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WHEN WORK MOVES:
JOB SUBURBANIZATION AND BLACK EMPLOYMENT

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ABSTRACT

This paper presents evidence that job suburbanization caused significant declines in black employment from 1970 to 2000. I document that, conditional on detailed job characteristics, blacks are less likely than whites to work in suburban establishments, and this spatial segregation is stable over time despite widespread decentralization of population and jobs. This stable segregation suggests job suburbanization may have increased black-white labor market inequality. Exploiting variation across metropolitan areas, I find that job suburbanization is associated with substantial declines in black employment rates relative to white employment rates. Evidence from nationally planned highway infrastructure corroborates a causal interpretation.

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1 Introduction

Over the last 60 years in the United States, the unemployment rate among black working age adults has roughly doubled the national unemployment rate (Fairlie and Sundstrom, 1999). Large disparities remain conditional on education and AFQT scores (Ritter and Taylor, 2011). The *spatial mismatch hypothesis*, introduced by Kain (1968) and further popularized by Wilson (1987) and Wilson (1996), attributes racial disparities in employment rates in part to spatial frictions in the labor and housing markets. Black households tend to live relatively far from work opportunities, reducing their access to gainful employment, and this distance has increased over recent decades. In particular, firms and white households relocated from central cities to suburban rings at an accelerated pace following World War II.[1] By contrast, black households, who faced discrimination in housing and mortgage markets, remain concentrated in central cities. As a result, blacks tend to live further away from the portions of metropolitan areas experiencing substantial job growth, depressing their labor market outcomes.

There is suggestive evidence for spatial mismatch in aggregate data. Table 1 documents employment rates and share living in the central city for black and white working-age, non-institutionalized males in 14 large metropolitan areas from 1930 to 2000.[2] Blacks live in the central city at higher rates, and the black-white difference in this share increases sharply up to 1970, plateauing since. Up to 1970, employment rates are similar within-race for those living in the central city and suburbs. After 1970, a large gap emerges for blacks, with employment rates about 10 percentage points higher in the suburbs in 1980 and 13 percentage points higher by 2000.[3] Hence, while job growth relocates to the suburbs following World War II, blacks remain concentrated in the central city, and blacks living in the central city appear to be increasingly worse off than those living in the suburbs.

It remains unclear whether job suburbanization and the decline of black employment over this period are causally linked, however. Though researchers have posited several explanations for why work has decentralized, including improvements in transportation technology and infrastructure, land costs, and the suburbanization of workers (Glaeser and Kahn, 2001), the process of job suburbanization is not well understood. Job suburbanization may be associated with changes in labor demand and supply that would generate changes in the racial composition of the workforce even in the absence of suburbanization. Moreover, even if firms began to locate in the suburbs due to exogenous factors, it is not clear what implications this would have for the racial composition of the workforce. While the segregation of black households in the central city has been a persistent feature of US metropolitan areas (Cutler et al., 1999), workers may respond to the changing geography of work by changing jobs, altering their commute, or moving to a different neighborhood.

[1] In 1960, 61% of metropolitan area jobs were located in the central city; by 2000, the central city share declined to 34% (Baum-Snow, 2014).

[2] I limit to these 14 metropolitan areas because they are consistently identified in Census and Current Population Survey microdata. I use the Census definition of central cities throughout, which are generally the largest places in a metropolitan statistical area.

[3] In addition, incarceration rates are significantly higher for those living in the central city (Wilson, 1987).

Table 1: Employment Rates for Working-Age Men in 14 Large Metropolitan Areas

	Black Employment Rates			% Living	White Employment Rates			% Living	% Jobs
	City	Suburbs	Metro	in City	City	Suburbs	Metro	in City	in City
1930	80.0	79.4	79.9	80.8	81.8	82.5	82.0	66.7	
1940	71.6	74.0	72.1	78.5	77.9	80.7	79.0	61.9	
1950	75.1	78.8	75.9	79.9	83.7	86.2	84.8	55.0	
1970	75.2	73.2	74.9	81.5	81.4	84.0	83.1	36.6	49.0
1980	61.1	71.4	63.8	73.1	80.1	84.1	83.0	27.4	44.8
1990	58.4	70.0	61.8	78.6	78.4	83.5	82.0	32.5	42.0
2000	59.6	73.1	64.1	66.5	81.3	83.6	82.9	26.6	38.9

Notes: Statistics from 1930-1950 and 1980 are derived from IPUMS Census data. Statistics from 1970, 1990, and 2000 are derived from IPUMS Current Population Survey data.
'Working-age' is defined as ages 24 to 64.
The 14 metropolitan areas are: Baltimore, Boston, Buffalo-Niagara Falls, Chicago, Detroit, Houston, Los Angeles-Long Beach, Minneapolis-St. Paul, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco-Oakland, Washington, DC. I limit to these 14 metropolitan areas because they are consistently identified in Census and Current Population Survey microdata.

These response margins may be sufficient for job suburbanization to have little effect on who works.

In this paper I present novel evidence that job suburbanization caused significant declines in black employment from 1970 to 2000. I do so in two parts.

First, using establishment-level administrative data from the Equal Employment Opportunity Commission, I document that blacks are substantially less likely than whites to work in suburban establishments. In particular, conditional on job characteristics, the black share of employees in metropolitan area establishments is decreasing in an establishment's distance from the central business district. Remarkably, this spatial segregation is stable over time despite widespread movement of population and jobs to the suburbs. I also provide additional evidence that this spatial segregation reflects at least in part the *causal* effect of job location on racial composition. I document that the relationship between job location and racial composition holds *within firms* that operate multiple establishments within a metropolitan area. I also find that establishments that *relocate* from the central city to the suburbs experience sharp coincident declines in the black share of their employees, despite no detectable changes in their occupational composition.

This persistent spatial segregation suggests job suburbanization may have reduced black employment rates. Cross-sectional estimates suggest that job suburbanization decreased the black share of the workforce by 3.7% each decade. However, suburbanization may be offset by worker re-sorting across workplaces or related to other important changes in labor demand or supply. This motivates the second half of the analysis, which exploits variation across metropolitan statistical areas in suburbanization rates using Census data.

Using a synthetic panel and a differences-in-differences research design, I find that job suburbanization is associated with substantial declines in black employment rates relative to white employment rates. For every 10% decline in the fraction of MSA jobs located in the central city over this period, black employment rates declined by 1.3 to 1.9%, while white employment rates increased by a (statistically insignificant) 0.3 to 0.4%. This relationship holds within observable skill groups, and estimates are similar for men and women. Relative earnings declined by 1.2 to 2.3%, though these estimates are less stable across specifications. Conversely, job suburbanization is unrelated to or weakly related to other substantive structural changes in the labor market, such as job growth or changes in industry or occupation mix that would predict changes in black relative employment rates.

To further address the potential endogeneity of job suburbanization—in particular, changes in the spatial distribution of work driven by unobserved labor supply shocks that are unevenly distributed across blacks and whites—I instrument for job suburbanization using variation in nationally planned interstate highway construction across MSAs as identified in Baum-Snow (2007). These highways were planned in the 1940's and 1950's and primarily designed to link far away places rather than facilitate local commuting or economic development. Hence, their assignment across MSAs should be exogenous to residual labor supply shocks from 1970 to 2000. While highways have a variety of effects on the labor market that may potentially violate the exclusion restriction, I argue that they are unrelated to labor demand and supply shocks that would disproportionately affect black workers, the most concerning omitted variables.

Highway-based IV estimates are comparable to OLS estimates, corroborating a causal interpretation. Moreover, I find that highways cause residential suburbanization of white households but not black households, consistent with the premise that black households faced significant additional barriers to suburban residence.

I conclude that job suburbanization was an important determinant of black-white labor market inequality from 1970 to 2000. The estimates imply that job suburbanization can explain the majority of the relative decline in black male employment over this period.

While this paper provides novel evidence on spatial segregation in the labor market and the causal effect of workplace location on the racial composition of employees, it is largely silent on why space matters. Blacks may be less likely to work in the suburbs due to commuting costs, job search costs, or employer preferences. Interestingly, the labor market is substantially less spatially segregated than the housing market, so commuting flows do offset residential segregation to some degree. However, while blacks are residentially less concentrated in central city neighborhoods then they were in 1970, this movement has not been sufficient to noticeably alter the spatial segregation of the labor market. Blacks may not move to the suburbs to offset any commuting or search costs because of suburban housing prices, discrimination in housing or mortgage markets, or preferences. Distinguishing between these mechanisms is an important area for future research.

An extensive literature sets out to test the spatial mismatch hypothesis, typically by relating labor market outcomes to measures of job accessibility in a cross-section (see Ihlanfeldt and Sjoquist (1998) for a review of the older literature).[4] Most recent work in this literature finds some support

[4] Three notable exceptions are Mouw (2000) and Weinberg et al. (2004). Mouw (2000) estimates the relationship between changes in job density and neighborhood-level employment rates in Chicago and Detroit from 1980 to 1990. Weinberg et al. (2004) exploit individual moves across neighborhoods using the 1979 National Longitudinal Survey

for spatial mismatch, though there has been considerable debate about its empirical importance (Ellwood, 1986). Results tend to be sensitive to how job accessibility is measured (Raphael, 1998).[5] More importantly, results from this literature are made difficult to interpret by the endogeneity of household and firm location. Residents who are less productive may sort into neighborhoods that are farther from work opportunities, where rents are typically lower.[6] Similarly, firms may choose to locate in neighborhoods with residents who are more productive. In this paper, I take a more "reduced form" approach–rather than attempt to estimate the effects of work proximity per se, I estimate the effects of job suburbanization at the local labor market level.

Andersson et al. (2018) is an important and recent contribution to this literature. The authors use matched employer-employee data from 2000 to 2005 in 9 large metropolitan areas to study the relationship between job accessibility and jobless duration among workers displaced during mass layoffs. They document compelling evidence that, among similar job searchers, search duration is decreasing in job accessibility. By contrast to the current paper, Andersson et al. (2018) do not study how job accessibility contributes to racial differences in labor market outcomes, or the effects of job *suburbanization* more generally. I view the approaches of Andersson et al. (2018) and the current paper as complimentary.

A smaller literature examines how a work establishment's location influences the racial composition of its employees. This research has found that location appears to be an important determinant of employee composition. However, prior work has been limited to relatively small samples–cross-sectional studies of a few thousand firms in a handful of metropolitan areas (Holzer and Ihlanfeldt, 1996), or case studies of individual plant relocations (Zax and Kain, 1996; Fernandez, 2008). By contrast, the administrative data used here cover hundreds of thousands of establishments for several decades, including thousands of relocation episodes.

Though focused on spatial mismatch, this paper also relates to work on residential segregation and neighborhood effects, particularly given the potential connection between suburbanization and neighborhood composition. Cutler and Glaeser (1997) and Ananat (2011) argue that residential segregation leads to worse labor market and social outcomes for black Americans. However, as in the existing spatial mismatch literature, these papers cannot convincingly estimate the effect of segregation on individuals because people choose which city to live in. The neighborhood effects literature surmounts this problem by exploiting the random or quasi-random assignment of households to neighborhoods. Notable papers in this literature include Oreopoulos (2003), Jacob (2004), and work on the Moving to Opportunity (MTO) program (e.g. Ludwig et al., 2013), which offered randomly selected families living in high-poverty housing projects vouchers to move to neighborhoods with lower poverty rates. Ludwig et al. (2013) find that the MTO program had no detectable

of Youth. Both papers find evidence of spatial mismatch.

[5]For example, previous researchers have used the local job density, local job growth, and the average commuting times of local workers as measures of job accessibility. Hellerstein et al. (2008) argue that accessibility measures should be *race-specific*; for example, the density of jobs into which blacks are hired is a more relevant accessibility metric for blacks than job density per se.

[6]Alternatively, if spatial frictions are relevant, residents who find it difficult to obtain work may sort into neighborhoods with higher employment density.

effect on the economic outcomes of adult participants, though Quiqley and Raphael (2008) argue that MTO had only small effects on the degree of spatial mismatch faced by families.

By contrast, this paper studies the effects of a changing city–in particular, the changing location of employers–on the distribution of labor market outcomes among the populace. I find that job suburbanization has a substantial impact on black-white labor market inequality. While in the context of this study it is not possible to convincingly disentangle the effect of job suburbanization from that of *residential* suburbanization–and hence, changes in residential segregation–I provide novel evidence that changes in job location are an important causal channel that can explain the relationship between job suburbanization and black employment entirely.

2 Data

In this paper I use two types of data: individual level and city level Census data; and establishment level data from EEO-1 forms.

2.1 Census Data

I use Census data to measure various labor market characteristics and job suburbanization. I use Census data from 1970, 1980, 1990, and 2000. I focus on these Census years for two reasons. First, the second wave of the Great Migration, a period when a substantial share of Southern black households moved to other regions of the country, ends around 1970. Analysis of Census data from earlier than 1970 would be complicated by the large and potentially endogenous black migration flows over this period. Second, MSA is not identified in the publicly available 1960 Census microdata.

To measure labor market characteristics, I use Integrated Public Use Microdata (IPUMS) Census data (Ruggles et al., 2010). The 1970 Census data is a 2% national sample, while the remaining years are 5% national samples. I restrict the analysis to the 58 consistently identified MSAs with the largest black populations as defined in 1970.[7] These cities are listed in Appendix Table A1.

To measure job suburbanization, I use various Census data products. Measuring the spatial distribution of work consistently across years is complicated by the fact that central city definitions change significantly with the 1990 Census. In particular, many cities that are defined as suburbs in 1980 are classified as central cities in 1990. These changes make it difficult to construct consistent measures of job suburbanization after 1980 using only Census IPUMS data. Instead, I combine IPUMS data with tabulations from the Census Transportation Planning Package (CTPP) to measure the spatial distribution of work in 1990 and 2000.[8] The CTPP data include tabulations

[7]Unfortunately, after 1970, many MSAs are only partially identified in the Integrated Public Use Microdata (IPUMS) Census data. That is, some MSA residents are not identified as MSA residents in the data. These residents tend to live in (suburban) areas that straddle MSA boundaries, so the representativeness of the black population (who tend to reside in central cities) should be less affected. Nevertheless, I restrict to MSAs where no more than 15% of the estimated MSA population is omitted in 1980, 1990, or 2000.

[8]This follows Baum-Snow (2014), who uses the CTPP from 2000 to measure commuting flows between suburbs and central cities.

reporting the total number of individuals working at various levels of geography. I divide those totals into central cities and suburbs using 1970 Census definitions for central cities. For 1970 and 1980, I use Census IPUMS data. In the Census microdata, I measure the spatial distribution of work using the Census indicator for whether an individual works in the central city or outside the central city (suburbs) of an MSA. Note that, while I hold the set of municipalities defined as central cities constant, I follow Census definitions of central city and MSA geographies, which evolve over time in some cases.

