaries, on the other hand, would not be inclusive of many 2010 workers; for example, a suburban county resident in 2010 who works in manufacturing in the central city would not be included in the totals if that county fell outside the metropolitan boundaries in 1970. Metropolitan areas and census tracts are drawn from the contiguous United States. The number of metropolitan areas used in the analysis is 363, and the number of census tracts are 58,872.

Independent Measures – Metropolitan Areas

Independent variables are utilized from the 1970, 1990, 2000, and 2010 decennial United States Census and from 2006 to 2010 American Community Survey (ACS) estimates. All data is utilized from the decennial census when possible. I use the 2006-2010 five-year pooled estimates for the ACS to maximize reliability.

The primary independent variables in this paper concern the population of manufacturing workers in a metropolitan area. The first set of measures are the proportion of employed workers aged sixteen or over in manufacturing industries in a metropolitan area in 1990, 2000, and 2010. The second variable related to manufacturing employment are ratios that divides the *total number* of manufacturing jobs in 1970 by the total number of manufacturing jobs in 1990, 2000, and 2010. Finally, a third variable is an additional ratio measure that divides the *proportion* working in manufacturing industries in 1970 by the proportion in a later year. The use of a ratio variable between the number employed in manufacturing industries in 1970 and the later years is preferred to the ratio between the proportion employed in manufacturing industries. Large differences in population change across metropolitan areas are masked when using the proportion ratio measure. For example, a metropolitan area could maintain the same proportion of manufacturing workers even if the actual number of jobs decreases precipitously so long as the population also declined at the same rate. In this way, using the number employed in manufacturing industries corresponds to the vitality of growth in that metropolitan area *relative* to not only its previous history (i.e. 1970) as well as other metropolitan areas. As a check of the robustness of the findings of the count ratio, analyses are reported in the results that utilize the proportion ratio instead.

Additional metropolitan covariates include five other measures. Table 1 includes the mean and description for all of the variables in the study. Residential segregation is a potentially pivotal predictor of inequalities whereby more residentially segregated places may have also exacerbated racial environmental inequalities and overall higher levels of industrial pollution. A common measure of residential segregation, the dissimilarity index, is utilized for white/black and white/Hispanic residential segregation (Logan, Xu, and Stults 2014). The dissimilarity index is a measure of evenness between racial groups that varies from 0 to 100, and measures the percentage of one racial group who would have to move neighborhoods to achieve the same racial composition in all neighborhoods within a metropolitan area. Second, the proportion of metropolitan residents in poverty is included as a test to see if more affluent urban areas are associated with greater industrial pollution or if poorer metropolitan areas are targeted for industrially noxious facilities. Third, the racial composition of the metropolitan area – measured as the white proportion of the total population – is also included as a control variable to determine if the race is also an important predictor for urban areas as it is for neighborhoods. Finally, the census region – East, South, Midwest, and West – in which the metropolitan area is located are used as dummy variables, with the East as the reference category (Ard 2015). All metropolitan-level independent variables (except the dummy variables for the census region) are grand mean centered.

[Table 1 about here]

Independent Measures – Census Tracts

Census tract level variables test core environmental justice hypotheses, add integral control measures, and provide for a relatively small geographic unit with which to estimate air pollution toxins. First, racial composition is comprised of two measures: the proportion of tract residents that are non-Hispanic black, and are Hispanic. These variables test important arguments about racial inequality in exposure to environmental degradation (Bullard 1990; Taylor 2014). Second, I investigate class differences by using the median income of the census tract, as well as its square. Previous research has found a curvilinear effect for median income such that working-class neighborhoods are often the most disadvantaged (Downey and Hawkins 2008). Third, the proportion of owner-occupied homes measures both the relative wealth of the tract (as home ownership is a major source of wealth in the United States), but also defense of place, as homeowners may be more inclined to invest in place-based efforts more than renters (Rudel 2013). Although the chief concern with manufacturing is to test metropolitan-level compositions of the economy, the proportion of works in manufacturing industries at the tract level is also used as a control variable to test to see if the metropolitan manufacturing measure is associated with toxic air, net of this more local factor. Further, even though previous research suggests that few workers actually work in the tract in which they reside (Author

Cite A), the measure usefully serves as a proxy for industrial activity in the area, which is often linked to more toxic air (Sicotte and Swanson 2007). Finally, the tract population tests to see if larger or smaller tracts are correlated with greater health risks from industrial pollution. All independent variables at the census tract level are group mean centered.

Dependent Variable

The dependent variables in this study are a tract's toxic concentration in 1990, 2000, and 2010. The data for the dependent variable are from the Risk-Screening Environmental Indicators Geographic Microdata (RSEI-GM) using the geographically aggregated data for Version 2.3.4 (Environmental Protection Agency 2015). Using Toxic Release Inventory (TRI) data from the Environmental Protection Agency, the RSEI-GM integrates information about toxicity of chemicals, amount of emissions, and plume modeling to estimate the health risks for a given geographic area. Large industrial facilities are regulated through the TRI if they employ at least ten full-time employees, are in specific industry sectors like mining and manufacturing, and manufacture 25,000 pounds or greater of at least one chemicals measured by the TRI. Because chemicals and types of manufacturing facilities have been added to regulatory purview under the TRI, I use only the chemicals and reporting industries that were utilized in 1990 to create the data for each of the three years. Results for the effects of the manufacturing ratio in supplemental models (not shown) for 2000 and 2010, though, are robust to the inclusion of all possible chemical and manufacturing sectors for the respective years.

