Testing the Spatial Mismatch Hypothesis Using Inter-City Variations in Industrial Composition

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Following Kain (1968), economists have argued that a lack of jobs in the inner city may be responsible for low and declining black employment, and have implicated industrial shifts as a source of change. We exploit inter-city variations in industrial composition to develop instruments for job locations. An increase in the fraction of jobs located in the central city raises black employment rates relative to whites. The effects are greatest in large MA's and for young and old workers, women, and those with less than a college education. The mismatch hypothesis implicitly assumes that mobility between the central city and suburbs is costly for firms and workers. Consistent with this hypothesis, we also find that job centralization is associated with higher wages for people working in the central city relative to the suburbs. IV estimates confirm the OLS results.

JEL Codes: J1, R1

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I. Introduction

Researchers have long been aware of large differences in employment between blacks and whites. While many explanations have been provided, Kain's (1968) suggestion that a spatial mismatch - a lack of jobs in inner-cities where most blacks live - is an important factor, has proven to be among the most persistent. More recently, Wilson (1987) and Kasarda (1989) have argued that industrial shifts, and the shift of employment out of manufacturing in particular, have reduced job opportunities for blacks living in the inner city. This work has renewed interest in the mismatch hypothesis.

Despite this interest, tests of the mismatch hypothesis have yielded contradictory results and raised concerns about endogeneity. Many strategies have been used to test the mismatch hypothesis. One approach has been to exploit inter-city variations in job locations. Cross-city analyses that regress employment rates of central city blacks on measures of job centralization typically find strong effects[1]. A second strand of research exploits intra-city variations in job proximity. Results from these studies often indicate weaker effects of job locations on black employment[2].

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[1] In Mooney (1969) the overall employment rate was the most important factor in determining black employment (relative to whites), but the fraction of jobs in the central city was also an important determinant. Farley (1987) also finds that an increase in jobs in the central city raises black employment relative to whites. Ihlanfeldt and Sjoquist (1989) find that an increase in the fraction of low skilled jobs located in central cities raises black earnings (net of commuting costs). Studying inter-city variations in segregation, Masters (1974), finds weak effects while Cutler and Glaeser (1997) find strong effects. Weinberg (1999) finds strong effects of black residential centralization.

[2] Kain (1968) and Leonard (1987) find evidence that black employment declines with distance from black neighborhoods. However, Ellwood (1986) finds that cross-neighborhood variations in job proximity have only small effects on black employment rates. Ihlanfeldt and Sjoquist (1989) find strong effects of job locations on black employment. Raphael (1998) finds that changes in job proximity have strong effects. Work by Zax and Kain (1991,1996), Rogers (1997), and Ross (1998) exploit the

In trying to reconcile these results, Jencks and Mayer (1990) suggest that endogeneity may bias inter-city comparisons in favor of the mismatch hypothesis. An exogenous decrease in the labor force attachment of central city residents will lead employers to locate outside of the central city both because it will be harder to find workers and because decreases in labor force attachment may be associated with higher crime rates (see Gould, Weinberg, and Mustard (2002) on the effect of labor markets on crime). On the other hand, if the availability of jobs in the central city is measured using the fraction of jobs in the central city, estimates may be biased downward if the supply of labor to the central city or the boundaries of the central city vary across MA's. Endogenous neighborhood choice is a concern in studies that exploit intra-MA variations in job location. Sorting of low labor attachment individuals into neighborhoods with worse job access biases these estimates up. If the neighborhoods with the least desirable housing stock are located closest to central business districts, where jobs are most plentiful these estimates will be biased down (see Conley and Topa (1999) and Weinberg, Reagan, and Yankow (2002)).

Rather than addressing the issues of neighborhood choice in intra-MA studies, the present paper makes uses inter-MA variation, making a number of contributions to that line of work. First, we develop instruments for job locations. The identification strategy relies on the insight that some industries are more likely to locate in the central city than

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dynamics of individual employment and residential mobility to find evidence for the mismatch hypothesis. Recent work by Holzer, Quigley, and Raphael (2002) controls for endogeneity when looking at the effect of distance from black neighborhoods on employers' hiring of black workers. Jencks and Mayer (1990); Hozer (1991); Kain (1992); and Ihlanfeldt and Sjoquist (1998) provide comprehensive reviews of the literature.

others, and that some metropolitan areas have a greater representation of central-city-locating industries than other metropolitan areas. Thus, our instruments exploit inter-MA variations in industrial composition along with industrial variations in location tendencies, to identify variations in job locations across metropolitan areas, that are exogenous to black employment. It is noteworthy that both Wilson (1987) and Kasarda (1989) have focused on industrial shifts as an important factor reducing central city job opportunities. We also use microdata, which allows us to control for heterogeneity and estimate effects for particular groups; look at more cities with greater variation in population than most inter-MA analyses; and control for unobserved heterogeneity using a range of strategies.[3]

While interest in the mismatch hypothesis derives from its implications for racial employment differences, the fundamental assumption underlying the mismatch hypothesis is that the mobility of firms and workers within cities is costly. An implication of imperfect mobility is that variations in the location of labor demand within a city affect wages of people working in that section. We begin our analysis by testing this implication. Our estimates indicate that an increase in labor demand in central cities is associated with higher wages for people who work in central cities[4].