2.2 EEO-1 Form Data

For some of the analyses below, I use a unique set of establishment-level panel data. These data, known as EEO-1 form data, are collected by the U.S. Equal Employment Opportunity Commission (EEOC) and cover the years 1971-2000. As part of the Civil Rights Act of 1964, firms meeting certain size requirements are required to complete EEO-1 forms annually and submit them to the EEOC. Firms are required to report their overall racial, ethnic, and gender composition and the racial, ethnic, and gender composition of each of their establishments meeting size requirements, disaggregated by 9 major occupation groups.[9] Employers are instructed to base demographic classifications on worker self-identification or visual inspection, where the former is the preferred method.[10] Before 1982, all firms with 50 or more employees were required to submit EEO-1 forms. In 1982, the firm size cutoff was adjusted up to 100. For the analysis, I drop all establishments that would not meet the post-1982 criteria. Firms are required to file a separate report for each establishment with at least 50 employees and the company headquarters. Establishments are consistently identified with firm and establishment identifiers. I observe each establishment's location and industry. I present summary statistics for the EEO-1 data covering the same 58 MSAs in Appendix Table A3. For most of the analysis using EEO-1 data, I restrict to establishments that I am able to geocode using street address, zip code, or city.[11] Results are very similar if I restrict to establishments that I am able to geocode using street address.[12]

3 Job Suburbanization in the United States

To analyze the effects of job suburbanization using variation across MSAs, I first need a measure of job suburbanization that can be applied consistently across MSAs with differing initial spatial distributions of work. I also require a measure that can be calculated using available Census data. I

[9]The 9 occupation categories consist of: officials and managers, professionals, technicians, sales workers, administrative support workers, craft workers, operatives, laborers/helpers, and service workers.

[10]There is no distinction between race and ethnicity in the data; in particular, Hispanic workers are classified as a distinct, non-overlapping group.

[11]For establishments that I am only able to geocode using zip code or city, I assign the coordinates of the centroid for that zip code or city.

[12]Due to the size requirements, establishments in the EEO-1 data are not representative of all U.S. establishments. Unsurprisingly, industries that tend to have large establishments, e.g. manufacturing, are overrepresented, while industries that tend to have small establishments, e.g. services, are underrepresented. Overall, the EEO-1 data account for about 40% of total employment (Robinson et al., 2005).

focus on the proportional change in the number of central city jobs due to the change in the spatial distribution of work, what I term the *share effect*. The number of central city jobs may change because the whole MSA is growing or shrinking—the *scale* effect— or via the share effect. More concretely, let T_t denote the number of jobs in an MSA at time t ($t = 70, 80, 90, 00$); let π_t^{cc} denote the fraction of MSA jobs located in the central city; and let T_t^{cc} denote the number of central city jobs. The change in the log of the number of central city jobs can be decomposed as follows:

$$\begin{aligned}\log T_{t_1}^{cc} - \log T_{t_0}^{cc} &= \log(\pi_{t_1}^{cc} T_{t_1}) - \log(\pi_{t_0}^{cc} T_{t_0}) \\ &= \underbrace{[\log \pi_{t_1}^{cc} - \log \pi_{t_0}^{cc}]}_{\textit{share}\text{ effect}} + \underbrace{[\log T_{t_1} - \log T_{t_0}]}_{\textit{scale}\text{ effect}}.\end{aligned}$$

Hence, I measure job suburbanization using $\Delta_{t_1,t_0} \log \pi^{cc} = \log \pi_{t_1}^{cc} - \log \pi_{t_0}^{cc}$. In each decade, the fraction of work in the central city (π^{cc}) decreases by an average of about 10% across MSAs. However, this average masks substantial heterogeneity across MSAs; the standard deviation is about 10% over each decade. I report job suburbanization for all MSAs included in the analysis in Appendix Table A1 and Appendix Table A2.

3.1 Spatial Segregation in the Labor Market

In this section I assess whether, conditional on job characteristics, blacks are less likely to work in the suburbs than whites. I also assess how the relationship between job location and racial composition has changed over time.

I use EEO-1 data to measure how the racial composition of workplaces varies with workplace location. The granularity of the EEO-1 data allow for a finer measure of location than an indicator for central city status. Ideally, I would measure location effects on racial composition for very disaggregated areas within metropolitan areas (e.g., Census tracts), adjusting for establishment characteristics. Unfortunately, there are not enough establishments in the EEO-1 data to do this effectively. Instead, I parameterize the effect of location, focusing on an establishment's distance from the corresponding central business district (CBD) of the central city.[13]

To facilitate comparisons across MSAs, I first normalize each establishment's black share of employees by the black share of employees for all establishments in the MSA that year. I refer to this measure as an establishment's *normalized black share*. Hence, in an MSA where 15% of the workforce is black, a 0.10 increase in an establishment's normalized black share is a 1.5 percentage point increase in the establishment's black share of employees.

In Panel A of Figure 1 I plot the relationship between distance from CBD and normalized black share from 1971-1975 and 1996-2000. These plots are non-parametric, local polynomials with Epanechnikov kernels of bandwidth 1.25. In both periods, there is a sharp negative relationship between distance from CBD and normalized black share. For every 10-mile increase in the distance

[13] The Census Bureau defines a CBD as "an area of very high land valuation characterized by a high concentration of retail businesses, service businesses, offices, theaters, and hotels, and by a very high traffic flow." I use the latitude and longitude of each CBD as measured in Holian and Kahn (2012).

from the CBD, an establishment's normalized black share is about 0.25 lower. Remarkably, this relationship has changed little from 1971 to 2000. By contrast, the analogous slope for the racial makeup of residential neighborhoods, depicted in Panel B of Figure 1, is substantially steeper, but flattens significantly over this period.[14] Hence, while worker commuting patterns generally mute the translation of residential segregation into workplace segregation, the spatial segregation of the labor market remained roughly constant over this period despite significant residential desegregation.

This slope is also roughly unchanged after adjusting for establishment industry, occupation composition, and size. To adjust for these job characteristics, I estimate the following model:

$$\text{norm. black share}_{jt} = \tau_{m(j)i(j)t} + \beta \text{distance}_{jt}^{CBD} + \gamma \ln x_{jt} + \epsilon_{jt} \tag{1}$$

where j indexes establishments, $i(\cdot)$ indexes industries, $m(\cdot)$ indexes MSAs, and $\tau_{m(j),i(j),t}$ are MSA by industry by year fixed effects. I also try replacing the MSA by industry by year fixed effects with MSA by *firm* by year fixed effects. Under this specification, β is identified from variation in establishment location in the same MSA and year *within the same firm.* I weight observations by establishment size. I also estimate analogous models where the observations at the *job*-level (establishment by occupation), where I include MSA by industry by occupation by year fixed effects (or firm by occupation by year fixed effects) and weight observations by job cell size. In all models, I cluster standard errors at the establishment level.

Slope estimates are presented in Table 2. Establishment-level estimates are presented in Panel A; job-level estimates are presented in Panel B. In column (1) I pool all years of data and include MSA by industry by year fixed effects. The estimated coefficient, -0.0256, implies that for every 10-mile increase in its distance from the CBD, an establishment's normalized black share decreases by 0.256. Column (2) includes MSA by firm by year fixed effects, and the coefficient *increases* in magnitude to -0.0283. In columns (3)-(5) I estimate (1) by decade, including MSA by industry by year fixed effects. The estimates are stable across time periods. The analogous estimates in Panel B are similar, though slightly larger in magnitude. Controlling for fine job characteristics, blacks are less likely to work in the suburbs than whites, and this relationship between location and racial composition is stable over time. Given these coefficients the changing location of work alone would predict about a 3.7% decline in the black share of the workforce each decade.

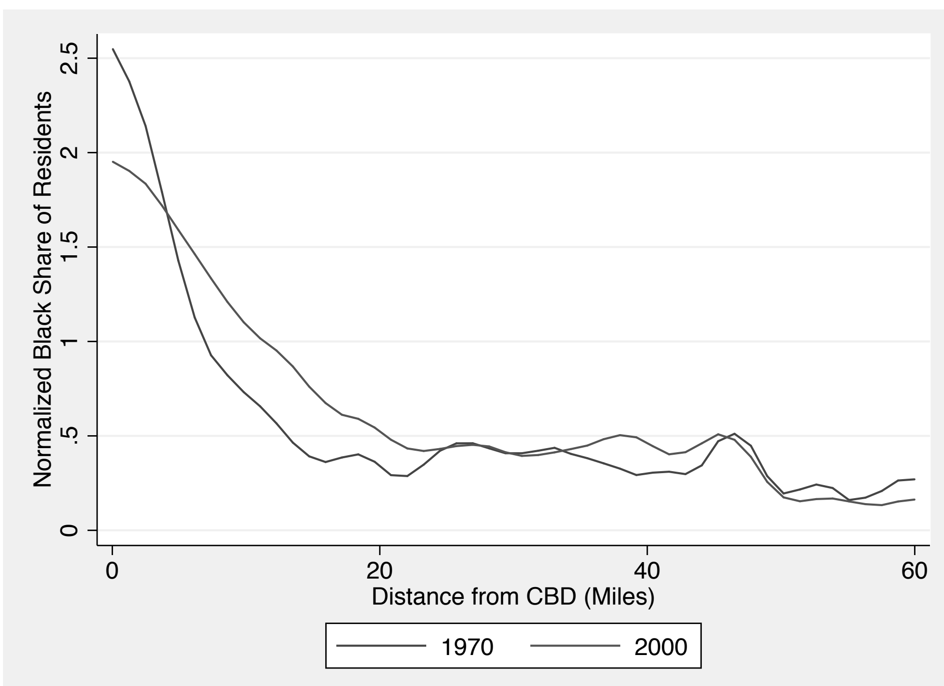
The cross-sectional relationship between distance from CBD and normalized black share suggests that spatial frictions play a significant role in determining where people work. However, it may be the case that jobs located further from the CBD differ in important unobserved ways so that, independent of location, those jobs would be less likely to be filled by black workers. These may include characteristics of the work itself or employer preferences over workers. To provide additional evidence that spatial frictions play a significant role in the racial composition of an establishment's workforce, I estimate the effects of establishment relocations on the black share of employees. The advantage of studying establishment relocations is that job characteristics and local labor market

[14]This is consistent with Cutler et al. (1999), who document significant declines in residential segregation from 1970 to 2000 as measured by the dissimilarity and isolation indices.

Figure 1: Distance from CBD and Black Share of Employees and Residents

(a) Establishments

(b) Neighborhoods



Notes: Panel A plots the non-parametric relationship between an establishment's normalized black share of employees and its distance from the central business district, weighting by establishment size. I plot Kernel-weighted local polynomials using an Epanechnikov kernel with bandwidth 1.25. Panel B plots non-parametrically the relationship between a neighborhood's (as measured by Census tracts) normalized black share of residents and its distance from the central business district, weighting by tract population. I plot Kernel-weighted local polynomials using an Epanechnikov kernel with bandwidth 1.25.

Table 2: Distance from CBD and Black Share

Outcome: Normalized Black Share					
Panel A: Establishment	All		By Decade		
			1970's	1980's	1990's
	(1)	(2)	(3)	(4)	(5)
Distance from CBD (Miles)	-0.0256**	-0.0283**	-0.0256**	-0.0257**	-0.0255**
	(0.0004)	(0.0007)	(0.0006)	(0.0005)	(0.0004)
log Establishment Size	✓	✓	✓	✓	✓
Industry × MSA × Year FEs	✓		✓	✓	✓
Firm × MSA × Year FEs		✓			
# Establishments	418,906	418,906	193,401	187,369	210,097
Panel B: Within-Occupation	All		By Decade		
			1970's	1980's	1990's
	(6)	(7)	(8)	(9)	(10)
Distance from CBD (Miles)	-0.0276**	-0.0324**	-0.0279**	-0.0277**	-0.0272**
	(0.0004)	(0.0007)	(0.0005)	(0.0004)	(0.0004)
log Establishment Size	✓	✓	✓	✓	✓
Ind. × Occ. × MSA × Year FEs	✓		✓	✓	✓
Firm × Occ. × MSA × Year FEs		✓			
# Establishments	418,906	418,906	193,401	187,369	210,097

Notes: Table refers to estimates of equation (1). All models include log establishment size as a control. Panel A models are estimated at the establishment level. Panel B models are estimated at the job level (establishment by occupation).

˜ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.

Standard errors in parentheses, clustered at the establishment level. Regression weighted by establishment size (Panel A) or job cell size (Panel B).

conditions are (approximately) fixed before and after the relocation. As long as relocations are not associated with other types of restructuring that alters the racial mix of employees–an assumption I revisit below–any change in the racial composition of employees following the move should be due to the *location* of the establishment.

This empirical strategy follows previous work, Zax and Kain (1996) and Fernandez (2008). Both papers are case studies of single manufacturing plants that relocate from central cities (Detroit in Zax and Kain (1996); Milwaukee in Fernandez (2008)) to neighboring suburbs, and study how plant employees respond to those relocations. In both papers, the authors use worker-level personnel data and estimate models for the decision to quit the job, and the decision to move to a new address. My approach here differs from prior work in several important ways. First, I have data on over one thousand establishment relocations spanning 1972 to 2000. With data on significantly more relocations, I can make more general statements about the effects of relocation. Moreover, while prior work has relied on before and after snapshots, I use yearly panel data, which allows for a more credible event study research design. Unfortunately, while Zax and Kain (1996) and Fernandez (2008) use worker-level data, I only have access to establishment-level data on workforce composition. Hence, I cannot measure how worker decisions depend on worker-specific changes in commuting time. Instead, I will look at how the composition of the *entire establishment* changes with relocation.

I restrict the analysis to establishments that move from a central city to a suburb within a given MSA, and whose distance from the central business district of the central city increases by at least 5 miles. In Table A3 column (5) I present descriptive statistics for relocating establishments that form my estimation sample and, for comparison, central city establishments with consistent addresses that that do not relocate in column (4).

I estimate event study regression models of the form:

$$\text{norm. black share}_{jt} = \alpha_i + \lambda_{d(i),t} + X_{it}\gamma + \sum_{j=a}^{b} \theta_j D_{it}^j + \epsilon_{it} \tag{2}$$

where α_i and $\lambda_{d(i),t}$ are establishment and Census division by year fixed effects, X_{it} is a polynomial in log establishment size, and D_{it}^j are leads and lags for relocation, defined as

$$D_{it}^j = \begin{cases} \mathbf{1}(t \leq \tau_i + a) & \text{for } j = a \\ \mathbf{1}(t = \tau_i + j) & \text{for } a < j < b \\ \mathbf{1}(t \geq \tau_i + b) & \text{for } j = b \end{cases}$$

where τ_i is the year the establishment relocates. I normalize the value of $\theta_{-1} = 0$. The sequence of θ_j can be interpreted as the difference in establishment black share from the year prior to relocation

[14] Zax and Kain (1996) find that white employees whose commutes lengthened due to the relocation were more likely to move, but no more likely to quit, than white employees whose commute shortened. By contrast, black employees whose commutes lengthened were more likely to both move and quit. Fernandez (2008) finds that black employees were less responsive on the move margin than white employees, and similarly responsive on the quit margin.

and j periods thereafter. Note that the end points pool the end point years (a or b) and years further from relocation ($< a$ or $> b$). For estimation, I set $a = -6$ and $b = 6$. In estimating (2) I use only data from relocating establishments. Hence, identification derives from the *differential timing* of relocation across establishments. The identifying assumption is that, if not for the differential timing of relocation across establishments, they would be on parallel trends.