Plume modeling techniques are used in the RSEI-GM to measure the fate of the release of a given chemical. Each facility in the TRI database is centered in an 810 m^2 grid cell as part of a large grid numbering more than 11 million grid cells across the United States. Each grid cell that is within a 49 kilometer radius of the facility receives a health risk value based on the estimated pounds of releases for that grid cell. Grid cells that are closer to the facility will likely receive higher toxic concentration values, and those that are further away often have lower values. These differences emerge because of the decay of chemicals across space.

To move the dependent variable from these small-scale grid cells to census tracts, the toxic concentration values from the grid cells must be proportionally aggregated to this higher unit (see Ard [2015] for a detailed discussion of this approach). Because the toxic concentration value for a grid cell is valid for any point within that grid cell, the tract-level toxic concentration is created by determining the proportion of the tract's area that overlaps with a grid cell, and then aggregating it accordingly. This variable is highly skewed, and is log transformed to account for this rightward skew.

The RSEI-GM is a major advance in modeling of air pollution that only used a unit coincidence model (i.e. a count measure of facilities in tracts) or those that only used pounds of pollutants (e.g. Pais, Crowder, and Downey 2013). This is because it utilizes a geographic information system, and the toxicity of the chemicals for human health. The data is not without limitations. Because it uses only large facilities in the estimation of health risks, data from small and medium-sized facilities are not included in the calculations. Additionally, the RSEI-GM only accounts for industrial air pollutants. Air pollution may come from other sources such as transportation sources and from households. Other water-based or ground-based pollution are also not included. While the data is the best national data to denote health risks from chemical air pollutants, a final limitation is that the data is estimated, and is not directly observed.

Analytical Strategy

After discussing descriptive trends in metropolitan disparities in industrial air pollution and in the changing manufacturing economy, I utilize repeated cross-sectional models for the years 1990, 2000, and 2010 to analyze the interrelation of these two trends. In particular, I utilize spatial two-level hierarchical linear models because the present paper is particularly interested in how metropolitan-level processes condition pollution exposure at the more localized scale of census tracts. A spatial lag is utilized at the metropolitan level to measure and control for spatial autocorrelation (Dong et al. 2015). The lag utilizes a *k*-nearest neighbors weights matrix that takes into a given number of metropolitan areas that are closest in proximity to a given metropolitan area. Deviance Information Criterion values supplied by the model suggest that the six nearest neighbors provides the model of best fit when compared to other *k*-nearest neighbors matrices and with distanced-based matrices; results utilizing these other matrices for the lag, though, are highly similar to those presented here. The goal of this lag is to control for spillover effects between metropolitan areas that are geographically near one another.

Three final points relating to the modeling procedures and to statistical significance testing remain. First, the cross-sectional models are not pooled in a single model because of the large differences between the years as industrial air pollution levels have declined from 1990 to 2010. In a pooled model, these large differences artificially mask the spatial inequalities that are important to this study and environmental justice research more broadly. Second, longitudinal models are not employed because industrial air pollution data from the RSEI-GM is available only since the late 1980s. An ideal research design might use longitudinal procedures measuring changes in manufacturing alongside those in pollution levels for the entirety of the period from the U.S.'s industrial zenith in the middle of the twentieth century to present day. Although manufacturing change since 1970 could be utilized in such models, the absence of industrial air pollution data from 1970 until the late 1980s prevents such an analysis. This gap in data is because the U.S. did not require heavy polluting facilities to report details of toxic emissions until federal legislation in the form of the Community-Right-to-Know Act of 1986 in the wake of the Bhopal industrial accident in 1984. Third, statistical significance testing in the form of *p*-values are not utilized in this article because the study's data is a census of the population, namely of census tracts in metropolitan areas in the United States.

Results

Descriptive Analysis

Two primary differences animate the present analysis: the first concerns large differences in pollution across urban areas, and the second concerns changes in manufacturing in the United States from 1970 to 2010. First, to illustrate the disparities across urban areas in exposure to industrial air pollution, I calculated the total number of tracts in a metropolitan area that would rank in the most polluted 25 percent nationally in 1990, 2000, and 2010. Table 2 shows the top ten metropolitan areas in the total number of tracts that they place among the most toxic 25 percent in 2010. The Chicago metropolitan area tops the list, followed by Houston, Detroit, Cleveland, and Pittsburgh. Sixty-eight metropolitan areas have at least half of their tracts in the worst quarter of all tracts in the United States in 2010 and, in six metropolitan areas, every tract ranks among America's most highly polluted.[2] By contrast, 201 metropolitan areas had less than five percent of their tracts ranked among the most toxic in 2010, and 132 of these did not have more than 5 percent in 1990 and 2000 as well. These immense differences showcase that some metropolitan areas are to subject to relatively small amounts of toxic air from industrial facilities, but that a subset of metropolitan areas – numbering less than a hundred – experience the brunt of industrially produced toxic air in the United States.