Given this evidence for costly mobility within metropolitan areas, we then turn to study the racial implications of the mismatch hypothesis. We find that an increase in jobs in the

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[3] Our data set contains 195 MA's with populations over 100,000. Most intra-MA studies focus on the largest MA's (*e.g.* Los Angeles, Chicago, Philadelphia, Detroit). Inter-MA studies by necessity include more MA's. Mooney (1969) uses 25 MA's and Ihlanfeldt and Sjoquist (1989) use 98 SMSA's. Only Farley (1987) includes MA's with as few as 50,000 residents.

central city increases black employment relative to whites. The effects are greatest in large MA's, where the costs of working in a distant portion of the city are likely to be greatest. When we look at specific demographic groups, the largest effects are found among young and older workers, people with less than a college education, and women. IV estimates exceed corresponding OLS estimates, indicating the importance of controlling for variations in job centralization due to variations in labor supply and in central city boundaries. The implied effects of job centralization are generally large. A one standard deviation increase in job centralization would eliminate 46% to 62% of the black-white employment gap among young, non-college educated men, between 40% and 56% among young, college-educated men, and eliminate it for young, college-educated women. Increases in job decentralization are also found to explain much of the increase in the black-white employment gap.

Section II presents a simple model to illustrate the factors that are necessary for the mismatch hypothesis to operate. Section III describes the construction of the instruments for job centralization. We study the effects of job locations on wages for central city and suburban workers in Section IV. Section V presents estimates of the effects of job locations on employment among blacks and whites. Section VI concludes.

II. A Simple Model

This section develops a simple model of the labor market in a metropolitan area. Our goal is to illustrate the features that are necessary for the mismatch hypothesis to operate. Although our interest in the mismatch hypothesis derives from racial concerns, the

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[4] For related results see Wachter (1972); Ehrenberg and Goldstein (1974); Eberts (1981); Straszheim (1984); Madden (1985); Ihlanfeldt (1992), and McMillen and Singell (1992).

mismatch hypothesis is fundamentally a theory about imperfect (or costly) mobility of firms and workers within cities[5]. We start with a general model of labor demand and supply within an MA before specializing it to focus on its implications for racial employment patterns.

Consider an MA with two sections – a central city (*cc*) and suburb (*s*). Immobility on the part of firms stems from differences in the importance of inter-personal contacts, space requirements, and accessibility for shipments of inputs and outputs. For simplicity, we assume that there are two industries, each of which locates exclusively in one section of the city[6]. Industries are referred to by the section of the city in which they locate. Let

$$q^i = \Theta^i F(L^i) \; i \in \{cc, s\}$$

denote the output of industry *i* as a function of the effective labor it employs. Where Θ^i denotes the productivity of industry *i* in the MA. Natural advantages and historical accidents combined with increasing returns to scale in the production of intermediate inputs or informational externalities generate variations in Θ^i across cities (see Krugman (1991) and Ellison and Glaeser (1997)). Under perfect competition, the log wage (per unit of effective labor) in each part of the city is given by the marginal product of the industry that locates in that part of the city,

$$w^i = \theta^i + \ln F'(L^i), \quad \theta^i \equiv \ln \Theta^i .$$

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[5] We use the terms costly mobility and imperfect mobility interchangeably to imply an upward sloping labor supply and downward sloping labor demand to the central city and suburbs. Arnott (1998), Brueckner and Martin (1997), and Coulsnon, Laing, and Wang (1999) also develop theoretical models.
[6] The fact that each industry locates exclusively, in one part of the city is not crucial for the analysis, what is important is that labor employed in each part of the city is imperfectly substitutable.

We start with a reduced form labor supply function. The supply of labor to each part of the city is assumed to be increasing in the wage in that part of the city and decreasing in the wage in the other part of the city.

$$L^i = L^i(w^{cc}, w^s) \text{ where } L^i_i > 0, L^i_{\sim i} < 0.$$

For this assumption to hold two things must be true. First, residential locations must be imperfectly elastic because of heterogeneity in preferences toward living in each part of the city (arising naturally or from discrimination) or because of an upward sloping supply of housing in each part of the city. It must also be costly for people in one part of the city to commute to or obtain information about jobs in the other part of the city.

Under these assumptions, the different portions of cities constitute distinct labor markets in the sense that relative wages in each portion of the city vary with the location of labor demand[7]. In particular, if the demand for and supply of labor in each part of the city are less than infinitely elastic, an increase in demand for labor in the central city raises wages in the central city relative to the suburbs. The proof is in the theory appendix. This result, that the location of labor demand affects relative wages in each part of the city, is a key implication, which is tested below.

To model the effects of the location of labor demand on employment and to study the effect on blacks and whites we model individual employment and commuting decisions.