I plot the θ coefficients in Figure 2. The pattern is stark. Prior to relocation, establishments exhibit little evidence of pre-trends, though their normalized black share drops by about 0.03 from three years prior to the move to one year prior. This slight drop may reflect a trend that would continue even in the absence of relocation if, for example, relocating employers are already shedding black employees. It may also reflect workers anticipating the future move or miscoded relocation years. In the year of relocation, normalized black share drops sharply by 0.12. Hence, even if relocating employers would have reduced their number of black employees if they had not relocated, this pattern indicates that relocation alone *causes* a decline in the black share of employees. This decrease continues following the move so that 6 years after the move, the normalized black share has dropped by more than 0.21. On average, movers had a normalized black share of 0.86 in the year prior to the move. In the Appendix, I also show that the change in the racial composition of employees at relocating establishments is not driven by coincident changes in the occupational composition of employees at those establishments. Blacks are substantially less likely to work the same job following its relocation to the suburbs.

For the sake of comparison, I also plot the *predicted* drop in normalized black share, where the prediction is based on the moving establishment's MSA and change in distance from the CBD. In particular, I estimate a variant of (1), allowing the β coefficient to vary by MSA, and then use the estimated model to predict the normalized black share for all establishments in the data based on MSA and distance from CBD alone.

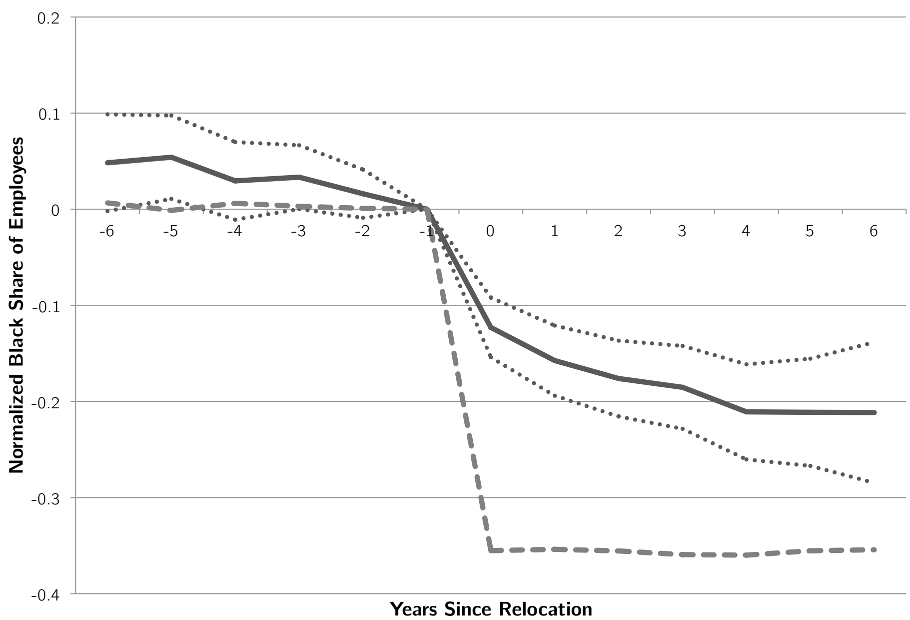
These predicted declines are significantly larger than the observed declines. This discrepancy may reflect some combination of the following: (1) the causal effect of location is heterogenous and relocating establishments are atypical[15]; (2) the β coefficients from equation (1) are not the causal effect of establishment location; (3) the effect of establishment *location* is not the same as the effect of an establishment *relocation*. The effects may not coincide if, for example, central city residents are more aware of job opportunities at establishments that have relocated to the suburbs than establishments that have only located in the suburbs. Nonetheless, the effect of relocation is substantial.

Black workers are less likely to work further away from the CBD. This is at least in part due to spatial frictions. Over time, establishments tend to locate further away from the CBD. If working patterns across MSA locations persist, the changing spatial distribution of work suggests that black employment will decline. However, black workers may adjust their behavior in response. For example, they may alter their commuting patterns or move to neighborhoods further from the

[14] That is, $\tau_{m(j)i(j)t}$ and $\ln x_{jt}$ are set to zero.

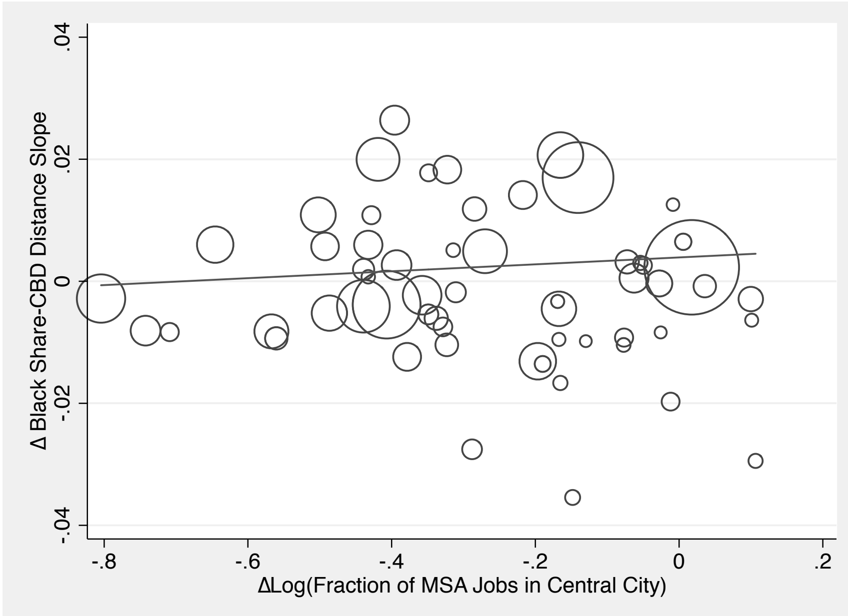
[15] For example, relocating establishments have relatively low black shares even *prior to* relocation.

Figure 2: Establishment Relocations and Black Share



Notes: This figure plots event study coefficients and 95% confidence intervals (dotted) estimated using model (2) where the outcome variable is the establishment's normalized black share of employees. The models are estimated using all establishments that relocate from the central city to the suburbs and whose distance from the central business district increases by at least 5 miles. The coefficient for the year prior to the event (θ_{-1}) is normalized to zero. Estimated models include Census division by year fixed effects and log establishment size as controls. Standard errors are clustered at the establishment level. The purple line depicts predicted changes in the normalized black share of workers based on the MSA-specific cross-sectional relationship between establishment normalized black share and distance from the central business district. See section 3.1 for further details on the construction of these predictions.

Figure 3: Job Suburbanization and Changes in Spatial Segregation



Notes: The black share-CBD distance slope is an MSA-level measure of the relationship between an establishment's black share of employees and its distance from the central business district. See section 3.1 for further details on the construction of this slope.

CBD. I examine whether the MSA-level relationship between an establishment's distance from the CBD and the black share of its employees changes in response to job suburbanization.

Given that the distance-black share slope has changed so little from 1971 to 2000, a period that saw substantial job suburbanization, it seems unlikely that job suburbanization flattened this relationship. However, this aggregate stagnancy may mask across-MSA heterogeneity. I measure a separate distance-black share slope for each MSA as in equation (1). I estimate this slope separately using data from 1971-1975 and 1996-2000. I then plot the change in this slope against job suburbanization from 1970 to 2000 as measured in Census data and defined in section 3.[16] The mean slopes in the early and late periods, weighted by 1971 employment, are -0.031 and -0.030 with standard deviation 0.016 in both periods.

I present the results in Figure 3. There are two aspects to note. First, there is little within-MSA change in distance-black share slopes. Second, there is little evidence that job suburbanization is associated with increases in the distance-black share slope across MSAs. In fact, the correlation is positive (0.20) and marginally significant at the 10% level. Hence, while black employment in the suburbs does increase over this period, black workers remain similarly less likely to work in the suburbs despite widespread job suburbanization.

[16] Results are similar if I use job suburbanization as measured in the EEO-1 data.

4 Job Suburbanization and Black Employment Rates

I have documented that conditional on job characteristics, blacks are ex-ante less likely than whites to work in suburbs, and this segregation persists despite widespread job suburbanization. This suggest that job suburbanization may reduce black labor market opportunities and increase racial labor market inequality. In this section, I exploit variation across MSAs to estimate the local labor market level relationship between job suburbanization and black employment rates.

In analyzing labor market outcomes, I restrict attention to men and women between the ages of 24 and 63 who are non-Hispanic white or black. To measure employment I use an indicator for whether an individual is currently labor market 'active', meaning employed or in school.[17] In practice, this measure reflects employment because only a small fraction of individuals in my sample report being in school and this does not differ significantly by race. For this reason, I refer to 'active' and 'employed' interchangeably.

Combining Integrated Public Use Microdata (IPUMS) (Ruggles et al., 2010) from each Census, I construct a synthetic panel by collapsing individuals into cells and merging cells across years. The 1970 Census data is a 2% national sample, while the remaining years are 5% national samples. I group individuals by MSA of residence, gender, race, education, and cohort. I exclude the institutionalized because individuals in that population may not be residing in their relevant labor market. This may attenuate the relevant estimates below given that incarceration rates began to increase substantially in the mid-1970's and a large share of black adults was incarcerated, though the cohorts I focus on will have largely 'aged-out' of criminal activity by 1980 (Western and Pettit, 2000). Patterns for women should be less susceptible to this issue. I divide the sample into 3 education groups: less than high school graduate, high school graduate, and college graduate. I also divide the sample into cohorts, those who are the following ages in 1970: 24-33, 34-43, and 44-53.[18] I group by cohort rather than age because the intention is to follow the same group of individuals from decade to decade.[19] Of course, the composition of cells may change from decade to decade due to migration. I explore the role migration plays in the analysis in section 4.3.

Summary statistics on the demographics and labor market outcomes for the synthetic cohorts are presented in Table 3. Black men are less active in the labor market than white men in 1970 and experience larger proportional declines in employment in the short run and long run. By contrast, black women are more active in the labor market than white women in 1970. However, the white women experience larger increases in employment rates over time.

[17] Results are similar if I use weeks worked as the employment measure.

[18] This corresponds to individuals born in: 1936-1945; 1946-1955; 1956-1965.

[19] Moreover, there are important changes in the educational opportunities children face over this period, and these changes vary across MSAs and by race. In particular, following the *Brown v. Board of Education* Supreme Court decision of 1954, many large urban school districts were mandated to desegregate under federal court order. These court orders had substantial effects on school segregation and black educational attainment (Guryan, 2004). In addition, while many blacks in older cohorts residing outside of the South were educated in the South, this is less true for younger cohorts. Hence, even within a given MSA, there is wide variation in education experiences across cohorts, particularly for blacks.

Table 3: Sample Descriptive Statistics, Cell-Level

	Black				**White**			
	1970	1980	1990	2000	1970	1980	1990	2000
Share	0.132	0.138	0.126	0.143	0.868	0.862	0.874	0.857
Female	0.563	0.565	0.574	0.576	0.515	0.517	0.517	0.518
1936-1945	0.287	0.285	—	—	0.341	0.343	—	—
1946-1955	0.335	0.317	0.455	—-	0.313	0.310	0.478	—
1956-1965	0.378	0.398	0.545	1.000	0.346	0.346	0.522	1.000
<HS Grad	0.559	0.487	0.410	0.329	0.289	0.241	0.173	0.125
HS Grad	0.402	0.452	0.501	0.569	0.541	0.556	0.565	0.568
College Grad	0.038	0.060	0.089	0.102	0.170	0.203	0.262	0.307
Active, Male	0.868	0.747	0.693	0.546	0.947	0.869	0.819	0.714
	(0.059)	(0.121)	(0.144)	(0.113)	(0.030)	(0.106)	(0.127)	(0.090)
Active, Female	0.568	0.594	0.616	0.489	0.479	0.554	0.623	0.565
	(0.117)	(0.155)	(0.173)	(0.123)	(0.080)	(0.122)	(0.156)	(0.100)
π^{cc}	0.529	0.489	0.460	0.423	0.525	0.489	0.459	0.422
	(0.111)	(0.125)	(0.156)	(0.169)	(0.112)	(0.120)	(0.146)	(0.160)
$\Delta \log(\pi^{cc})$	—	-0.094	-0.094	-0.110	—	-0.089	-0.089	-0.107
	—	(0.110)	(0.137)	(0.079)	—	(0.104)	(0.126)	(0.073)
Share Living in	0.795	0.734	0.678	0.617	0.393	0.324	0.292	0.270
Central City	(0.131)	(0.155)	(0.181)	(0.207)	(0.157)	(0.150)	(0.153)	(0.155)

Notes: Includes 58 consistently identified MSAs with largest black populations in 1970, and only cells with at least 25 individuals. Weighted by cell size. See section 4 for further details on cell construction. π^{cc} refers to the fraction of MSA jobs located in the central city. 'Share Living in Central City' refers to share of entire racial group living in central city of each cell's MSA, not the share of cell living in the central city. The latter cannot be identified in all years of Census data.

4.1 Empirical Strategy

I test the spatial mismatch hypothesis by estimating the relationship between job suburbanization and black-white inequality in employment rates, exploiting variation across MSAs. In particular, I test whether black cohorts experience larger declines in employments rates relative to comparable white cohorts in MSAs that experience more job suburbanization. I estimate linear differences-in-differences models of the following form:

$$\begin{aligned}\Delta Y_{mg} =& \sum \alpha^g + \beta \Delta \log(\pi_m^{cc}) + f(Y_{mg}^{t_0})\gamma \\ &+ I_{black} \times \left(\beta^B \Delta \log(\pi_m^{cc}) + f(Y_{mg}^{t_0})\gamma^B\right) + \epsilon_{mg}\end{aligned} \tag{3}$$

where α^g are group level fixed effects and I_{black} is an indicator for a cell of black individuals. Y is either the log share of a cell that is employed[20], or log average annual earnings. In some specifications I do not condition on baseline employment (earnings), but in others I specify $f(\cdot)$ as a quadratic function. I include a control for a polynomial in baseline Y because employment or earnings growth may depend nonlinearly on baseline employment or earnings.[21] The coefficient β has the following interpretation: a 10% decline in the fraction of MSA jobs located in the central city is associated with at .10 $\times$ β% decline in cell employment. The coefficient β^B reflects the *relative* decline for black cells.

Before describing the baseline results, I explore how job suburbanization relates to other baseline cell-level and MSA-level characteristics.

One concern with my empirical strategy is that job suburbanization may occur in areas where employment is already declining, particularly for black workers. Though the 1960 Census does not identify MSA, for half the respondents in the 1970 Census, I can observe their employment status in 1965. To measure pre-trends by cell, I use the change in employment rates by cell, assigning individuals to MSAs using their residence in 1970. I estimate models of the form

$$\Delta^{PRE} \log\left(\text{Employment Rate}\right) = \sum \alpha^g + \beta \Delta \log(\pi_m^{cc}) + \beta^B I_{black} \times \Delta \log(\pi_m^{cc}) + \epsilon_{mg} \tag{4}$$

I estimate separate models for job suburbanization occurring over the short run (1970 to 1980) and long run (1970 to 2000). The results are provided in Table 4 Panel A. I find that cells that experienced more job suburbanization from 1970 to 1980 had somewhat lower employment growth from 1965 to 1970. For suburbanization occurring from 1970 to 2000, the magnitude is even smaller and statistically insignificant. Importantly, the differences in trends between black and white cells is statistically insignificant in both cases and have opposite sign. Hence, black employment does not appear to be on a differential trend in suburbanizing MSAs.