[Table 2 about here]

Almost all metropolitan areas in the United States evince sharp declines in the proportion of workers in manufacturing industries since 1970. The average percent of workers in manufacturing industries in a metropolitan area in 1970 was 23.3 percent before dropping to 18 percent in 1990, 15 percent in 2000, and 12 percent in 2010. Of the 363 metropolitan areas in the analysis, all but 18 had the proportion of manufacturing workers decrease from 1970 to 2010. Even with population growth in metropolitan areas nationally from 164 million in 1970 to 257 million in 2010, 165 metropolitan areas had lower total number of workers in manufacturing jobs in 2010 than in 1970. Taken together, almost all metropolitan areas experienced proportional declines in manufacturing populations in the period from 1970 to 2010, and most also evinced declines in the total number of manufacturing workers relative to national population growth across the period.

Regression Analysis of Metropolitan Manufacturing Composition

Table 3 for 1990, 2000, and 2010 showcase six models predicting the toxic concentration across metropolitan census tracts in the United States. Relationships between key independent variables are substantively similar across the three years. A primary independent variable of interest across all models is the proportion of workers in manufacturing industries in a metropolitan area in that year. This variable is positively and strongly associated with tract-level toxic concentration. Metropolitan areas with a greater proportion of manufacturing workers have tracts that have greater health risks from chemical emissions. This effect size is consistently strong across each of the three years.

[Table 3 about here]

This study's theoretical focus is on the changing manufacturing economy, and, because of this, the models also incorporate a more dynamic perspective that takes into account each year's number of manufacturing workers relative to the number of workers in 1970. The coefficient for this ratio variable is negative in 1990, 2000, and 2010. Metropolitan areas that had comparatively high drops in manufacturing workers from 1970 to the later date have negative values for the measure because it is grand mean centered; those with growth in manufacturing work have positive values. Because the metropolitan areas with particularly strong losses in manufacturing work have negative values and the coefficient is negative, tracts in these metropolitan areas are linked with higher levels of industrial air pollution. For example, a metropolitan area at the 25th percentile of the manufacturing ratio in 1990 had 0.67 higher predicted value of toxic concentration than a metropolitan area at the 75th percentile; this effect size corresponds to approximately one quarter of one standard deviation of the dependent variable in 1990. This difference across this interquartile range is smaller in 2010 (0.37) and 2000 (0.28) compared to 1990. Despite the loss in manufacturing work in these urban areas, they are still more highly polluted places, even compared to urban areas with growth in manufacturing work.

These relationships between manufacturing and industrial air pollution are also robust to important control variables. Results from these control variables show that the proportion black and proportion Hispanic at the tract level in 1990, 2000, and 2010 is associated with greater health risks from industrially produced toxins, an important finding that mirrors other environmental justice analyses (Mohai, Pellow, and Roberts 2009; Taylor 2014). Also similar to previous studies (Sicotte and Swanson 2007), more manufacturing workers at the tract level is associated with greater industrial air pollution. At the metropolitan level, urban areas with a greater degree of residential segregation – for both the white/black measure and the white/Hispanic measure – are linked to higher levels of industrial air pollution, although in Model 5 in 2010 for white/Hispanic residential segregation the coefficient is negative, not positive. Relationships are mixed for census regions depending on the year under examination. Southern and Midwestern areas are more polluted compared to the East in 1990 and 2010, but not in 2000. This is partly because of the lambda coefficient for the spatial lag in 2000, which is about twice as large as it is in the other years. This spatial lag, then, is capturing regional variation at a smaller scale than the census region variable especially in 2000, although evidence supplied by the spatial lag is found across all models that metropolitan areas with greater pollution are most often located near other highly polluted urban areas.

In Models 2, 4, and 6, four cross-level interactions are introduced to see if the manufacturing measures are differentially related to neighborhood racial composition. For the proportion manufacturing in the metropolitan area, the interactions with each of the racial composition measures are positive for proportion black across the models. The coefficient is also positive for Hispanics in 2000, but is negative in the other two study years. These interactions for proportion manufacturing show that racial disparities are wider for neighborhoods with more black residents in metropolitan areas with more manufacturing workers, but that the relationship varies more for Hispanic neighborhoods. Interactions for the manufacturing ratio are relatively uniform across the years as each interaction term is positive. This positive interaction term for manufacturing ratio indicates that racial inequalities are wider in urban areas that have growth in manufacturing jobs since 1970, a finding that may relate to the increased inequity in facility siting since that time (Saha and Mohai 2005). In addition to being associated with greater industrial air pollution, metropolitan areas with manufacturing decline are linked to comparatively narrow racial inequalities within the metropolitan area. The negative effects of greater health risks from industrially produced toxins are felt more evenly across metropolitan neighborhoods in this areas.