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[7] We require two more technical assumptions. First, we assume that an increase in the wage in either portion of the city increases total employment (because some people who had been unemployed choose to work) formally, $L^i_i + L^{\sim i}_i > 0$. Related to this, we assume that $L^i_i + L^i_{\sim i} > 0$ or that an equal increase in wages in both portions of the city, raises employment in both portions of the city. Increasing the wage in one section of the city increases total employment and attracts workers from the other section of the city; an

For simplicity, we focus on workers with a common skill level. Individuals maximize utility given by the log of their income less any disutility from commuting. People who work in the portion of the city in which they live are assumed to face no commuting cost. Workers have a reservation utility of *r* if they are not employed. Let w^i denote the wage in part of the city *i*. A person residing in area *i* works if $\ln(w^i) \geq r$.

Workers can also choose where to work. To capture the fact that working in a distant portion of a city is costly in terms of direct financial costs and forgone leisure and in terms of additional job search, a worker living in area *i* who works in area *~i* incurs a utility cost of $C^{i,\sim i}$ [8]. The utility of someone who lives in area *i* and works in area *~i* is given by $\ln\left(w^{\sim i}\right) - C^{i,\sim i}$. To capture congestion costs and individual heterogeneity (in a reduced form manner) $C^{i,\sim i}$ is assumed to be an increasing function of people commuting from *i* to *~i* to work. For people to be indifferent between working in each part of the city, $c^{i,\sim i} \equiv \exp\left\{C^{i,\sim i}\right\} = w^{\sim i}/w^{i}$. In this model, commuting costs arbitrage wage differences between different parts of the city so that employment decisions depend only on the wage in the area of residence.

Let $h_g^i(\cdot)$ and $H_g^i(\cdot)$ denote the probability density and cumulative distribution functions of *r* for group *g* (either black or white) people living in part *i* of the city. Let ρ_g^i denote the fraction of group *g* individuals living in area *i*. A greater fraction of blacks live in central cities ($\rho_b^{cc} > \rho_w^{cc}$), presumably because of current or historical discrimination in

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increase in the other wage pulls labor away. We assume that the first two effects dominate the third.

[8] The implications would be similar if we assumed a financial cost that was proportional to the wage, as would arise from a time cost of commuting and job search.

the housing markets (Gabriel and Rosenthal 1996). For simplicity, residential locations are taken as exogenous, although the distribution of reservation wages is allowed to differ for central city and suburban residents to account for selection. Given our interest in less skilled workers, for whom jobs are more plentiful in the suburbs, we assume that in equilibrium, $w^{cc} < w^{s}$. The employment rate for group *g* workers is a weighted average of their employment rate in each section of the city,

$$E_g = \rho_g^{cc} H_g^{cc}\left(w^{cc}\right) + \rho_g^{s} H_g^{s}\left(w^{s}\right).$$

With identical reservation wage distributions and wages, the employment rate of blacks will be lower than that of whites because a greater fraction of blacks live in the central city, where wages are lower.[9]

An increase in the central city wage, as would occur if the productivity of the central city industry increased, raises the employment of blacks relative to whites. The effect of a wage change is given by,

$$E_b - E_w = \left[\rho_b^{cc} h_b^{cc}\left(w^{cc}\right) - \rho_w^{cc} h_w^{cc}\left(w^{cc}\right)\right] dw^{cc} + \left[\rho_b^{s} h_b^{s}\left(w^{s}\right) - \rho_w^{s} h_w^{s}\left(w^{s}\right)\right] dw^{s}.$$

The employment of blacks is more responsive to the central city wage because a larger share of blacks live in the central city ($\rho_b^{cc} > \rho_w^{cc}$). A greater labor supply response in the relevant region for blacks ($h_b^i(r^i) > h_w^i(r^i)$) accentuates, but is not necessary for this effect. A decrease in suburban wages may either increase or decrease the employment of blacks relative to whites. While, a higher fraction of whites live in the suburbs

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[9] Assuming that blacks' wages are lower relative to their reservation wages accentuates, but is not necessary for, a racial employment difference. On the other hand, if blacks' wages are higher relative to their reservation wages, then the employment gap would be reduced or might even be reversed.

($\rho_b^s < \rho_w^s$), making the employment of whites more sensitive to suburban wages, the labor supply elasticity of blacks may exceed that of whites offsetting this difference. Overall, we expect the black-white employment differential to be increasing in the central city-suburban wage difference.

This section developed a simple model of the mismatch hypothesis. The basis for the mismatch hypothesis is imperfect mobility between the central city and suburbs on the part of firms and workers. The question, from an empirical perspective, is not whether there are costs to mobility within MA's. Even researchers who have found only weak evidence for the mismatch hypothesis find that job locations have effects consistent with the costs of commuting (e.g. Ellwood 1986). The question is whether the barriers to mobility are sufficient to explain meaningful differences in employment.