A second concern is that job suburbanization is associated with other covariates that may

[19] Groups are combinations of cohort, education, sex, and race.

[20] Results are very similar if I use share *levels* as the outcome of interest.

[21] For example, because the cell employment rate is capped at 1, cells with high baseline employment have very little potential for growth relative to cells with lower baseline employment.

Table 4: Job Suburbanization and Baseline Cell and MSA Characteristics

Panel A: Suburbanization and Employment (1965 to 1970) Outcome: Δ^{PRE} log (Employment Rate)	1970-1980	1970-2000
$\Delta \log(\pi^{cc})$	0.083˜	0.034
	(0.049)	(0.060)
$\Delta \log(\pi^{cc}) \times$ black	0.058	-0.040
	(0.040)	(0.027)
Group FEs	Yes	Yes
N Cells	1607	563
N MSAs	58	58

Panel B: Suburbanization and 1970 Characteristics	1970-1980		1970-2000	
Outcome: $\Delta \log(\pi^{cc})$	δ	δ^B	δ	δ^B
Log Fraction Active (Group)	0.318˜	-0.018	0.246	-0.088
	(0.160)	(0.095)	(0.300)	(0.209)
Log Earnings (Group)	-0.168	-0.056	-0.045	-0.281
	(0.098)	(0.071)	(0.229)	(0.196)
Fraction of Work in Central City (MSA),	-0.008	-0.002	0.072*	0.019
Standardized	(0.017)	(0.010)	(0.031)	(0.021)
Fraction Black (MSA),	-0.022	-0.020	-0.114**	-0.058˜
Standardized	(0.019)	(0.014)	(0.039)	(0.033)
Dissimilarity Index (MSA),	-0.036**	-0.009	-0.098**	-0.016
Standardized	(0.012)	(0.011)	(0.026)	(0.018)
Violent Crime Rate (MSA),	-0.004	0.012	0.110	0.011
Standardized	(0.019)	(0.011)	(0.052)	(0.026)
Property Crime Rate (MSA),	-0.005	-0.003	-0.089*	0.006
Standardized	(0.017)	(0.012)	(0.036)	(0.025)
Group FEs	Yes		Yes	
N Cells	1564		547	
N MSAs	56		56	

Notes: Panel A displays estimates of equation (4). In Panel A, the outcome is cell-level changes in employment rates from 1965 to 1970. Panel B displays estimates of equation (5). In this panel, the outcome is MSA job centralization. Columns (1) and (2) refer to centralization from 1970 to 1980; columns (3) and (4) refer to centralization from 1970 to 2000. The odd columns display the estimated δ coefficients from equation (5), the 'main effects'; the even columns display the estimated δ^B coefficients, the black cell interactions. All models include group fixed effects (fixed effects for all combinations of cohort, education, sex, and race). Dissimilarity segregation indices are taken from Cutler et al. (1999).
˜ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.
Standard errors in parentheses, clustered at the MSA level. Regression weighted by cell size.

influence labor market outcomes differently for black and white workers. Table 4 Panel B provides coefficient estimates for models in the form:

$$\Delta \log(\pi_m^{cc}) = \sum \alpha^g + W_m\delta + I_{black} \times W_m\delta^B + \epsilon_{mg} \tag{5}$$

where W_m is a vector of cell-level and MSA-level covariates. I relate these correlates to short run and long run subsequent job suburbanization. I relate job suburbanization to the following baseline cell-level characteristics: log fraction active, log earnings. I also include the following baseline MSA-level characteristics: fraction of jobs in the central city, black share of population, racial residential segregation, violent crime rate, and property crime rate. To measure I use the dissimilarity index constructed in Cutler et al. (1999). Data on reported crimes come from the FBI's Uniform Crime Reports. The UCR reports crimes per 100,000 for 7 types of offenses: murder, rape, robbery, aggravated assault, burglary, larceny, and motor vehicle theft. I divide these 7 offenses into two categories, violent and property crimes, and sum within these categories. I standardize the MSA-level covariates to have mean zero and standard deviation one across MSAs.

From 1970 to 1980, I find residential segregation to be a significant predictor of job suburbanization across cells. Baseline employment rates are a marginal predictor. Notably, these relationships do not differ significantly for black cells. From 1970 to 2000, baseline residential segregation and the fraction black of the population are significant predictors of job suburbanization. This is consistent with research suggesting that black in-migration to central cities was a major cause of 'white flight' (Boustan, 2010). The baseline fraction of jobs located in the central city is a marginal predictor.

4.2 Baseline Estimates

In estimating (3), I restrict the analysis to cells with at least 25 observations, and weight cells by their size. This leaves 1607 cells in 1970 over 58 MSAs. I cluster standard errors at the MSA level. I estimate separate models for three periods: 1970 to 1980, 1970 to 1990, and 1970 to 2000. Table 5 provides these baseline estimates. In the top panel, the outcome is log employment rate. In the bottom panel, the outcome is log average income. All columns other than (1), (4), and (7) include controls for second order polynomial in baseline employment or earnings.

Across specifications and periods, changes in the spatial distribution of work have little association with white employment rates. The coefficient is generally small in magnitude and statistically indistinguishable from zero at the 10% level. By contrast, job suburbanization is associated with declines in black employment, and the relationship is highly statistically significant across specifications. Over the 1970's, the β^B coefficient of 0.25 to 0.29 implies that a 10% decline in the fraction of MSA jobs located in the central city—about the mean level experienced over this period—is associated with about a 2.5% to 2.9% decline in black cell fraction employed, relative to white employment. The estimates for annual earnings have the same sign, but the coefficient is more dependent on the inclusion of baseline earnings as a control.

From 1970 to 1990, a 10% decline in the fraction of jobs located in the central city is associated

Table 5: Job Suburbanization and Labor Market Outcomes

	1970-1980			1970-1990			1970-2000		
Outcome: $\Delta\log$ (Emp. Rate)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Delta\log(\pi^{cc})$	-0.030	-0.020		-0.023	-0.006		-0.039	-0.029	
	(0.051)	(0.057)		(0.071)	(0.049)		(0.048)	(0.037)	
$\Delta\log(\pi^{cc}) \times$ black	0.247**	0.286**	0.262**	0.233**	0.181**	0.162**	0.232**	0.163**	0.142**
	(0.065)	(0.075)	(0.058)	(0.054)	(0.057)	(0.055)	(0.041)	(0.038)	(0.039)
Outcome: $\Delta\log$ (Earnings)									
$\Delta\log(\pi^{cc})$	-0.030	-0.050		0.080	0.093		0.027	0.036	
	(0.066)	(0.075)		(0.101)	(0.105)		(0.062)	(0.066)	
$\Delta\log(\pi^{cc}) \times$ black	0.365**	0.160	0.139˜	0.230*	0.143	0.050	0.233**	0.124*	0.033
	(0.097)	(0.094)	(0.072)	(0.076)	(0.079)	(0.068)	(0.072)	(0.057)	(0.049)
Group FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FEs	No	No	Yes	No	No	Yes	No	No	Yes
Baseline Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
N Cells	1607	1607	1607	1099	1099	1099	563	563	563
N MSAs	58	58	58	58	58	58	58	58	58

Notes: Table displays estimates of equation (3). Columns (1)-(3) refer to models covering 1970-1980, columns (4)-(6) refer to models covering 1970-1990, and columns (7)-(9) refer to models covering 1970-2000. All models include group fixed effects (fixed effects for all combinations of cohort, education, sex, and race). Columns (2), (3), (5), (6), (8), and (9) include a quadratic in log baseline employment (Panel A) or earnings (Panel B) interacted with race. Columns (3), (6), and (9) include MSA fixed effects. In Panel A, the outcome is changes in log employment rates; in Panel B, the outcome is changes in log earnings. All models are estimated at the cell level.
˜ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.
Standard errors in parentheses, clustered at the MSA level. Regression weighted by cell size.

with a 1.8% to 2.3% decrease in black relative employment. Over the full period, a 10% decline in the fraction of jobs located in the central city is associated with a 1.6% to 2.3% decrease in black relative employment. The latter relationship is estimated using a single cohort of workers: those who were 25-34 in 1970, and 55-64 in 2000. Figure 4 displays this relationship graphically, plotting $\Delta_m \log(\pi^{cc})$ against changes in log black and white employment rates for *all* individuals in these cohorts pooled by MSA. For black workers, there is a clear, positive relationship; for white workers, there is no relationship.

Given that the average value for $\Delta \log(\pi^{cc})$ is about -0.1 for each decade, the observed job suburbanization predicts a 1.6% to 2.3% decrease in black employment. This is 43-62% of the decline predicted by the changing location of work alone, as described in section 3.1. This suggests that blacks were able to make adjustments to partially offset the potential effects of job suburbanization.

I examine heterogeneity in the baseline estimates by education and gender. These estimates are presented in Table 6. I focus on the 1970-2000 period. All models include a quadratic in baseline employment or earnings. For employment, the β^B coefficient is largest for high school dropouts, but also present for high school and college graduates. The coefficient is somewhat larger for women than men, though the difference is not statistically significant. This is striking given that men and women tend to work in very different industries and occupations over this period, and further supports the claim that the measured effects of suburbanization are not driven by changes in job composition. For earnings, the relationship is present for women but not men.

4.3 Endogenous Migration

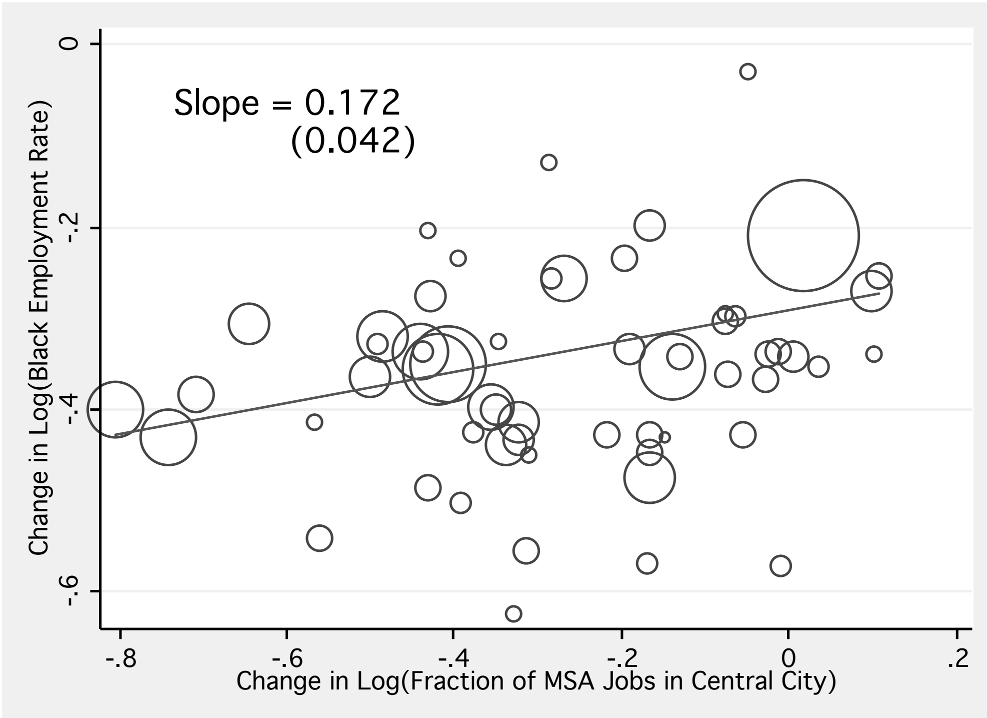
Due to data limitations, I conduct the main analysis using a synthetic panel rather than a true panel of individuals. For the same reason that residential sorting is a concern for any cross-sectional analysis, the endogenous migration of households to and from MSAs may introduce a compositional bias in the synthetic panel analysis. The productivity of migrants to and from an MSA may vary systematically with job suburbanization, so that the correlation between job suburbanization and employment growth may in part reflect the changing composition of cells rather than within-person changes. For example, productive black households may move out of an MSA following widespread suburbanization, leaving less productive black households behind. While this type of endogenous migration would suggest that the spatial distribution of work is relevant for labor market outcomes, it complicates the interpretation of the coefficient estimates.

In assessing the role of migration, I focus on the 1970-1980 period, where job suburbanization appears to have its largest effect.[22] I utilize the fact that the 1980 Census identifies an individual's place of residence and employment status in 1975 for half the sample. Hence, I observe a true panel of a large subsample of individuals over this 5-year period. I estimate models analogous to (3), except over a 5-year period, and compare the results when using a synthetic panel to results using a true panel. I construct the synthetic panel by assigning individuals to MSAs separately by where

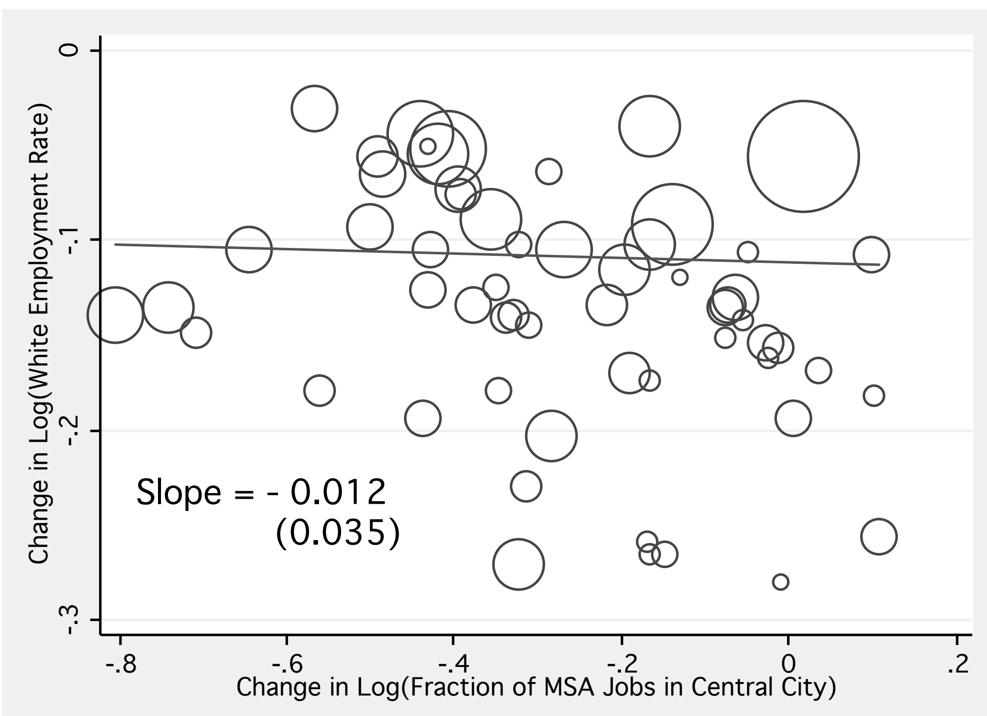
[22]While data limitations prevent me from studying migration at the same level of detail over the full period, I do find that changes in cell size from 1970 to 2000 are unrelated to job suburbanization.

Figure 4: Job Suburbanization and Changes in Employment Rates, 1970-2000

(a) Synthetic Panel, Black



(b) Synthetic Panel, White



Notes: This figure plots changes in black and white employment rates against job centralization across 58 MSAs from 1970 to 2000 for those born between 1956 and 1965 (25-34 in 1970 and 55-64 in 2000). See section 4.2 for details on the construction of synthetic cohorts.