Table 4 uses a ratio variable between the *proportion* of manufacturing workers instead of a ratio between the count of workers, and the results show patterns that are similar, with a few exceptions. Primary findings relating to manufacturing ratio remain the same, no matter the ratio measure under consideration. Metropolitan areas that had a particularly strong drop in the proportion of workers in manufacturing industries from 1970 to each of the three study years are associated with higher levels of industrial air pollution. This provides further evidence to buttress the models in Table 3 regarding this relationship between manufacturing decline and the production of pollution. The interaction terms in 1990, 2000 and 2010 for proportion black and proportion Hispanic for each of the main manufacturing variables are in similar directions to those in Table 3 except that the interaction between proportion black and proportion metropolitan manufacturing in 2010 is now negative and the interaction between proportion black and the manufacturing ratio is 1990 is also now negative. For manufacturing decline in particular, the findings in Table 4 (with the exception of proportion black in 1990) indicate that, like Table 3 with the manufacturing count ratio, racial inequalities are somewhat narrowed in places experiencing manufacturing decline, and extended in those urban areas experiencing comparative manufacturing growth. In total, the findings in Table 4 for the relationship between historical manufacturing change and contemporary pollution outcomes are highly similar to those in Table 4, with a few exceptions noted above.

[Table 4 about here]

Discussion and Conclusion

The coevolution of industrial manufacturing and environmental degradation is most exemplified by the rise of cities. Findings from this paper suggest that the historical elements of this coevolution are critically important in the investigation of inequalities in exposure to toxic air. These findings can be summarized in four parts. First, there are large disparities across metropolitan areas in exposure to toxic air and little evidence from previous literature about how these disparities have come to be. Second, the proportion of manufacturing workers in a metropolitan is positively associated with the presence of health risks from industrially produced toxic air. Third, metropolitan areas that have had precipitous declines in manufacturing jobs are especially linked to greater toxic air. Fourth, cross-level interactions showcase that in the most polluted cities that have experienced declines in manufacturing workers have relatively smaller gaps in racialized pollution outcomes, but that racial inequalities remain even after accounting for metropolitan measures.

These findings suggest that previous approaches on metropolitan inequality and on neighborhood inequality remain incomplete, and could be complemented with a place tradition perspective (Molotch, Freudenberg, and Paulsen 2000). That is, the lack of historical research on industrial pollution misses out on the origins of industrial pollution. An analysis of the composition of the manufacturing workforce aids in reconstructing how industrial history connects to contemporary patterns of pollution exposure. This important step acknowledges how environmental degradation is directly tied with how capitalist production conditions and constrains urban development.

For industrial pollution outcomes in particular, this paper makes important empirical and theoretical offerings. The historical composition of the metropolitan economy is critical to understanding present-day pollution exposure. In particular, metropolitan areas with declines in manufacturing are associated with higher levels of industrial pollution. This finding suggests that the industrial economy of the decades past furnished patterns of action surrounding industrial pollution that remain highly relevant. Even when there were declines in manufacturing jobs, these metropolitan areas maintained high levels of pollution. Future research should explore why that is the case. It may be because the industry remains and that automation has taken over a relatively high share of the manufacturing work. In this way, it is not necessarily a weakening manufacturing economy in a place, but rather an increased efficiency of production—including of environmental ills. Or it may be the case that, with exogenous economic threats abounding in the form of globalization, local elites respond with a defensiveness of industry and a doubling down on place tradition surrounding that industry. Cities compete against one another in attempting to lure or retain growth (Logan and Molotch 2007), and particularly hard-hit places may opt to protect local industry at all costs, even as these industries move jobs – but not production – outside of that very place. In either case, the narrow focus on retaining polluting industries even without their jobs conformed to existing place tradition, and still produced pollution.

This paper has limitations which promote avenues for future research. First, the relationship of other economic factors across time – such as economic output from manufacturing or other from specific manufacturing industry types – could be generative sites with which to further analyze industrial pollution. Second, following inter-urban migration patterns over time could be of interest to see if migrants move to more or less polluted urban areas, and if these places are growing or declining manufacturing centers. Third, it would be of interest to connect the theoretical perspective to other types of pollution, like those from transportation sources (Morello-Frosch and Jesdale 2006) or smaller and medium-sized manufacturing facilities (Elliott and Frickel 2015). Finally, as discussed in the methodology section, the absence of historical data on industrial air pollution prevents longitudinal modeling in the study period from 1970 to 2010, a limitation with little recourse given data constraints.

Sustainable cities of the future must be guided toward those ends in the present. This research highlights that the past is prologue in this regard. Metropolitan industrial economies of times past sketch the introduction of the characters and plot of the present day. For the most polluted metropolitan areas playing out the dénouement of a manufacturing climax of decades past, critical questions and radical solutions must propose a new chapter.

References

Ard, Kerry. 2015. "Trends in exposure to industrial air toxins for different racial and socioeconomic groups: A spatial and temporal examination of environmental inequality in the U.S. From 1995 to 2004." *Social Science Research* 53:375-390.

Ard, Kerry. 2016. "By all measures: an examination of the relationship between segregation and health risk from air pollution." *Population and Environment* 38(1):1-20.