III. Identification and Estimation

We test whether job centralization across cities, *c*, affects difference in wages between central city and suburban workers and the black-white employment gap. Letting, Δ_c^W denote the central-city suburban wage gap and Δ_c^E denote the racial wage gap in city *c*, and Z_c denote other city characteristics, we estimate models,

$$\Delta_c^i = \theta^i JobCentralization_c + \Gamma^i Z_c + \varepsilon_c^i,\ i \in \{W, E\}. \qquad (1)$$

As indicated, job centralization is likely to be endogenous. A lower labor force attachment among blacks or, in the case of wages, central city residents in general, will make it harder for firms in the central city to find workers and may be associated with higher crime rates. These factors would cause more firms to locate outside the central city biasing up estimates θ^E and θ^W. On the other hand, exogenous variations in the attractiveness of living and working in the central city will cause the supply of labor to the central city to vary across MA's biasing estimates of down θ^E and θ^W. Spurious variations in the boundaries of the central city lead to attenuation bias.

One solution to is to include a measure of supply, which we do using residential locations. More central city residents will directly affect labor supply to the central city. Moreover, amenities that make working in the central city more attractive will tend to make living there more attractive as well. Thus, the fraction of people living in the central cities should be correlated with the willingness of suburban residents to work in the central city. The fraction of people residing in the central city will also reflect variations in the boundaries of central cities, generating a positive correlation with the measurement error in the fraction of jobs in the central city[10].

This approach, while valuable, is an imperfect solution because observed job and residential centralization will reflect variations in supply and demand. To address this issue, we instrument for job locations. IV estimates identify the effect of an exogenous increase in demand for labor in the central city. Even with IV, different effects can be estimated depending on whether residential centralization is controlled. An exogenous increase in central city labor demand has direct and indirect effects. The direct effect is conditional on residential locations. The indirect effect arises as more people move into

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[10] Following Ihlanfeldt and Sjoquist (1989), we have tried to control for variations in the boundaries of central cities using the fraction of the land area in the central city and suburbs. Variations in land area account for roughly 10 percent of the variation in job centralization. Unfortunately, the fraction of land located in the central city exhibits substantial variation. Most of this variation is due to how wide an area is covered by the MA, and most of the variation is in the size of the suburban communities. The MA's in our sample range in size from 226 to 88,082 square kilometers (5 times the variation in

the central city in response to an increase in the demand for labor there, partially offsetting the direct effect. Without instrumenting for residential centralization, this effect cannot be identified, but is possible to get some sense of it by controlling for residential centralization.

Our instruments for job locations exploit inter-city variations in industrial composition interacted with industrial differences in job centralization. Table 1 reports job centralization for 17 broad industries in 1980 and 1990. These patterns are quite stable, and appear to be due to variations in space requirements, the importance of being centrally located, and the importance of access to transportation for materials. Thus, the industries whose metropolitan employment is least centralized are agriculture and durable manufacturing, while the industries with the highest central city employment shares are finance, insurance, and real estate; public administration; and professional services excluding health and education.

Industrial differences in employment locations are necessary (but not sufficient) for our instruments to be valid. We test for differences in the central city employment shares of the 232 industries used in the analysis. Let $f_{CC|ic}$ denote the fraction of employment in the central city conditional on industry *i* and city *c*. We regressed $f_{CC|ic}$ on MA and industry fixed effects. The F-value for the hypothesis that there were no industry-differences was 43.0, which substantially exceeds the 1% critical value of 1.25 for an F-distribution with 231 and 30,331 degrees of freedom. Controlling for MA effects, the

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population). The coefficient of variation in the fraction of land located in the central city is 1.22 compared to .327 for the fraction of jobs and .436 for the fraction of residents.

industry fixed effects account for one quarter of the variation in $f_{CC|ic}$. Thus the industrial differences that table 1 points to are statistically and economically meaningful.

A number of authors (e.g. Wilson (1987) and Kasarda (1989)) have argued that manufacturing locates heavily in central cities, and that its decline reduced employment opportunities in the central cities relative to the suburbs. To investigate this hypothesis, table 1 also reports industry growth trends and a decomposition of the change in job centralization. Overall, the share of jobs located in central cities fell by 2.4 percentage points between 1980 and 1990 (from 54% to 51.5%). The fraction of persons residing in central cities increased by .1 percentage points, so there was a real decline in job opportunities in central cities. The decline in job centralization occurred within industries, rather from shifts between them. (Reading across the last row of table 1, column 3 gives the total change, column 4 gives the within industry change, and column 8 gives the between industry change.) In fact, during this period, manufacturing located more heavily in the suburbs, so its decline tended to increase relative demand in cities.

Our instrument for job centralization is a "share-shift" or fixed coefficients demand index, similar to that used by Bartik (1991) and Gould, Weinberg, and Mustard (2002). Let $f_{i|c}$ denote the fraction of the workforce in MA *c* that is employed in industry *i*. We estimate the extent to which each industry locates in central cities using national data. Let $f_{cc|i}$ denote the fraction of the national urban workforce in industry *i* employed in central cities. Our instrument for the fraction of the workforce in MA *c* employed in central cities is

$$\hat{f}_{CC|c} = \sum_i f_{CC|i} f_{i|c}$$

Intuitively, the instruments are a weighted average of the industrial employment locations where the industry weights for each MA are the fraction of that MA's workforce employed in the industry. We classified industries according to the 3-digit system used in the census (this classification has 232 industries). We also develop separate instruments for the demand for labor in the central city by gender and education[11]. The construction of these instruments is given in the appendix.