Table 6: Job Suburbanization and Labor Market Outcomes, Heterogeneity

	1970-2000				
	HS Dropout	HS Grad	College Grad	Men	Women
Y: $\Delta \log$ (Emp. Rate)	(1)	(2)	(3)	(4)	(5)
$\Delta \log(\pi^{cc})$	0.017	-0.029	-0.039	-0.008	-0.036
	(0.070)	(0.039)	(0.035)	(0.029)	(0.050)
$\Delta \log(\pi^{cc}) \times$ black	0.216**	0.098**	0.083*	0.118**	0.169**
	(0.062)	(0.035)	(0.040)	(0.036)	(0.047)
Y: $\Delta \log$ (Earnings)					
$\Delta \log(\pi^{cc})$	0.077	0.023	0.016	0.065	0.004
	(0.101)	(0.071)	(0.066)	(0.057)	(0.088)
$\Delta \log(\pi^{cc}) \times$ black	0.144	0.107˜	0.125	-0.008	0.233*
	(0.093)	(0.062)	(0.096)	(0.077)	(0.090)
Group FEs	Yes	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes
N Cells	206	218	139	275	287
N MSAs	58	58	58	58	58

Notes: Table displays estimates of equation (3) covering 1970-2000. Column (1) restricts to cells with less than high school degree, column (2) restricts to high school graduates, column (3) restricts to college graduates, column (4) restricts to men, and column (5) restricts to women. All models include group fixed effects (fixed effects for all combinations of cohort, education, sex, and race) and a quadratic in log baseline employment (Panel A) or earnings (Panel B) interacted with race. In Panel A, the outcome is changes in log employment rates; in Panel B, the outcome is changes in log earnings. All models are estimated at the cell level.

˜ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.

Standard errors in parentheses, clustered at the MSA level. Regression weighted by cell size.

Table 7: Job Suburbanization, Employment, and Migration, 1975-1980

	$\Delta\log$ (Emp. Rate)		Fraction	$\hat{\Delta}\log$ (Emp. Rate)
	True	Synthetic	Emigrate	Baseline
	(1)	(2)	(3)	(4)
$\Delta\log(\pi^{cc})$	0.078	0.017	0.112*	0.012
	(0.065)	(0.086)	(0.056)	(0.010)
$\Delta\log(\pi^{cc}) \times$ black	0.291*	0.368*	-0.060	0.003
	(0.116)	(0.158)	(0.059)	(0.009)
Group FEs	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes
N Cells	1682	1682	1682	1682
N MSAs	58	58	58	58

Notes: Table displays estimates of equation (3) covering 1975-1980. In columns (1) and (2), the outcome is changes in log employment rates, measured using a 'true' panel in column (1) and using a 'synthetic' panel in column (2). In column (3) the outcome is the fraction emigrating from their initial MSA. In column (4) the outcome is the difference between the 1975 employment rate *excluding* eventual migrants and the 1975 employment *including* eventual migrants. See section (4.3) for further details on how these outcomes are constructed.
Notes: ~ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.
Standard errors in parentheses, clustered at the MSA level. Regression weighted by cell size.

they live in 1975 and where they live in 1980. To form the true panel, I assign individuals to MSAs based only on where they live in 1975.

Unfortunately, I cannot observe the spatial distribution of work in 1975. Instead, I halve the same measure of job suburbanization from over the 10-year period. Note that, even under random migration, the coefficients in the true panel analysis may be attenuated for the same reason that attrition attenuates coefficient estimates. Households that move are mechanically less 'exposed' to job suburbanization in their assigned MSA than households that do not move. Under random migration, given that about 15% of individuals change MSAs over this period, and assuming coefficients of zero for moving households, this attrition would predict that the coefficients in the true panel analysis is about 85% as large as the coefficients in the synthetic panel analysis.

I present estimates from the 5-year analysis in Table 7. In columns (1) and (2) the outcome is $\Delta\log$ (Fraction Employed). In column (1) the analysis is conducted using a true panel; column (2) is estimated using a synthetic panel. In general, the coefficients do not differ substantially. As would roughly be predicted by random migration, the coefficient on $\Delta\log(\pi_m^{cc}) \times black$ is about 15% smaller in magnitude under the true panel, and statistically significant using either the true or synthetic panel.

In addition, I test directly for selective migration by examining whether job suburbanization predicts migration flows and the composition of migrants. For migration flows I look at the fraction of a cell that emigrates out of the original MSA. Column (3) presents coefficient estimates from this exercise. To examine the composition of emigrants, I look at how the 1975 employment rate of a cell would change if the eventual migrants were excluded (I label this as $\Delta^M(emp)$). Column (4) presents coefficient estimates from this exercise. While job suburbanization predicts a small, marginally significant decrease in emigration for white cells, it is uncorrelated with changes in the composition of cells due to emigration.

4.4 Job Suburbanization and Composition

The spatial distribution of jobs shifted towards the suburban ring while the structure of the US labor market was changing in other important ways. From World War II to the late 1970s, the relative supply of college-educated workers rose substantially (Autor et al., 2008). The manufacturing share of employment has declined consistently since World War II. Since 1980, there has been a pronounced increase in wage inequality and job polarization–employment and wage gains in low and high skilled occupations relative to middle skill occupations–both of which have been attributed by many researchers to technological change (Acemoglu and Autor, 2011). Job suburbanization may have occurred as part of a joint process with these and other fundamental changes in the labor market, which would complicate teasing out the causal implications of suburbanization. In this section, I explore whether job suburbanization is associated with changes in the types of work performed in the labor market.

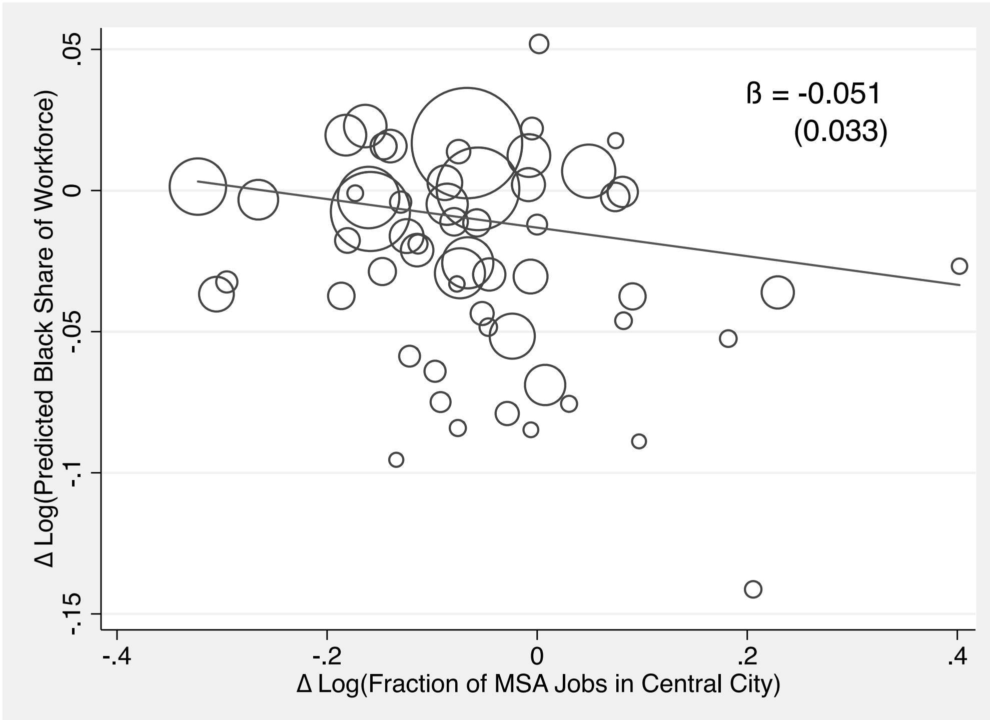
To evaluate the importance of sector shifts associated with job suburbanization, I test whether MSAs that experience greater job suburbanization also experience relative growth in the sectors that disproportionately employed whites or blacks in 1970. For each MSA by major industry pair, I estimate the share of workers in 1970 that are black. I then predict the black share of the workforce in subsequent decades by taking a weighted average of these 1970 black shares, weighting by the share of workers in each major industry and MSA in that decade.

Figure 5 plots changes in $\log \pi^{cc}$ from 1970 to 1980 (Panel A) and 1970 to 2000 (Panel B) against predicted changes in the black share of the workforce. In both cases, the relationship is statistically insignificant at the 5% level. Moreover, the sign flips from negative from 1970 to 1980 to positive from 1970 to 2000. Again, the results are similar if I group by occupation rather than industry. Job suburbanization is not associated with quantitatively important sector shifts. I document this finding in more detail in the Appendix.

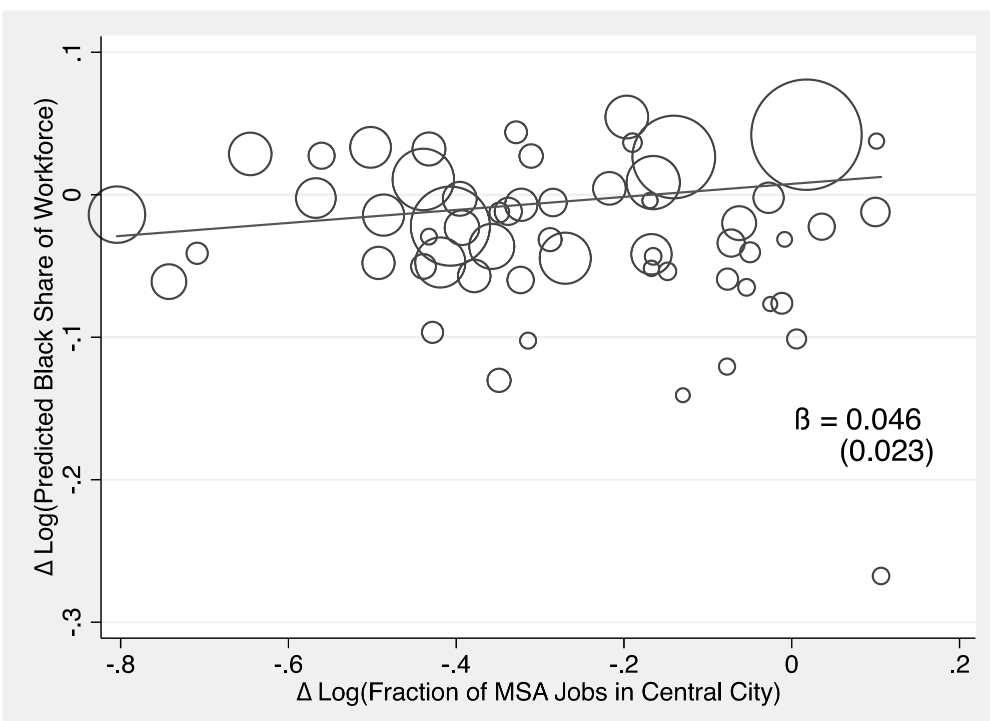
Overall, there is little discernible relationship between job suburbanization and changes in job composition across MSAs over this period. This suggests the baseline results in 4.2 are not driven by changes in job composition. I confirm this directly as a robustness check. In Appendix Table A6, I add control for changes in job composition to equation (3). In particular, I control for predicted changes in the black share of the workforce based on changes in industry or occupation composition, as constructed in section 4.4. Indeed, including these controls does not materially affect the results. Moreover, the fact that job suburbanization is unrelated to overall skill upgrading suggests that the results in Table 5 are a within-skill group phenomenon. Appendix Table A5 confirms this. The β^B

Figure 5: Job Suburbanization and Composition

(a) 1970-1980



(b) 1970-2000



Notes: Predictions for the black share of the workforce are constructed based on the racial composition of different industries in different MSAs in 1970, and changes in each MSA's industry composition over time. See section 4.4 for further details on the construction of this figure.

coefficient estimates are similar when I include MSA by education category fixed effects or MSA by education by sex by cohort fixed effects.

4.5 Highways as Source of Variation

Unobserved shocks to the productivity of black workers could induce firms to migrate *and* produce black employment declines, even in the absence of a spatial mismatch mechanism. For example, the emergence of crack cocaine markets in the 1980's and 1990's could potentially explain both the deterioration of some black communities and the relocation of employers from the central city (Evans et al., 2016).

To test whether the observed relationship between job suburbanization and declines in black relative employment is driven entirely by such productivity shocks, I require an instrument for job suburbanization that is plausibly orthogonal to such shocks. More generally, the ideal instrument would satisfy an exclusion restriction: it would only (potentially) affect black employment by changing the spatial distribution of work.

To instrument for job suburbanization, I exploit a previously used source of variation in suburbanization: the interstate highway system (Baum-Snow, 2007; Michaels, 2008). This instrument is imperfect: research has documented that highways have a variety of effects on the labor market, which I describe in section 4.5.1, and it is possible that they affect black relative employment through channels other than the spatial distribution of work. However, I argue that they are exogenous to labor demand and supply shocks that would disproportionately affect black workers, the most concerning omitted variables. I also study the reduced form effects of highways on black relative employment.

4.5.1 Prior Research

Baum-Snow (2007) documents that the U.S. interstate highway system played an important role in post-war residential suburbanization. With nearly all construction occurring between 1956 and 1980, the interstate highway system would ultimately span over 40,000 miles. The highway system was originally designed to connect major metropolitan areas, serve U.S. national defense, and connect major routes in Canada and Mexico. Using plausibly exogenous variation in highway construction across MSAs, Baum-Snow (2007) finds that one new highway passing through a central city reduces its population from 1950 to 1990 by about 18%. These effects are substantial: they imply that the interstate highway system accounts for about 1/3 of the decline in central city population relative to total MSA growth over this period. Using the same identification strategy, Baum-Snow (2014) finds that highways also caused substantial job suburbanization.

Highways can potentially increase suburbanization through several mechanisms. First, they decrease transportation costs for both firms and households. For firms, highways make physical proximity to other transportation hubs (e.g. ports and rail stations) and upstream or downstream firms less important, allowing them to take advantage of cheaper land and other suburban amenities. Michaels (2008) argues that, as highway construction was nearing completion, trucks became the primary mode of shipping goods within the United States. For households, highways reduce the costs of commuting to central work and access to other central city amenities from a suburban residence. These direct effects on transportation costs may also have feedback effects. By increasing the number of firms and households in the suburbs, they make these areas more attractive for other firms and households. Firms may follow suburbanizing workers and achieve agglomeration economies in the suburbs.

In addition, interstate highways had other important effects on local economies. Michaels (2008) shows that highways increased trade for exposed rural counties and raised the relative demand for skilled manufacturing workers in skill-abundant rural counties while reducing it elsewhere. Duranton et al. (2014) find that highways lead cities to increase the weight of their exports and specialize in sectors producing heavy goods. Duraton and Turner (2012) find that interstate highways increase MSA growth from 1983 to 2003.

Building the interstate highway system also forced the destruction of neighborhoods and displacement of households, particularly in central cities. There is evidence that black households faced a disproportionate share of displacements, and that local planners exploited interstate construction as an opportunity to eliminate poor, "blighted", and often black communities (Rose and Mohl, 2012). This suggests another channel through which the interstate highways system may affect black relative employment rates, potentially violating the exclusion restriction. However, more than 90% of interstate-central city intersections in the MSAs I study were already built by 1970. Hence, the effects of neighborhood clearances should already be reflected in baseline labor market outcomes. For the analysis below, my measure of MSA highway exposure is the stock of interstate highway rays emanating from the central city in 1970.