Ash, Michael, James K. Boyce, Grace Chang, and Helen Scharber. 2013. "Is Environmental Justice Good for White Folks? Industrial air toxics exposure in urban America." *Social Science Quarterly* 94(3):616-636

Bell, Daniel. 1973. *The Coming of Post-Industrial Society*. New York: Basic Books.

Brown-Saracino, Japonica. 2015. "How Place Shapes Identity: The origins of distinctive LBQ identities in Four Small U.S. Cities." *American Journal of Sociology* 121(1):1-63.

Bryant, Bunyan and Paul Mohai. 1992. *Race and the Incidence of Environmental Hazards*. Boulder, CO: Westview Press.

Bullard, Robert D. 1990. *Dumping in Dixie: Race, Class, and Environmental Quality*. Boulder, CO: Westview Press.

Castells, Manuel. 1977. *The Urban Question: A Marxist Approach.* Cambridge, MA: The MIT Press.

Collins, Mary B., Ian Munoz, and Joseph JaJa. 2016. "Linking 'toxic outliers' to environmental justice communities." *Environmental Research Letters* 11:1-9.

Cronon, William B. 1991. *Nature's Metropolis: Chicago and the Great West*. New York: W.W. Norton and Company.

Crowder, Kyle and Liam Downey. 2010. "Interneighborhood Migration, Race, and Environmental Hazards: Modeling Microlevel Processes of Environmental Inequality." *American Journal of Sociology* 115(4):1110-1149.

Dong, Guanpeng, Richard Harris, Kelvyn Jones, and Jianhui Yu. 2015. "Multilevel Modeling with Spatial Interaction Effects with Application to an Emerging Land Market in Beijing, China." *PLOSOne* 10(6):e0130761.

Downey, Liam. 2007. "US Metropolitan-area Variation in Environmental Inequality Outcomes." *Urban Studies* 44(5/6):953-977.

Downey, Liam, and Brian Hawkins. 2008. "Race, Income, and Environmental Inequality in the United States." *Sociological Perspectives* 51(4):759-781.

Downey, Liam, Summer Dubois, Brian Hawkins, and Michelle Walker. 2008. "Environmental Inequality in Metropolitan America." *Organization & Environment* 21(3):270-294.

Downey, Liam 2015. *Inequality, Democracy, and the Environment*. New York: NYU Press.

Elliott, James R. and Scott S. Frickel. 2015. "Urbanization as Socioenvironmental Succession: The Case of Hazardous Industrial Site Accumulation." *American Journal of Sociology* 120(6):1736-1777.

Environmental Protection Agency. 2015. "EPA's Risk-Screening environmental Indicators (RSEI) Methodology: RSEI Version 2.3.4." Washington D.C.: Environmental Protection Agency.

Foster, John Bellamy, Brett Clark, and Richard York. 2010. *The Ecological Rift; Capitalism's War on the Earth*. New York: Monthly Review Press.

Grant, Don, Mary Nell Trautner, and Andrew W. Jones. 2004. "Do Facilities with Distant Headquarters Pollute More? How civic engagement conditions the environmental performance of absentee managed plants." *Social Forces* 83(1):189-214.

Grant, Don, Mary Nell Trautner, Liam Downey, and Lisa Thiebaud. 2010. "Bringing the Polluters Back In: Environmental Inequality and the Organization of Chemical Production." *American Sociological Review* 75(4):479-504.

Hall, Randal. 2012. *Mountains on the Market: Industry, the Environment, and the South.* Lexington, KY: University Press of Kentucky.

Harvey, David. 1973. *Social Justice and the City*. Athens, GA: The University of Georgia Press.

Hatton, Erin. 2011. *The Temp Economy: From Kelly Girls to Permatemps in Postwar America*. Philadelphia: Temple University Press.

Hurley, Andrew. 1995. *Environmental Inequalities: Class, Race, and Industrial Pollution in Gary, Indiana, 1945-1980*. Chapel Hill, NC: The University of North Carolina Press.

Kaufman, Jason and Matthew E. Kaliner. 2011. "The re-accomplishment of place in twentieth century Vermont and New Hampshire: History repeats itself, until it doesn't." *Theory & Society* 40(2):119-154.

Kravitz-Wirtz, Nicole, Kyle Crowder, Anjum Hajat, and Victoria Sass. 2016. "The Long-Term Dynamics of Racial/Ethnic Inequality in Neighborhood Air Pollution Exposure, 1990-2009." *Du Bois Review* 13(2): 237-259.

Little, Peter C. 2014. *Toxic Town: IBM, Pollution, and Industrial Risks*. New York: New York University Press.

Logan, John R. and Harvey L. Molotch. [1987] 2007. *Urban Fortunes: The Political Economy of Place*. Berkeley, CA: The University of California Press.

Logan, John R., Zengwang Xu, and Brian J. Stults. 2014. "Interpolating US Decennial Census Tract Data from as Early as 1970 to 2010: A Longitudinal Tract Database." The Professional Geographer 66(3): 412–420.

Melosi, Martin V. and Joseph A. Pratt. 2007. *Energy Metropolis: An environmental history of Houston and the Gulf Coast*. Pittsburgh: University of Pittsburgh Press.