Sample first stage regressions are reported in appendix table 3. The estimate indicate that the instruments are both statistically significant and explain a large portion of the variation in job locations. The coefficient on the instrument exceeds one in all cases, indicating that there is a multiplier effect, with an exogenous increase in the share of jobs in the central city generating demand for other central city businesses. Below, we estimate separate effects for large and small metropolitan areas and generally find weak effects in small metropolitan areas. While the instruments are good predictors in both sets of metropolitan areas, they predict somewhat better in small metropolitan areas, so the weaker estimates in small metropolitan areas must reflect economic differences, rather than a weak first stage equation.

IV. The Mismatch Hypothesis and Wages by Place of Work

Because the mismatch hypothesis is fundamentally a theory of mobility costs within MA's, we start our analysis by studying the effect of job centralization on the relative wages of central city and suburban workers. We find that an increase in labor demand in

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[11] Another method we have used is to construct black specific instruments for job location by weighting our job location instruments by the percent of employment in the industry that is black. These yield similar results to those reported here.

the central city is associated with higher relative wages for people employed in central cities, indicating imperfect mobility for both firms and workers.

Our data are drawn from the 1980 Census Public Use Micro-Samples[12]. Details of the sample construction are in the data appendix. The use of individual-level data permits us to control for individual characteristics that affect wages. In estimating wages for central city and suburban workers, we employ a two stage procedure to control for individual characteristics. Let w_{cai} denote the log weekly wage of individual *i* working in area *a* of city *c* and let x_{cai} denote his characteristics. In the first stage, log weekly wages are regressed upon individual worker characteristics,[13]

$$w_{cai} = \beta x_{cai} + \varepsilon_{cai} .$$

We estimate the wage in part *a* of city *c* using the mean log wage residual of the individuals working in that part of the city, $W_{ca} = \frac{1}{n_{ca}} \sum_i \varepsilon_{cai}$ [14]. Second stage regressions of the form in (1) (with $\Delta_c^W = W_{cCC} - W_{cS}$) are run to estimate the effect of job centralization on the wages of individuals working in the central city relative to those

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[12] Unlike the 1980 Census, the 1990 PUMS suppresses whether respondents work in the central city or suburbs.

[13] Our controls include years of completed schooling, a quartic in potential experience, and dummy variables for hispanic, black, and marital status. The effects of the explanatory variables are likely to vary by gender and level of education (*e.g.* experience and marital status are expected to have different effects for men and women). To account for these differences, we include dummy variables for four gender-education groups (those without any college and those with some college) and fully interact the explanatory variables with these indicator variables.

[14] We have chosen this procedure to due to computational constraints. Use of dummy variables would require defining over 400 MA-place of work dummy variables for 3.7 million observations. Use of mean residuals should have little effect on the estimates.

working in the remainder of the MA.[15] The second stage regressions are weighted by the MA population to make the estimates representative of the national urban population. Use of the central city-suburban wage difference controls for differences in labor market conditions and the cost of living across MA's. We note that the analysis focuses on wages by place of work (as opposed to place of residence). Summary statistics are presented in table 2.

Table 3 shows that an increase in the relative demand for labor in the central city is associated with higher wages for people working in the central city relative to those working in the suburbs. Column 1 (WLS1) indicates that a 1 percentage point increase in the fraction of jobs in the central city increases wages of central city workers by .063 percentage points relative to suburban workers. The costs of searching for and commuting to a job should increase with city size. When separate effects are estimated for large and small MA's (column 2), the effects in large MA's are higher by one half, but there are no discernable effects in small MA's.

As discussed, variations in the supply of labor to the central city and in the boundaries of the central city will bias these estimates downward. As a first step toward controlling for these factors, we include the fraction of people residing in the central city. When added to the specifications in columns 3 and 4 (WLS2), residential centralization has the

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[15] We report separate estimates for large and small MA's. Let $BigMA_c$ ($SmallMA_c$) denote an indicator variable equal to 1 if MA *c* has a population over (under) 500,000 and zero otherwise. In these models, our specification is,

$$W_{cCC} - W_{cS} = BigMA_c \cdot Z_c \Gamma_{Big} + SmallMA_c \cdot Z_c \Gamma_{Small} + \theta_{Big} BigMA_c f_{CC|c} + \theta_{Small} SmallMA_c f_{CC|c} + \upsilon_c$$

Thus, we fully interact MA characteristics, Z_c, with size.

expected negative sign. Moreover, controlling for residential centralization substantially increases the effects of job centralization. Columns 5 and 6 report IV1 estimates that do not include residential centralization. These estimates give the effect of exogenous changes in job centralization without controlling for the offsetting response of residential locations. They are considerably higher than the WLS1 estimates without controls for residential centralization, but are quite close to the WLS2 estimates with such controls. Columns 7 and 8 present IV2 estimates, which control for residential centralization. These give a sense of the effect of shifting demand to the central city when residential locations are not allowed to respond. Not surprisingly, these estimates exceed those that do not condition on residential locations.