4.5.2 Background: The Federal Highway Act of 1944

A potential concern with exploiting variation derived from the interstate highway system is that highway assignment may be determined endogenously. As Baum-Snow (2007) notes, the interstate highway system was likely in part designed to facilitate local commuting and local economic development in particular regions. The highway system might have also been designed accounting for productivity shocks to black workers in the 1970's, though this seems less plausible. Still, actual highway construction across MSAs may be related to counterfactual MSA-level outcomes. To deal with this, I instrument for realized highway construction using the 1947 federal interstate highway plan as in Baum-Snow (2007) and other work.

In 1937, the Franklin D. Roosevelt administration began to plan an interstate highway system. In their recommended highway plan, the National Interregional Highway committee considered the distribution of population, manufacturing activity, agricultural production, the location of post-World War II employment, a strategic highway network drawn up by the War Department in 1941, the location of military and naval establishments, and interregional traffic demand, in that order. This led to the Federal Highway Act of 1944, which instructed the roads commissioner to develop an initial plan for a national interstate highway system. As specified by the legislation, the highways in the planned system were to be "... so located as to connect by routes as direct as practicable, the principal metropolitan areas, cities, and industrial centers, to serve the national defense, and to connect at suitable border points with routes of continental importance in the Dominion of Canada and the Republic of Mexico..." (as cited in Baum-Snow, 2007). Importantly, the legislation makes no mention of local commuting or local economic development. The final plan produced under this Act, approved in 1947, is presented in Appendix Figure A3.

Major funding for the interstate highway system began with the Federal Highway Acts of 1956. The 1956 Interstate Highway Act expanded the 1947 plan and committed the federal government to pay 90 percent of the cost of construction. In particular, the 1956 plan incorporated additional highways that were designed for local purposes like commuting and development. Therefore, in some specifications I instrument for actual highway rays using highway rays planned in 1947. The first stage t-statistic is in excess of 5.

4.5.3 Empirical Strategy and Results

To begin, I explore the relationship between highways and several key outcomes: job suburbanization, residential suburbanization, and job composition. In all subsequent analyses, my measure of highway exposure is the number of interstate highway rays emanating from the central city in 1970. To determine the relationship between highways and job suburbanization, I estimate specifications of the following form, where again coefficients can differ by race:

$$\begin{aligned}\Delta Y_{mg} = &\sum \alpha^g + \gamma_1 rays_m^{1970} + \gamma_2 radius_m + f(emp^{1970})_{mg} + X_m\gamma_3 \\ &+ I_{black} \times \left(\gamma_1^B rays_m^{1970} + \gamma_2^B radius_m + +X_m\gamma_3^B\right) + \epsilon_{mg}\end{aligned} \tag{6}$$

where $rays_m^{1970}$ denotes the number highway rays emanating from the central city of MSA m in 1970 and $radius_m$ is the radius of the central city, a key control in the analysis of Baum-Snow (2007). Intuitively, one must control for central city radius because it determines the extent to which sprawl is reflected in suburbanization measures, and highways are more likely to travel through central cities that are physically larger. Note that the average number of central city highway rays in 1970, weighted by the sample population size, is 3.9; the unweighted average is 3.[23]

As in Table 4, I begin by relating highways to pre-period changes in employment rates and baseline cell and MSA characteristics. The results are presented in Appendix Table A7. There is no relationship between an MSA's highway stock in 1970 and cell-level changes in employment rates from 1965 to 1970. Notably, highway assignment has little relationship with an MSA's racial composition in 1970. Similarly, Baum-Snow (2007) finds that planned and actual highway construction has little relationship with an MSA's racial composition in 1950.

Table 8 Panel A presents estimates of (6) where the outcome is $\Delta_m \log(\pi^{cc})$. I find that the stock of highways in 1970 predicts job suburbanization thereafter. In odd specifications I use actual interstate highway rays constructed as the explanatory variable of interest; in even specifications I

[23] Note that if a highway passes through a central city, this counts as 2 rays.

instrument for highways constructed using highway rays included in the 1947 plan. In all columns, t_0 is 1970, while t_1 is 1980 in columns (1) and (2), 1990 in columns (3) and (4), and 2000 in columns (5) and (6). In the baseline OLS specification, one highway ray emanating from the central city is associated with a 3.5%, 5.8%, and 7.2% decrease in the fraction of MSA jobs located in the central city by 1980, 1990, and 2000. When I instrument for highways, the point estimates increase somewhat, particular when weighting by black population, though they are less precise.

In the Appendix, I show that highway rays predict the suburbanization of white households, but not black households. Each ray leads to a 4.7%, 8.2%, and 10.2% decline in the central city share of the white population by 1980, 1990, and 2000. By contrast, highways lead to only a negligible decline in the central city share of the black population. This disparity is consistent with a central premise of the spatial mismatch hypothesis: black households faced significant additional barriers to suburban residence over this period. Highway rays also increase subsequent segregation, with each ray predicting an increase of 0.01, 0.045, and 0.053 point increase in a city's dissimilarity index by 1980, 1990, and 2000. Finally, I show highways predict only negligible changes in local industry mix and predicted changes in the black share of the workforce as measured in section 4.4.

Finally, I estimate the reduced form effect of highways on black relative employment and earnings. I estimate specifications of the same form as (6), where Y is now log employment rate or log earnings.

I present estimates in Table 8 Panel B and Panel C. Odd specifications are OLS models, while I instrument for highways in even specifications. All specifications include a quadratic in baseline employment. The pattern of coefficients is consistent across specifications and outcomes. While highways predict increases in the employment rates and earnings of whites, consistent with Duraton and Turner (2012), they predict relative decreases in these labor market outcomes for blacks. For the employment outcomes, the magnitudes of the coefficients are stable across specifications. In the OLS models, each additional highway ray predicts a 1% increase in white employment rates, but about 2% relative decline in black employment. Coefficients from the IV models are similar. Strikingly, while a racial gap in employment rates emerges from 1970 to 1980, the gap remains roughly constant through 2000. As in section 4.2, the magnitude of the coefficients in the earnings models is sensitive to whether I control for baseline earnings.

Highway construction causes job suburbanization and increases the gap in employment rates between white workers and black workers. In Table 8 I also include IV estimates for β and β^B, where I instrument for job suburbanization using highway rays or planned rays. In specifications corresponding to columns (1), (3), (5), and (6), the first stage (Panel A of Table 8) Angrist-Pischke F-statistics exceed 10, allaying concerns over weak identification in these models (Angrist and Pischke, 2009).[24] Columns (5) and (6) indicate that, for every 10% decrease in the fraction of jobs located in the central city induced by highways from 1970 to 2000, black employment rates decline by 2.4 to 2.5% relative to white employment rates. While job suburbanization might not be the

[24]In the specification corresponding to column (4), the Angrist-Pischke F-statistics associated with Rays^{1970} and $\text{Rays}^{1970} \times$ black are 8.63 and 13.2. In the specification corresponding to column (2), both are below 10.

Table 8: Highways, Job Suburbanization, and Labor Market Outcomes

	1970-1980		1970-1990		1970-2000	
	OLS	IV	OLS	IV	OLS	IV
Outcome: $\Delta \log(\pi^{cc})$	(1)	(2)	(3)	(4)	(5)	(6)
Rays^{1970}	-0.035**	-0.037*	-0.058**	-0.079**	-0.072**	-0.110**
	(0.010)	(0.017)	(0.015)	(0.024)	(0.020)	(0.030)
$\text{Rays}^{1970} \times$ black	-0.005	-0.016	-0.005	-0.024	-0.007	-0.027
	(0.006)	(0.009)	(0.007)	(0.013)	(0.009)	(0.018)
Outcome: $\Delta \log$ (Emp. Rate)						
Rays^{1970}	0.008*	0.0110*	0.009*	0.015*	0.012**	0.020*
	(0.004)	(0.005)	(0.004)	(0.006)	(0.004)	(0.008)
Rays^{1970}	-0.022**	-0.021*	-0.018*	-0.018	-0.019**	-0.028**
$\times$ black	(0.005)	(0.009)	(0.007)	(0.011)	(0.007)	(0.010)
β, IV	-0.235~	-0.295	-0.156~	-0.188~	-0.156~	-0.180~
	(0.132)	(0.229)	(0.079)	(0.106)	(0.80)	(0.096)
β^B, IV	0.575**	0.486*	0.288*	0.220*	0.249**	0.242**
	(0.198)	(0.224)	(0.121)	(0.105)	(0.094)	(0.087)
Outcome: $\Delta \log$ (Earnings)						
Rays^{1970}	0.009	0.021**	0.011	0.006	0.021*	0.015
	(0.005)	(0.007)	(0.007)	(0.012)	(0.010)	(0.014)
Rays^{1970}	-0.020**	-0.022*	-0.020	-0.015	-0.016	-0.022
$\times$ black	(0.006)	(0.011)	(0.011)	(0.015)	(0.011)	(0.018)
β, IV	-0.285	-0.616	-0.192	-0.074	-0.222~	-0.143
	(0.195)	(0.394)	(0.147)	(0.166)	(0.127)	(0.150)
β^B, IV	0.586**	0.630	0.364	0.172	0.239	0.192
	(0.221)	(0.393)	(0.233)	(0.172)	(0.173)	(0.150)
Group FEs	Yes	Yes	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
CC Radius Control	Yes	Yes	Yes	Yes	Yes	Yes
N Cells	1559	1559	1066	1066	545	545
N MSAs	56	56	56	56	56	56

Notes: Table displays estimates of equation (3). Columns (1)-(2) refer to models covering 1970-1980, columns (3)-(4) refer to models covering 1970-1990, and columns (5)-(6) refer to models covering 1970-2000. All models include group fixed effects (fixed effects for all combinations of cohort, education, sex, and race) a quadratic in log baseline employment (Panel A) or earnings (Panel B) interacted with race, and central city radius interacted with race. Even columns instrument for actual highway rays in 1970 with planned highways. In Panel A, the outcome is changes in log fraction of MSA jobs located in the central city; in Panel B, the outcome is changes in log employment rates; in Panel C, the outcome is changes in log earnings. All models are estimated at the cell level.

~ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.

Standard errors in parentheses, clustered at the MSA level. Regression weighted by cell size.

Two MSAs are not included in the highway data (Baum-Snow, 2007): Jackson, MS and West Palm Beach, FL.

only mechanism through which highways affect relative employment rates, labor supply shocks are unlikely to be an alternative and changes in labor demand are also unlikely to be a significant channel. Yet the relationship between job suburbanization and black employment suggested here is comparable to the baseline estimates from section 4.2. This corroborates a causal interpretation of the relationship between job suburbanization and black employment.

5 Discussion

For several decades, spatial mismatch has been a commonly cited cause of persistently high black unemployment. I describe the process of job suburbanization and estimate its effects on racial labor market inequality. Exploiting variation in suburbanization across local labor markets from 1970 to 2000, I find that, conditional on job characteristics, blacks are ex-ante less likely than whites to work in suburbs, and this segregation persists despite widespread job suburbanization. Using synthetic panel methods, I find that for every 10% decrease in the fraction of MSA jobs located in the central city, black relative employment rates declined by 1.6-2.3%. This relationship holds within observable skill groups, and for both men and women. Relative earnings declined by 1.2 to 2.3%, though these estimates are less stable. Conversely, job suburbanization is unrelated to other significant structural changes in the labor market that would predict changes in black relative employment rates. Instrumenting for suburbanization using central city intersections with the interstate highway system yields similar estimates, corroborating a causal interpretation.

To evaluate the importance of job suburbanization in producing labor market inequality over this period, I use the estimated coefficients to examine the overall contribution of job suburbanization to realized changes in relative employment rates among working age men. From 1970 to 2000, the proportion of black men ages 24-64 living in the MSAs analyzed here that were employed or in school decreased from 0.822 to 0.684. For white men, the proportion decreased from 0.913 to 0.863. Hence, the employment rate for black men declined by 11.3% more than the employment rate for white men. Given that the fraction of MSA jobs located in the central city declined by 29 log points for the average black adult, a β^B estimate of 1.6 to 2.3 implies that job suburbanization decreased the black active share by about 4.8-6.9% relative to the white active share over this period, or 42-61% of the overall relative decline.

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A Appendix (For Online Publication)

A.1 Establishment Relocations and Occupational Composition

While the sharp pattern in Figure 2 suggests that relocation *causes* a decline in the black share of employees, it is possible that change in the racial composition of employees are driven by coincident changes within the establishment rather than the relocation per se. In particular, the types of work performed at an establishment may change following relocation in a way that would affect the racial composition of employees. In the appendix, I apply an event study research design analogous to (2) where the outcome is the share of an establishment's employees in a given occupation. Following Acemoglu and Autor (2011), I divide the occupation groups defined in the EEO-1 data into three skill groups: high, middle, and low. I label officials and managers, professionals, and technicians as "high skill"; sales workers, administrative support workers, craft workers, and operatives as "middle skill"; and laborers/helpers and service workers as "low skill." I plot the θ coefficients in Figure A1. While there appears to be a slight increase in the share of workers in high skill occupations following relocation, the magnitude is small–at most 1 percentage point–and statistically indistinguishable from zero in most years following relocation.

A.2 Job Suburbanization and Sector Composition

First, I test whether MSAs that experienced greater job suburbanization also realized differential growth. Figure A2 plots changes in $\log \pi^{cc}$ from 1970 to 1980 (Panel A) and 1970 to 2000 (Panel B) against changes in log total MSA employment, and a line depicting the estimated linear relationship from a regression weighted by each MSA's total population in 1970. There is little discernible relationship between suburbanization and growth. The correlation is 0.003 from 1970 to 1980 and -0.068 from 1970 to 2000 and statistically insignificant at the 10% level in both cases.

Second, I investigate whether MSAs that experienced greater job suburbanization also experienced sector shifts that differed from other MSAs. For example, I examine whether manufacturing shrank substantially more in high suburbanization MSAs. To do this, I estimate models of the form

$$\Delta log(\text{employment})_{im} = \alpha_i + \alpha_m + \sum_j \beta_j \Delta log(\pi^{cc})_m \times \mathbf{1}_{(g(i)=j)} + \epsilon_{im} \tag{A.7}$$

where i indexes industries (or occupations) and m indexes MSAs, so that $(\text{employment})_{im}$ is total employment in sector i in MSA m. α_i and α_m are sector and MSA fixed effects, while $\mathbf{1}_{(g(i)=j)}$ is an indicator for industry i belonging to major industry category j.[25] Hence, the β_j coefficients reflect the extent that industries in group j differentially grow or shrink in MSAs with high values of $\log(\pi^{cc})$ (low suburbanization). As a parsimonious way of describing the additional explanatory

[25] The major industry categories I use are: (1) agriculture, forestry, and fisheries; (2) mining; (3) construction; (4) nondurable goods manufacturing; (5) durable goods manufacturing; (6) transportation, communications, and other public utilities; (7) wholesale trade; (8) retail trade; (9) finance, insurance, and real estate; (10) business and repair services; (11) personal, entertainment, and recreation services; (12) profession services, health; (13) professional services, education; (14) professional services, other; and (15) public administration.

power of job suburbanization, I report the adjusted R^2 from regressions of the form of equation (A.7) with a varying set of controls. The results are presented in Panel A of Table A4. In columns (1)-(4) the changes are over 1970 to 1980; in columns (5)-(8) the changes are over 1970 to 2000. Even columns include job suburbanization as an explanatory variable. While the β_j coefficients are typically jointly significant, job suburbanization has very little additional explanatory power for sector shifts within MSAs. The inclusion of $\Delta \log(\pi^{cc})$ interactions leaves the adjusted R^2 virtually unchanged. The results are similar if I group by occupation rather than industry.