Mohai, Paul and Robin Saha. 2007. "Racial Inequality in the Distribution of Hazardous Waste: A National-Level Reassessment." *Social Problems* 54(3):343-370.

Mohai, Paul and Robin Saha 2015. "Which came first, people or pollution? Assessing the disparate siting and post-siting demographic change hypotheses of environmental injustice." *Environmental Research Letters* 10:1-17.

Mohai, Paul, David Pellow, and J. Timmons Roberts. 2009. "Environmental Justice." Annual Review of Environment and Resources 34:405-430.

Molotch, Harvey, William Freudenberg, and Krista E. Paulsen. 2000. "History Repeats Itself, But How? City Character, Urban Tradition, and the Accomplishment of Place." *American Sociological Review* 65(6):791-823.

Morello-Frosch, Rachel and Bill Jesdale. 2006. "Separate and Unequal: Residential Segregation and Estimated Cancer Risks associated with Ambient Air Toxics in U.S. Metropolitan Areas." *Environmental Health Perspectives* 114(3):386-393.

Pais, Jeremy, Kyle Crowder, and Liam Downey. 2013. "Unequal Trajectories: Racial and Class Differences in Residential Exposure to Industrial Hazard." *Social Forces* 92(3):1189-1215.

Pandian, Roshan K. 2017. "Does Manufacturing Matter for Economic Growth in the Era of Globalization?" *Social Forces* 95(3):909-940.

Pellow, David N. 2002. *Garbage Wars: The struggle for environmental justice in Chicago*. Cambridge, MA: The MIT Press.

Pellow, David N. and Lisa Sun-Hee Park. 2002. *The Silicon Valley of Dreams: Environmental Injustice, Immigrant Workers, and the High-Tech Global Economy*. New York: New York University Press.

Pratt, Joseph A., Martin V. Melosi, and Kathleen A. Brosnan, eds. 2014. *Energy Capitals: Local Impact, Global Influence*. Pittsburgh: University of Pittsburgh Press.

Prechel, Harland. 2015. "Organizational Political Economy and Environmental Pollution." *Sociology Compass* 9(9):828-840.

Prechel, Harland and Lu Zheng. 2012. "Corporate Characteristics, Political Embeddedness, and Environmental Pollution by Large U.S. Corporations." *Social Forces* 90(3):947-970.

Rudel, Thomas. 2013. *Defensive Environmentalists and the Dynamics of Global Reform*. New York: Cambridge University Press.

Rushing, Wanda. 2009. *Memphis and the Paradox of Place: Globalization in the American South*. Chapel Hill, NC: The University of North Carolina Press.

Saha, Robin and Paul Mohai. 2005. “Historical Context and Hazardous Waste Facility Siting: Understanding Temporal Patterns in Michigan.” *Social Problems* 52(4):618-648.

Sicotte, Diane and Samantha Swanson. 2007. “Whose risk in Philadelphia? Proximity to Unequally Hazardous Industrial Facilities.” *Social Science Quarterly* 88(2):515-534.

Sicotte, Diane. 2016. *From Workshop to Waste Magnet: Environmental Inequality in the Philadelphia Region*. New Brunswick, NJ: Rutgers University Press.

Slez, Adam, Heather O’Connell, and Katherine J. Curtis. 2017. “A Note on the Identification of Common Geographies.” *Sociological Methods & Research* 46(2):288-299.

Smith, Chad L. 2009. “Economic Deprivation and Residential Segregation: Comparing Superfund sites in Portland, Oregon and Detroit, Michigan.” *Social Science Research* 38:681-692.

Spears, Ellen J. 2014. *Baptized in PCBs: Race, Pollution, and Justice in an All-American Town.* Chapel Hill, NC: University of North Carolina Press.

Sze, Julie. 2008. *Noxious New York: The racial politics of urban health and environmental justice*. Cambridge, MA: The MIT Press.

Taylor, Dorceta E. 2014. *Toxic Communities: Environmental racism, industrial pollution, and residential mobility.* New York: New York University Press.

Wilson, William Julius. 1987. *The Truly Disadvantaged: The inner city, the underclass, and public policy*. Chicago: University of Chicago Press.

Endnotes

[1] While tabulating the statistics for metropolitan areas across time is a straightforward task insofar as aggregating data on counties, a small number of counties in the United States changed boundaries between 1970 and 2010. In some cases, these boundary changes occurred within the boundaries of a metropolitan area or were in non-metropolitan areas. Three groups of changes did affect metropolitan boundaries. First, Broomfield County in Colorado was created in 2001 from parts of Adams County, Boulder County, Jefferson County, and Weld County. Boulder County comprises its own metropolitan area, Weld County is in the Greeley Metropolitan Area, and Adams, Broomfield, and Jefferson are in the Denver-Aurora- Lakewood metropolitan area. Second, Cibola County, New Mexico was created in 1981 from part of Valencia County; the former is not in the Albuquerque metropolitan area but the latter is. Third, La Paz County, Arizona was created from part of Yuma County in 1982; Yuma County comprises the Yuma Metropolitan Area while La Paz County is not in a metropolitan area. To address these changes, I created a population-based weight using a "common geographies" approach (Slez, O'Connell, and Curtis 2015) that was then utilized to apportion 1970 county data into metropolitan areas based on 2010 boundaries. Models conducted without these three metropolitan areas are substantively similar to findings in this paper.