A one standard deviation increase in the fraction of jobs in the central city (.155) would increase central city wages by 1 (WLS1) to 3 (IV2) percentage points relative to suburban wages. The effects are higher in MA's with over 500,000 residents, 1.2 (WLS1) to 5.7 (IV2) percentage points. As is necessary for the mismatch hypothesis, these estimates indicate that mobility is costly for firms and workers in the sense that a reduction in employment opportunities in the central city lowers wages in the central city relative to the suburbs. The effects - between $5 and $30 per week for a resident of a large MA earning $25,000 per year from a standard deviation change in job centralization - are well within the plausible range.

V. The Mismatch Hypothesis and Racial Outcomes

Baseline Estimates

The previous section provides evidence that mobility between the central city and suburbs is costly for firms and workers, causing wages to change with the location of labor demand. Given these wage responses, this section studies the effects of job centralization on the employment of blacks relative to whites. To control for differences in labor market conditions across MA's, we take the black-white difference in employment rates as our dependent variable. To avoid selection, we calculate employment rates for all blacks and whites in an MA, not just central city residents. Thus, our estimates are the difference between a predominantly central city black population and a white population which is more evenly spread across both areas.

As above, we control for differences in observable individual characteristics using a two step procedure. In the first stage, individual employment status was regressed on observable characteristics (the same controls as above). The mean residuals from this regression were used to estimate race-specific employment rates in each MA. In the second stage, which again takes the form of (1), the black-white difference in employment rates were regressed on measures of job centralization and other controls. Individuals who worked or who were not at work but held jobs in the week prior to the survey were classified as employed. The sample includes individuals 18-65 years old not enrolled in school.

Table 4 present the results. The WLS1 estimates show that an increase in the fraction of jobs in the central city of an MA raises the employment of blacks relative to whites. The first column shows that a 1 percentage point increase in the fraction of jobs located in the central city of an MA raises the employment rate of the black residents in the MA by .11 percentage points relative to whites. Column 2 allows separate effects of central city jobs for MA's with more than 500,000 residents (WLS2). The effects for large MA's greatly exceed those for small MA's; in fact, there is little evidence that job locations affect employment status in MA's with less than 500,000 residents[16]. Variations in the supply of labor to the central city and in the boundaries of the central city will bias these estimates downward. Again, we control for these factors by including the fraction of people residing in the central city. As expected, the fraction of people living in the central city has a negative effect on black employment in large MA's. Controlling for residential centralization substantially increases the effect of job locations on black-white employment differences (columns 3 and 4).

We have considered a number of alternative explanations for the relationship between the job centralization and black-white employment differentials. Weinberg (2000) argues that black residential centralization will reduce black job access. Columns 5 and 6, add the black-white difference in the fraction of the population living in the central city. This variable has little effect on the estimates of job centralization. We have also experimented with controls for the employment rate in the MA, region effects, and the fraction of the population that is black with little effect on the results.

Instrumental Variable Estimates

Employer locations are likely to be endogenous – a low labor attachment among black workers will make it harder for central city firms to find workers and may be associated with higher crime. As above, variations in labor supply to the central city and variations in the boundaries of the central city will bias these estimates down. The remaining

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[16] We were concerned that the weak results for small MA's may be due to insufficient data for small MA's or to the breakpoint used. The standard errors for small MA's are similar to those for large MA's, suggesting that excessive noise is not responsible for the weak results among small MA's. We have shifted the break point from 500,000 residents to 250,000 or 1,000,000 residents. This adjustment has the expected effect on the standard errors of the estimates, but has little effect on the point estimates.

columns of table 4 use instrumental variables to control for these biases. Columns 7 and 8 report IV1 estimates that exclude residential centralization and columns 9 and 10 present IV2 estimates that control for it. In both cases, instrumenting for job centralization increases the effect of job centralization compared to the corresponding WLS estimates. As expected, controlling for the response of residential centralization to job centralization increases the effects of job centralization. When separate effects are estimated for large and small MA's, job locations are an important determinant of employment in large MA's but have little effect in small MA's. Thus, it is important to control for variations in the supply of labor to the central city and for variations in the boundaries of the central city, when estimating the effect of job centralization on black employment.

Instrument Validity

There are a number of concerns with our industrial composition instruments. First, the industrial composition of MA's may be affected by the labor attachment or human capital distribution among black residents of the MA – low attachment among black workers might lead industries with high black employment shares to locate in other cities. It is worth noting, however, that blacks constitute a small portion of the total population of our MA's (13.4% of the population in the average MA and 13.7% in MA's with populations over 500,000). Second, the industrial composition may affect the incentives to acquire human capital for blacks. To address these concerns, we have computed industrial composition for the MA's with more than 500,000 residents in 1980 for which 1940 data is available from the 1940 census[17]. We have chosen to use 1940 in order to

[17] To maintain consistence, we have aggregated industries, which eliminates some inter-industry variations (we employ a 61 industry classification). Also, the definitions of the

obtain data which predates the entry of the 1980 workforce. First, we find that inter-MA differences in industrial structure exhibit a remarkable degree of stability. Controlling for industry fixed effects, the partial correlation between industry employment shares in an MA in 1940 and 1980 is .69. We also construct our instruments for job locations using the 1940 industry employment shares. Estimates using these instruments, shown in column 11, are quite similar to the estimates using contemporaneous industrial composition. Given the similarity of the estimates and the unavailability of data for many smaller MA's in the 1940 data the remaining analyses utilize the 1980 industrial composition variables.