A.3 Highways, Residential Suburbanization, and Sector Composition

To determine the relationship between highways and residential suburbanization and segregation, I estimate MSA-level regressions rather than group-level regressions. I do this because I cannot observe whether individuals live in the central city in the 1970 Census. Instead, I use population data from the *County and City Data Books* (CCDB), which report decennial Census data aggregated to counties and cities of at least 25000 inhabitants. For the household suburbanization and segregation analysis, I estimate specifications of the following form:

$$\Delta Y_m = \delta_1 rays_m^{1970} + \delta_2 radius_m^{cc} + \epsilon_m \tag{A.8}$$

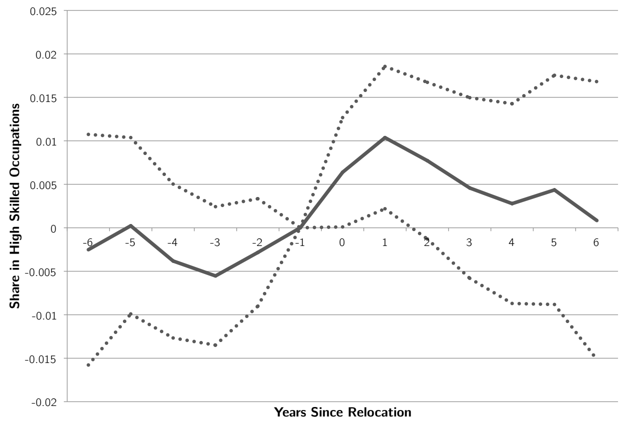
where Y denotes either $\log \pi_{res}^{cc}$, where π_{res}^{cc} is the fraction of an MSA's population living in the central city, or the dissimilarity index. I estimate this model for the whole population and separately by race when the outcome is household suburbanization.

I present estimates in Appendix Table A8. Again, actual interstate highway rays constructed is the explanatory variable in odd columns, while highway rays are instrumented using planned rays in even columns. Highway rays predict the suburbanization of white households, but not black households. This disparity is consistent with a central premise of the spatial mismatch hypothesis: black households faced significant additional barriers to suburban residence over this period. Each ray predicts a 4.7%, 8.2%, and 10.2% decline in the central city share of the white population by 1980, 1990, and 2000. By contrast, highways predict only a negligible decline in the black population. The effects are more negative when I instrument for highway construction, though the effect on the black central city population remains statistically insignificant. This is consistent with the premise that black households faced significant additional barriers to suburban residence. Highway rays increase subsequent segregation, with each ray predicting an increase of 0.010, 0.045, and 0.053 point increase in a city's dissimilarity index.

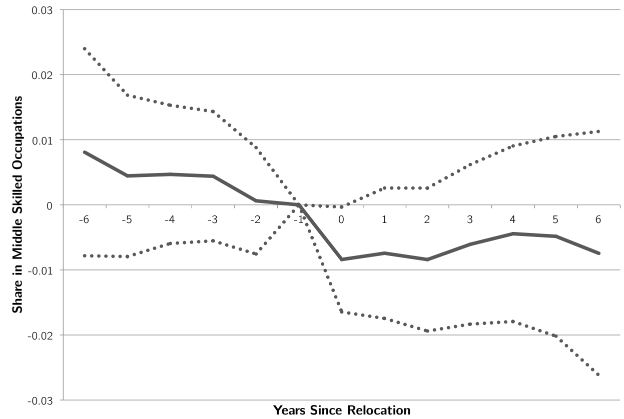
In Appendix Table A9 the outcome is predicted changes in the black share of the workforce, as constructed in section 4.4. When using industry weights, there is little relationship between highways and predicted changes in the black share of the workforce. When using occupation weights, a slight, negative relationship emerges in 1980's. This effect is marginally significant in OLS specifications, though the magnitude is substantially smaller than the employment effects documented in Table 8. The employment effects also first emerge earlier in the 1970-1980 period.

Figure A1: Establishment Relocations and Occupation Composition

(a) High Skilled Occupations



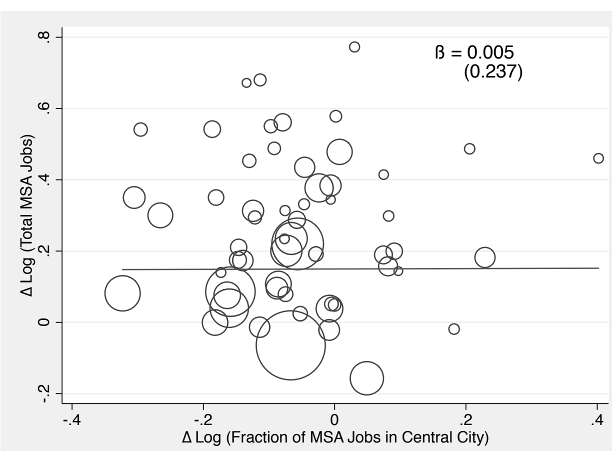
(b) Middle Skilled Occupations



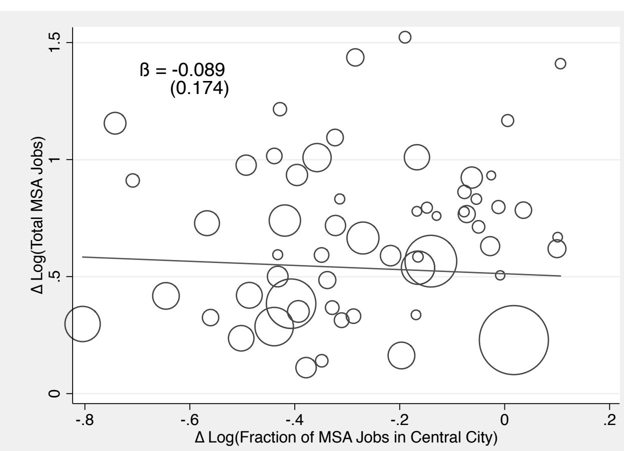
Notes: These figures plot event study coefficients and 95% confidence intervals (dotted) estimated using model (2) for different outcome variables. The models are estimated using all establishments that relocate from the central city to the suburbs and whose distance from the central business district increases by at least 5 miles. In Panel A the outcome is the fraction of establishment jobs that are high skill occupations; in Panel B the outcome is the fraction of establishment jobs that are middle skill occupations. The coefficient for the year prior to the event (θ_{-1}) is normalized to zero. Estimated models include Census division by year fixed effects and log establishment size as controls. Standard errors are clustered at the establishment level.

Figure A2: Job Suburbanization and Growth

(a) 1970-1980



(b) 1970-2000



Notes: Total MSA jobs are measured as the number of people that report working in a given MSA in the Decennial Census. See section 4.4 for further details on the construction of this figure.

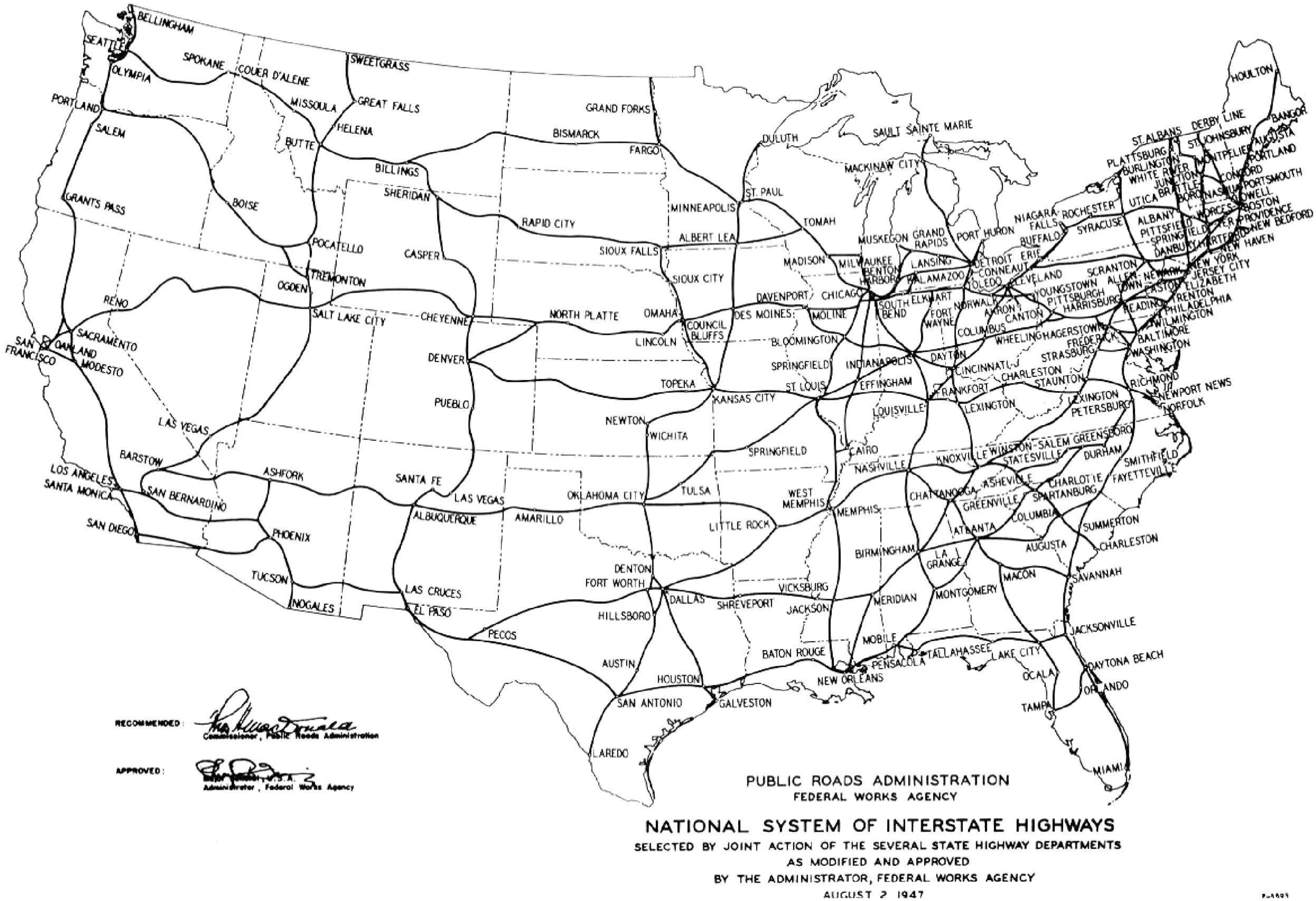


Figure A3: 1947 Interstate Highway Plan

Notes: This figure is taken from Baum-Snow (2007).

Table A1: Job Suburbanization By City, 1970-1980

Rank	MSA Name	$\Delta \log(\pi^{cc})$	Rank	MSA Name	$\Delta \log(\pi^{cc})$
1.	Detroit, MI	-0.323	31.	San Francisco-Oakland, CA	-0.066
2.	Atlanta, GA	-0.305	32.	Columbus, OH	-0.057
3.	Nashville, TN	-0.295	33.	Los Angeles-Long Beach-Garden Grove, CA	-0.056
4.	Minneapolis-St. Paul, MN	-0.265	34.	Akron, OH	-0.052
5.	Tampa-St. Petersburg, FL	-0.186	35.	Knoxville, TN	-0.047
6.	Cleveland, OH	-0.182	36.	Denver-Boulder, CO	-0.046
7.	Sacramento, CA	-0.181	37.	Birmingham, AL	-0.028
8.	Trenton, NJ	-0.173	38.	Dallas-Fort Worth, TX	-0.024
9.	St. Louis, MO-IL	-0.164	39.	Cincinnati, OH-KY-IN	-0.008
10.	Philadelphia, PA-NJ	-0.159	40.	Pittsburgh, PA	-0.008
11.	Chicago, IL	-0.147	41.	San Diego, CA	-0.006
12.	New Orleans, LA	-0.146	42.	Shreveport, LA	-0.006
13.	Dayton, OH	-0.140	43.	Syracuse, NY	-0.005
14.	Kansas City, MO-KS	-0.134	44.	Youngstown-Warren, OH-PA	0.000
15.	Baton Rouge, LA	-0.130	45.	Orlando, FL	0.002
16.	Richmond-Petersburg, VA	-0.124	46.	Houston, TX	0.008
17.	Seattle-Everett, WA	-0.124	47.	Greenville, SC	0.030
18.	Jacksonville, FL	-0.121	48.	Boston, MA	0.049
19.	Buffalo, NY	-0.114	49.	Norfolk-VA Beach-Newport News, VA	0.074
20.	Charlotte, NC-SC	-0.113	50.	Chattanooga, TN-GA	0.075
21.	Fort Lauderdale, FL	-0.097	51.	Indianapolis, IN	0.081
22.	Tulsa, OK	-0.092	52.	Columbia, SC	0.082
23.	Milwaukee, WI	-0.088	53.	San Antonio, TX	0.091
24.	Baltimore, MD	-0.086	54.	Jackson, MS	0.097
25.	Phoenix, AZ	-0.079	55.	Mobile, AL	0.182
26.	Beaumont, TX	-0.076	56.	West Palm Beach, FL	0.206
27.	Little-Rock-North Little Rock, AR	-0.076	57.	Miami, FL	0.229
28.	Toledo, OH-MI	-0.075	58.	Charleston-North Charleston, SC	0.402
29.	Washington, DC-MD-VA	-0.073			
30.	New York, NY-NJ	-0.067			

Notes: Includes 58 consistently identified MSAs with largest black populations in 1970.