[2] These six metropolitan areas are Anniston-Oxford AL, Blacksburg-Christiansburg-Radford VA, Kokomo IN, Lebanon PA, Muncie IN, and Rockford IL.

Table 1. Coding and mean of study variables.

Variable	Coding	1990 Mean	2000 Mean	2010 Mean
Tract Level				
Toxic Concentration, Logged	-22.08 to 18.9 (pounds of pollutants indexed to toxicity of chemicals)	9.25	7.93	6.62
Prop. Black	0 to 1	0.12	0.14	0.15
Prop. Hispanic	0 to 1	0.1	0.13	0.17
Median Household Income	$2,499 to $250,0001	$57,974.90	$60,943.63	$58.435.43
Median Household Income (squared)	1.2e+10 to 6.16e+10	-2.44e+8	2.36e+8	-2362853
Prop. Manufacturing Workers	0 to 1	0.17	0.13	0.1
Population	0.01 to 37,452	3442.12	3930.64	4352.7
Prop. Owner-Occupied Homes	0 to 1	0.64	0.65	0.63
Metropolitan Level				
Census Region				
East	20.44% of tracts			
South	33.24% of tracts			
Midwest	21.77% of tracts			
West	24.54% of tracts			
Prop. White	0.03 to 0.98	0.81	0.76	0.72
White/Black Residential Segregation	13.16 to 84.9 (Dissimilarity Index)	52.71	48.54	44.95
White/Hispanic Residential Segregation	7.63 to 71.79 (Dissimilarity Index)	32.43	35.86	35.63
Prop. Manufacturing	0.03 to 0.48 (proportion of employed civilian population aged 16 and older in manufacturing industries)	0.18	0.15	0.12
Manufacturing Ratio (Count)	0.27 to 16.81 (number of manufacturing workers in 1970 divided by number of manufacturing workers in given year)	1.6	1.59	1.51
Manufacturing Ratio (Proportion)	0.23 to 3.05 (proportion of manufacturing workers in 1970 divided by the proportion of manufacturing workers in given year)	0.83	0.69	0.56

Sources: 1970, 1990, 2000, and 2010 Census; 2006-2010 American Community Survey; 1990, 2000, and 2010 Risk-Screening Environmental Indicators Geographic Microdata.
Population: 58,782 census tracts. 363 Metropolitan Areas.
Note: Tract-level variables are group-mean centered, and metropolitan-level variables are grand mean centered, but are shown in this table before those transformations.

Table 3. Multilevel Analysis of Tract-level Toxic Concentration and Manufacturing Change in Metropolitan U.S.: Results for Count Ratio

	1990		2000		2010	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tract Level						
Prop. Black	1.29	1.08	0.98	0.96	1.15	1.43
	(0.03)	(0.04)	(0.04)	(0.05)	(0.03)	(0.04)
Prop. Hispanic	1.44	1.49	0.74	0.83	1.47	1.44
	(0.06)	(0.07)	(0.06)	(0.06)	(0.04)	(0.05)
Median Income (in thousands)	2.41e-5	2.51e-5	2.15e-5	2.21e-5	2.06e-5	2.12e-5
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Median Income, Squared (in thousands)	-6.01e-11	-6.6e-11	-5.91e-11	-6.2e-11	-5.86e-11	-6.19e-11
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Prop. Manufacturing Workers	2.12	2.22	2	1.92	1.79	1.83
	(0.11)	(0.11)	(0.15)	(0.15)	(0.11)	(0.11)
Population	3.8e-05	3.72	-6.22e-6	-2.82e-6	-2.53e-05	-2.67e-5
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Prop. Owner-occupied	-2.15	-2.18	-1.89	-1.9	-1.57	-1.58
	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.04)
Metropolitan Level						
Prop. White	-1.04	-1.16	2.37	2.99	-0.66	0.34
	(0.88)	(1.01)	(1.78)	(1.23)	(1.18)	(1)
Prop. Poverty	-7.25	-4.53	-8.11	-5.18	-4.29	-1.69
	(2.81)	(2.25)	(4.85)	(4.1)	(4.24)	(3.25)
White/Black Segregation	0.05	0.04	0.04	0.05	0.05	0.04
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
White/Hispanic Segregation	0.01	0.01	0.01	0.03	-0.01	0.003
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Census Region (East, ref.)						
South	1.37	0.92	-0.11	-1.08	0.71	0.78
	(0.58)	(0.5)	(0.95)	(1.1)	(0.51)	(0.48)
Midwest	0.37	0.23	-0.3	-0.04	0.55	0.41
	(0.59)	(0.43)	(0.57)	(0.81)	(0.52)	(0.45)
West	0.61	0.71	0.21	2.68	0.26	-0.16
	(0.51)	(0.49)	(0.64)	(0.56)	(0.73)	(0.74)
Prop. Manufacturing	12	12.5	12.28	15.5	19.5	19.4
	(1.65)	(1.47)	(2.37)	(2.01)	(2.38)	(2.36)
Manufacturing Ratio	-0.64	-0.61	-0.29	-0.26	-0.36	-0.39