Another concern is that our instruments for the demand for labor in the central city may be correlated with the relative demand for black workers. We test this in number of way. While, industries that locate in central cities employ more black workers, this difference is largely due to the industrial location patterns. Put differently, there is little tendency for industries with high shares in central cities to have higher employment shares for blacks within their central city or suburban workforces.

We have constructed instruments for the demand for black workers using our industrial composition variables assuming a fixed factors demand structure[18]. A regression of our instruments for job location on the demand index for black workers yields,

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metropolitan areas has also changed since 1940 and many of the smaller MA's are not identified on the 1940 census. Both factors should bias our estimates down.

[18] Letting D_c^b denote the demand index for black workers in city *c* and $f_{b|i}$ denote the fraction of industry *i* workforce that is black, $D_c^b = \sum_i f_{b|i} f_{i|c}$. Bound and Holzer (1993) employ a similar procedure.

$$\hat{f}_{CC|c} = .363 + .385\, D_c^b + .006 \log(population)$$
$$(.022) \quad (.191) \quad (.0008)$$

The relationship between the job location instruments and the demand for black labor is quite weak (the partial R^2 is .021). Including the demand index for black workers in our employment regressions has little effect on our job locations variables.

It is also possible that industries that locate in central cities pay higher (or lower) wages to black workers relative to white workers. To test this possibility, we estimated industry-specific racial wage gaps for each of the 232 industries used in our analysis and regressed them on the share of employment located in central cities. There was no statistically significant relationship between industry locations and industry differences in the racial wage gap.

Unobserved Ability and Central City Employment

Racial differences in human capital across metropolitan areas that correlate with our instruments may also bias our results. We investigate this possibility in two ways.

First, racial differences in ability may arise because of selective migration. If the availability of jobs in the central city increases blacks' chances of obtaining employment, blacks with greater labor force attachment would have an incentive to move to MA's with more jobs in the central city, which would bias our estimates up. We note that if the availability of jobs in the central city has no effect on black employment rates then there is no incentive for blacks with high labor force attachments to choose MA's with more jobs in the central city. Thus, choice of MA's is unlikely to generate a positive effect if the true effect is zero, although it may lead to an upward bias if the true effect is positive. The weak relationship between black-white employment differentials and the location of jobs in small MA's indicates that there is little tendency for blacks with high labor force attachment to move to MA's with more jobs in their central cities, aside from the effects of job location on employment opportunities for blacks. The 1980 census contains information on employment status and the MA of residence in 1975. Using employment status in 1975 as an indication of labor force attachment, we estimate whether people who were employed were more likely to move to MA's with more jobs in their central cities than those who were not employed[19]. A typical regression is,

$$\begin{array}{llllll} Jobs\,in\,CC_{1980} & = -.001 & +.0009\ Black & -.0003\ White * Emp & -.002\ Black * Emp \\ - Jobs\,in\,CC_{1975} & (.0002) & (.0008) & (.0003) & (.0009) \end{array}$$

The R^2 for the equation is .0001. The positive coefficient on *Black* indicates that blacks as a whole move to cities with more jobs in their central cities than whites. However, the significant negative effect on *Black*Employed* indicates that employed blacks are more likely to move to MA's with fewer jobs in their central cities. This effect would bias our estimates downward. We have estimated similar regressions controlling for the fraction of jobs in the central city of the 1975 MA; categorizing individuals on the basis of full-time and part-time employment in 1975; controlling for individual characteristics as well as stratifying the sample by gender and education. None of the estimates differ meaningfully from the results presented here. In general, even the significant effects are quite small compared to the overall variation in the fraction of jobs in the central city (among large MA's, one standard deviation is .140). Thus, movement of blacks with high

[19] Our sample for this analysis contains individuals between 23 and 65 in 1980 who were not in college in 1975 and who switched MA's. Given the effects of job location in large MA's, we restrict the sample to people who lived in large MA's in 1975 and 1980. The sample contains 77,099 observations.

labor force attachment toward MA's with more jobs in their central cities is unlikely to be responsible for our results.

We have also estimate the relationship between our instrument for central city employment and scores on the Armed Forces Qualifying Test (AFQT) and mother's education, two commonly used measures of ability. To perform these analyses, our instruments were merged into the National Longitudinal Survey of Youth of 1979. We constructed a sample of individuals who had left full time schooling. The observations were respondent years, so people who moved between cities contributed data in proportion to the amount of time they lived in each city. The only statistically significant relationship between the racial gap in AFQT or mother's education and our instruments was found for AFQT in small MAs where our estimates of the effects of job access are essentially zero. We conclude, that a correlation between our instruments and unobserved ability can not explain the large effects found in large metropolitan areas.