Table A2: Job Suburbanization By City, 1970-2000

Rank	MSA Name	$\Delta \log(\pi^{cc})$	Rank	MSA Name	$\Delta \log(\pi^{cc})$
1.	Detroit, MI	-0.804	31.	San Francisco-Oakland, CA	-0.270
2.	Atlanta, GA	-0.742	32.	Kansas City, MO-KS	-0.217
3.	Richmond-Petersburg, VA	-0.709	33.	Pittsburgh, PA	-0.197
4.	St. Louis, MO-IL	-0.645	34.	Orlando, FL	-0.190
5.	Minneapolis-St. Paul, MN	-0.567	35.	Beaumont, TX	-0.169
6.	Dayton, OH	-0.560	36.	Charleston-North Charleston, SC	-0.167
7.	Cleveland, OH	-0.502	37.	Houston, TX	-0.167
8.	Denver-Boulder, CO	-0.493	38.	Mobile, AL	-0.165
9.	Baltimore, MD	-0.487	39.	Boston, MA	-0.165
10.	Philadelphia, PA-NJ	-0.439	40.	Knoxville, TN	-0.148
11.	Sacramento, CA	-0.439	41.	Los Angeles-Long Beach-Garden Grove, CA	-0.141
12.	Trenton, NJ	-0.432	42.	Jackson, MS	-0.130
13.	Cincinnati, OH-KY-IN	-0.432	43.	Little Rock-North Little Rock, AR	-0.077
14.	Fort Lauderdale, FL	-0.428	44.	Nashville, TN	-0.077
15.	Washington, DC-MD-VA	-0.419	45.	Columbus, OH	-0.072
16.	Chicago, IL	-0.407	46.	San Diego, CA	-0.063
17.	Seattle-Everett, WA	-0.396	47.	Columbia, SC	-0.054
18.	Milwaukee, WI	-0.393	48.	Tulsa, OK	-0.050
19.	Buffalo, NY	-0.378	49.	Indianapolis, IN	-0.028
20.	Dallas-Fort Worth, TX	-0.358	50.	Baton Rouge, LA	-0.026
21.	Birmingham, AL	-0.349	51.	Jacksonville, FL	-0.012
22.	Youngstown-Warren, OH-PA	-0.349	52.	Shreveport, LA	-0.009
23.	New Orleans, LA	-0.338	53.	Charlotte, NC-SC	0.006
24.	Syracuse, NY	-0.329	54.	New York, NY-NJ	0.018
25.	Tampa, FL	-0.323	55.	San Antonio, TX	0.036
26.	Miami, FL	-0.322	56.	Norfolk-VA Beach-Newport News, VA	0.100
27.	Greenville, SC	-0.314	57.	Chattanooga, TN-GA	0.101
28.	Toledo, OH-MI	-0.311	58.	West Palm Beach, FL	0.106
29.	Akron, OH	-0.288			
30.	Phoenix, AZ	-0.285			

Notes: Includes 58 consistently identified MSAs with largest black populations in 1970.

Table A3: EEO-1 Descriptive Statistics

	All (1)	Geocoded (2)	Geocoded Address (3)	Stayers (4)	Movers (5)
Number of Establishments	490,334	475,784	340,521	141,452	1,478
Establishment Size	226	225	219	286	256
Black Share of Employees	13.8	13.9	14.0	16.8	12.2
Normalized Black Share of Employees				1.16	0.86
Industry (%)					
Agricultural Services	0.3	0.3	0.2	0.2	0.4
Mining	0.7	0.7	0.6	0.9	1.1
Construction	2.2	2.3	2.2	2.4	3.6
Manufacturing	22.3	22.1	21.7	21.0	33.0
Transportation, Comm., Util.	9.0	9.0	8.6	10.9	7.0
Wholesale Trade	6.5	6.5	6.6	6.3	13.2
Retail Trade	27.3	27.4	27.3	22.1	6.2
Finance, Insurance, Real Estate	9.7	9.7	10.0	11.3	15.2
Services	22.0	22.1	23.0	25.0	20.4
Distance from CBD (Miles)		12.3	11.7	5.5	4.2
		(20.3)	(14.3)	(6.1)	(4.6)
Δ Distance from CBD (Miles)					12.5
					(6.7)

Notes: 'Geocoded' refers to establishments that I am able to assign a geocode based on (in order of preference) a street address, zip code, or city. 'Geocoded Address' refers to establishments that I am able to assign a geocode based on a street address.
'Stayers' and 'Movers' only include establishments that are initially located in the central city and have consistently identified addresses. 'Movers' have changed addresses once, relocated to a neighboring suburb, and increased their distance from the CBD by at least 5 miles.

Table A4: Job Suburbanization, Job Composition, and Skill Upgrading

	1970-1980				1970-2000			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Job Composition								
Outcome: $\Delta log(\text{employment})_{im}$								
Adjusted R^2	0.296	0.296	0.379	0.380	0.520	0.525	0.622	0.622
$\Delta log(\pi^{cc})_m \times \mathbf{1}_{(i=j)}$		✓		✓		✓		✓
Industry FEs	✓	✓	✓	✓	✓	✓	✓	✓
MSA FEs			✓	✓			✓	✓
H_0: $\forall \beta_j = 0$, p-value		0.000		0.000		0.122		0.183
Skill Upgrading								
Outcome: $\Delta log(\text{mean education})_{im}$								
Adjusted R^2	0.059	0.059	0.073	0.073	0.104	0.104	0.153	0.154
$\Delta log(\pi^{cc})_m \times \mathbf{1}_{(i=j)}$		✓		✓		✓		✓
Industry FEs	✓	✓	✓	✓	✓	✓	✓	✓
MSA FEs			✓	✓			✓	✓
H_0: $\forall \beta_j = 0$, p-value		0.001		0.001		0.026		0.113

Notes: Panel A refers to estimates of equation (A.7) where the outcome is $\Delta log(\text{employment})_{im}$. Panel B refers to estimates of equation (A.7) where the outcome is $\Delta log(\text{mean education})_{im}$. Columns (1)-(4) cover changes in job composition and skill intensity from 1970 to 1980, while columns (5)-(8) cover changes from 1970 to 2000. All specifications include industry fixed effects. Even columns include measures of job suburbanization interacted with major industry category. Columns (3), (4), (7), and (8) include MSA fixed effects. The level of observation is the industry by MSA pair. I report adjusted R^2 for each specification. See section 4.4 for further details.

Table A5: Job Suburbanization and Labor Market Outcomes, Within Skill Group

	1970-1980			1970-1990			1970-2000		
Outcome: $\Delta \log$ (Emp. Rate)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Delta \log(\pi^{cc}) \times$ HS dropout	0.064			0.059			0.038		
	(0.084)			(0.081)			(0.079)		
$\Delta \log(\pi^{cc}) \times$ HS graduate	-0.040			-0.017			-0.042		
	(0.057)			(0.050)			(0.032)		
$\Delta \log(\pi^{cc}) \times$ college graduate	-0.076˜			-0.027			-0.038		
	(0.043)			(0.035)			(0.078)		
$\Delta \log(\pi^{cc}) \times$ black	0.247**	0.229**	0.217*	0.160**	0.141**	0.147˜	0.147**	0.121**	0.124*
	(0.069)	(0.057)	(0.088)	(0.050)	(0.051)	(0.082)	(0.035)	(0.044)	(0.061)
Outcome: $\Delta \log$ (Earnings)									
$\Delta \log(\pi^{cc}) \times$ HS dropout	-0.043			0.183			0.109		
	(0.086)			(0.166)			(0.090)		
$\Delta \log(\pi^{cc}) \times$ HS graduate	-0.047			0.089			0.020		
	(0.078)			(0.111)			(0.059)		
$\Delta \log(\pi^{cc}) \times$ college graduate	-0.069			0.037			0.028		
	(0.070)			(0.068)			(0.073)		
$\Delta \log(\pi^{cc}) \times$ black	0.155	0.140˜	0.093	0.110	0.016	0.010	0.106*	0.030	0.012
	(0.095)	(0.080)	(0.133)	(0.068)	(0.073)	(0.118)	(0.052)	(0.057)	(0.076)
Group FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA $\times$ Education FEs	No	Yes	No	No	Yes	No	No	Yes	No
MSA $\times$ Educ. $\times$ Sex $\times$ Coh. FEs	No	No	Yes	No	No	Yes	No	No	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N Cells	1607	1607	1607	1099	1099	1099	563	563	563
N MSAs	58	58	58	58	58	58	58	58	58

Notes: Table displays estimates of equation (3) with inclusion of education and $\Delta \log(\pi^{cc})$ interactions. Columns (1)-(3) refer to models covering 1970-1980, columns (4)-(6) refer to models covering 1970-1990, and columns (7)-(9) refer to models covering 1970-2000. All models include group fixed effects (fixed effects for all combinations of cohort, education, sex, and race) and a quadratic in log baseline employment (Panel A) or earnings (Panel B) interacted with race. Columns (2), (5), and (7) include MSA $\times$ education fixed effects. Columns (3), (6), and (9) include MSA $\times$ education $\times$ sex $\times$ cohort fixed effects.

˜ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.

Standard errors in parentheses, clustered at the MSA level. Regression weighted by cell size.

Table A6: Job Suburbanization, Job Composition, and Labor Market Outcomes

	1970-1980		1970-1990		1970-2000	
Outcome: Δ log (Emp. Rate)	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\log(\pi^{cc})$	0.005	-0.015	-0.014	-0.009	-0.034	-0.027
	(0.053)	(0.054)	(0.037)	(0.048)	(0.033)	(0.039)
$\Delta\log(\pi^{cc}) \times$ black	0.268**	0.281**	0.184**	0.191**	0.176**	0.177**
	(0.075)	(0.073)	(0.056)	(0.060)	(0.041)	(0.045)
Δ log(Pred. Black Share)	0.491*	0.373	0.454**	0.092	0.248*	-0.044
	(0.212)	(0.260)	(0.148)	(0.206)	(0.122)	(0.198)
Δ log(Pred. Black Share) $\times$ black	-0.344	-0.194	-0.300	-0.243	-0.470	-0.259
	(0.323)	(0.320)	(0.256)	(0.291)	(0.312)	(0.373)
Industry/Occupation Based Predictions	Ind	Occ	Ind	Occ	Ind	Occ
Group FEs	Yes	Yes	Yes	Yes	Yes	Yes
MSA FEs	No	No	No	No	No	No
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
N Cells	1607	1607	1099	1099	563	563
N MSAs	58	58	58	58	58	58

Notes: Table displays estimates of equation (3) with inclusion of predicted changes in black share of the workforce. Columns (1)-(2) refer to models covering 1970-1980, columns (3)-(4) refer to models covering 1970-1990, and columns (5)-(6) refer to models covering 1970-2000. All models include group fixed effects (fixed effects for all combinations of cohort, education, sex, and race) and a quadratic in log baseline employment (Panel A) or earnings (Panel B) interacted with race. Predictions for the black share of the workforce are constructed based on the racial composition of different industries (odd specifications) or occupations (even specifications) in different MSAs in 1970, and changes in each MSA's industry or occupation composition over time. See section 4.4 for further details. All models are estimated at the cell level.

˜ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.

Standard errors in parentheses, clustered at the MSA level. Regression weighted by cell size.

Table A7: Highways and Baseline Cell and MSA Characteristics

Panel A: Highways and Employment (1965-1970) Outcome: Δ^{PRE} log (Employment Rate)	(1)	(2)
Rays	-0.000	
	(.003)	
Rays × black	-0.004	
	(.003)	
N Cells	2016	
N MSAs	56	

Panel B: Highways and 1970 Characteristics Outcome: Rays	δ	δ^B
Log Fraction Active (Group)	-4.310**	.879
	(1.536)	(1.194)
Log Earnings (Group)	3.377*	-0.905
	(1.291)	(0.718)
Fraction of Work in Central City (MSA),	-0.013	0.133
Standardized	(0.273)	(0.154)
Fraction Black (MSA),	0.064	0.157
Standardized	(0.262)	(0.166)
Dissimilarity Index (MSA),	0.383	0.206˜
Standardized	(0.294)	(0.114)
Violent Crime Rate (MSA),	0.196	-0.128
Standardized	(0.321)	(0.129)
Property Crime Rate (MSA),	-0.441	-0.076
Standardized	(0.270)	(0.130)
N Cells	1516	
N MSAs	54	

Notes: Panel A displays estimates of equation (4) with $\Delta \log(\pi^{cc})$ replaced by highway rays in 1970. In Panel A, the outcome is cell-level changes in employment rates from 1965 to 1970. Panel B displays estimates of equation (5) $\Delta \log(\pi^{cc})$ replaced by highway rays in 1970. In this panel, the outcome is highway rays in 1970. Column (1) display the estimated δ coefficients from equation (5), the 'main effects'; column (2) display the estimated δ^B coefficients, the black cell interactions. All models include group fixed effects (fixed effects for all combinations of cohort, education, sex, and race) and a control for central city radius. Dissimilarity segregation indices are taken from Cutler et al. (1999).
˜ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.
Standard errors in parentheses, clustered at the MSA level. Regression weighted by cell size.
Two MSAs are not included in the highway data (Baum-Snow, 2007): Jackson, MS and West Palm Beach, FL. Dissimilarity segregation indices are taken from Cutler et al. (1999).

Table A8: Highways, Residential Suburbanization, and Segregation, 1970-2000

	1970-1980		1970-1990		1970-2000	
	OLS	IV	OLS	IV	OLS	IV
Outcome: $\Delta\log(\pi^{cc}_{res})$, White	(1)	(2)	(3)	(4)	(5)	(6)
Rays	-0.047**	-0.077**	-0.082**	-0.137**	-0.102*	-0.180**
	(0.014)	(0.023)	(0.028)	(0.041)	(0.039)	(0.058)
CC Radius Control	Yes	Yes	Yes	Yes	Yes	Yes
N MSAs	56	56	56	56	56	56
Outcome: $\Delta\log(\pi^{cc}_{res})$, Black						
Rays	0.006	-0.006	0.003	-0.022	-0.005	-0.050
	(0.011)	(0.018)	(0.021)	(0.033)	(0.036)	(0.054)
CC Radius Control	Yes	Yes	Yes	Yes	Yes	Yes
N MSAs	56	56	56	56	56	56
Outcome: $\Delta\log(Dissimilarity)$						
Rays	0.010	0.026	0.045**	0.048*	0.053**	0.056*
	(0.013)	(0.014)	(0.011)	(0.021)	(0.016)	(0.026)
CC Radius Control	Yes	Yes	Yes	Yes	Yes	Yes
N MSAs	56	56	56	56	56	56

Notes: Table displays estimates of equation (A.8). All models include controls for central city radius. Even columns instrument for actual highway rays in 1970 with planned highways. Dissimilarity segregation indices are taken from Cutler et al. (1999).

˜ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.

Standard errors in parentheses, clustered at the MSA level. Regression weighted by MSA population. Data from County and City Data Books.

Two MSAs are not included in the highway data (Baum-Snow, 2007): Jackson, MS and West Palm Beach, FL.

Table A9: Highways and Sector Growth, 1970-2000

	1970-1980		1970-1990		1970-2000	
Outcome: Predicted Black Share	OLS	IV	OLS	IV	OLS	IV
Industry Weighted	(1)	(2)	(3)	(4)	(5)	(6)
Rays	0.005˜	0.004	0.004	0.001	0.003	-0.002
	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Outcome: Predicted Black Share						
Occupation Weighted						
Rays	0.000	-0.001	-0.004˜	-0.006	-0.005˜	-0.006
	(0.002)	(0.004)	(0.003)	(0.005)	(0.003)	(0.006)
CC Radius Control	Yes	Yes	Yes	Yes	Yes	Yes
N MSAs	56	56	56	56	56	56

Notes: Table displays estimates of equation (A.8) where the outcome is predicted changes in the black share of the workforce. Predictions for the black share of the workforce are constructed based on the racial composition of different industries (Panel A) or occupations (Panel B) in different MSAs in 1970, and changes in each MSA's industry or occupation composition over time. See section 4.4 for further details. All models include controls for central city radius.
˜ Denotes statistical significance at the $p < 0.10$ level. * Denotes statistical significance at $p < 0.05$ level. ** Denotes statistical significance at $p < 0.01$ level.
Standard errors in parentheses, clustered at the MSA level. Regression weighted by MSA population.
Two MSAs are not included in the highway data (Baum-Snow, 2007): Jackson, MS and West Palm Beach, FL.