	(0.13)	(0.12)	(0.17)	(0.14)	(0.1)	(0.12)
Prop. Manufacturing x Prop. Black		6.77		6.7		3.1
		(0.58)		(0.65)		(0.62)
Prop. Manufacturing x Prop. Hispanic		-3.92		12.77		-0.52
		(1.03)		(1.16)		(0.98)
Manufacturing Ratio x Prop. Black		0.2		0.03		0.41
		(0.06)		(0.06)		(0.05)
Manufacturing Ratio x Prop. Hispanic		0.29		0.25		0.19
		(0.07)		(0.05)		(0.03)
Intercept	7.72	7.76	5.71	6.17	6.78	6.6
Lambda (λ)	0.37	0.34	0.79	0.77	0.42	0.39
Level-1 *N*	58,872	58,872	58,872	58,872	58,872	58,872
Level-2 *N*	363	363	363	363	363	363
Deviance Information Criterion	226562.9	226292.3	261744.6	261343.2	207574.7	207374.4
Pseudo R^2	0.68	0.68	0.87	0.87	0.76	0.76

Table 4. Multilevel Analysis of Tract-level Toxic Concentration and Manufacturing Change in Metropolitan U.S.: Results for Proportion Ratio

	1990		2000		2010	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tract Level						
Prop. Black	1.29	1.07	0.98	1.01	1.16	1.57
	(0.04)	(0.05)	(0.04)	(0.05)	(0.03)	(0.05)
Prop. Hispanic	1.44	1.47	0.74	0.83	1.47	1.54
	(0.06)	(0.08)	(0.06)	(0.06)	(0.04)	(0.06)
Median Income (in thousands)	2.41e-5	2.49e-5	2.15e-5	2.21e-5	2.07e-5	2.14e-5
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Median Income, Squared (in thousands)	-6.01e-11	-6.49e-11	-5.9e-11	-6.2e-11	-5.87e-11	-6.24e-11
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Prop. Manufacturing Workers	2.12	2.21	2	1.87	1.79	1.83
	(0.11)	(0.11)	(0.15)	(0.15)	(0.11)	(0.11)
Population	3.8e-05	3.82	-6.1e-6	-2.49e-6	-2.53e-05	-2.59e-5
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Prop. Owner-occupied	-2.15	-2.17	-1.89	-1.89	-1.57	-1.59
	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.04)
Metropolitan Level						
Prop. White	-0.3	-0.5	1.29	0.91	-0.31	-0.56
	(1.12)	(0.96)	(1.82)	(1.99)	(0.87)	(1.05)
Prop. Poverty	-4.21	-1.49	-3.28	-5.17	-1.97	-2.01
	(3.05)	(2.71)	(5.16)	(4.49)	(3.08)	(3.68)
White/Black Segregation	0.05	0.04	0.05	0.05	0.05	0.05
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
White/Hispanic Segregation	0.01	0.02	0.02	0.03	0.002	-0.01
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Census Region (East, ref.)						
South	0.77	1.13	2.4	-1.57	4.4e-4	0.33
	(0.4)	(0.57)	(0.68)	(0.73)	(0.4)	(0.4)
Midwest	-0.22	0.62	3.86	-0.07	-0.01	0.91
	(0.58)	(0.5)	(0.67)	(0.79)	(0.46)	(0.51)
West	0.32	0.65	2.72	0.8	0.16	0.73
	(0.64)	(0.41)	(0.77)	(0.62)	(0.46)	(0.59)
Prop. Manufacturing	14.5	14.3	15.9	16.5	21.5	23.46
	(1.85)	(1.84)	(2.02)	(2.19)	(2.37)	(2.73)
Manufacturing Ratio	-2.43	-2.23	-1.98	-1.96	-1.84	-2.43

	(0.43)	(0.43)	(0.62)	(0.59)	(0.69)	(0.54)
Prop. Manufacturing x Prop. Black		6.04		6.02		-0.21
		(0.54)		(0.69)		(0.67)
Prop. Manufacturing x Prop. Hispanic		-4.94		11.45		-2.56
		(1.01)		(1.16)		(0.97)
Manufacturing Ratio x Prop. Black		-0.06		0.82		2.54
		(0.25)		(0.3)		(0.27)
Manufacturing Ratio x Prop. Hispanic		0.52		0.7		1.38
		(0.28)		(0.27)		(0.22)
Intercept	8.35	7.75	3.45	4.04	7.12	6.22
Lambda (λ)	0.41	0.4	0.8	0.79	0.47	0.44
Level-1 *N*	58,872	58,872	58,872	58,872	58,872	58,872
Level-2 *N*	363	363	363	363	363	363
Deviance Information Criterion	226555.9	226319.9	261738.6	261383.8	207585.7	20736.17
Pseudo R^2	0.68	0.68	0.87	0.87	0.76	0.76