Estimates by Gender, Education, and Age

These estimates indicate that the availability of jobs in the central city is an important determinant of employment status for blacks overall but provide little indication as to which groups are most affected by job centralization. We expect job location to be most important for groups with more individuals on the margin to work - the young and elderly, less educated workers, and women[20]. Indeed much of the work on the mismatch hypothesis focuses exclusively on youth.

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[20] While employment among black women is higher than that among white women, it is lower than that among black men. A portion of the estimated effects among women may be due to an effect of job locations on white women.

Table 5 provides separate estimates of the effects of job locations on employment by gender, education, and age. We divide the sample into two education groups: individuals without any college (those with 12 or fewer years of school) and those with at least some college (those with more than 12 years of school including attendance with or without completion of a 13th year). We divide the sample into three age groups, 18-30; 31-50; and 51-65[21]. Weighted least squares estimates, with and without controls for the fraction of MA residents living in the central city, and the corresponding IV estimates are presented. We construct a separate measure of job locations for each gender-education group (as well as separate instruments for each group, which are described in the appendix). This procedure ensures that we measure the location of jobs that are relevant for each group.

As with the earlier results, the WLS1 estimates without controls for the fraction of residents in the central city are lower than the WLS2 estimates with such controls. IV1 and IV2 estimates are again larger than the corresponding WLS estimates. We focus initially on the estimates for MA's with populations over 500,000. Using both WLS and IV, the relationship between job centralization and racial employment differences are greater, by one half or more, among workers without any college than for workers with at least some college. Job centralization has a greater effect on women. The fraction of jobs in the central city also has the greatest effect on young workers. The WLS estimates for young workers are close to double the estimates for middle-aged workers. The IV estimates for college-educated workers drop off considerably between the young and middle-aged. The WLS estimates provide some evidence that job centralization affects

[21] A separate first stage regression is run for each gender-education-age group to control for observable characteristics.

older workers more than middle-aged workers, however, the smaller samples make the estimates for older workers less precise. In contrast to studies that focus on the effects of job access on employment for young workers only, our estimates indicate that the fraction of jobs in the central city affects all groups. Job locations have less effect on employment rates in MA's with less than 500,000 residents. Many of the estimates for young non-college men and women and for middle aged women both with and without college are economically important but are statistically insignificant.

Quantifying the Effects of Job Locations

This section quantifies the effect of job access on black workers. We consider two experiments. First, we consider the effect of a 1 standard deviation increase in job centralization. Below, we consider the change in job centralization between 1969 and 1979.

Table 6 presents estimates of the effect of a reallocation of jobs from the suburbs to the central city on black-white employment differences. Given the importance of job locations in MA's with over 500,000 residents, we restrict our attention to those MA's. The first row presents the black-white differences in employment rates in large MA's. Blacks have lower employment rates than whites for every group except college-educated women (the difference among non-college women is quite small). The second row presents the differences adjusted for observable characteristics. Among men, differences in observable characteristics account for a couple percentage points of the black-white difference in employment rates.

We estimate the effect of a one standard deviation, 14 percentage point, increase in the fraction of jobs located in the central city of MA's on the employment difference (row 3) using the IV1 estimates. The bottom panel for the IV2 estimates reports the effect of a one standard deviation increase in the fraction of jobs located in the central city conditional on the fraction of persons residing in the central city (9.5 percentage points). The table also reports the share of the adjusted black-white wage gap that would be eliminated by each increase in job centralization.

Among all adults, the effect of a one (conditional) standard deviation increase in the fraction of jobs in the central city range from a low of 2.5 (3.4) percentage points for college educated men to a high of 6.8 (9.3) percentage points for non-college men. The implied effects range from one third (one half) to the entire regression-adjusted black-white employment differential. The implied effects can also be compared to the effect of controlling for observed characteristics. In general, a one standard deviation increase in job centralization has effects equal to or greater than closing the black-white gap in observed human capital variables.

The implied effects are uniformly larger among individuals between 18 and 30. For young men with some college, the implied effects are 3.6 (4.9) percentage points; they are 8.5 (11.6) percentage points for young men with no college. While the implied effects are considerably larger for young workers, so are the black-white employment differentials. For this reason, a given increase in the fraction of jobs in the central city would eliminate a smaller share of the black-white employment gap among young workers. The effects remain quite large. A one standard deviation increase in job centralization would reduce the black-white employment difference among young non-college educated men by 46% (62%), among young college educated men by 40% (56%), and eliminate it for young college-educated women.

Table 7 assesses how much of the 1969 to 1979 increase in the black-white employment gap can be explained by the decline in job centralization over that period.[22] The first row reports the change in the black-white employment gap (the figures are the raw changes, although adjusted figures are quite similar). The gap increased more for young workers (11% across all groups) than for the entire population (6%). The second row gives the change in job centralization. Jobs decentralized more for non-college workers (7% to 8%) than for college graduates (5%). The third and fifth rows show the implied effect of the decline in job centralization on the black-white employment gap using the IV1 and IV2 estimates, while the rows beneath them report the share of the actual change explained. Excepting college graduate women, the decline in centralization is an important determinant of declining employment, with the implied effects ranging from 20% of the change to the entire change.

VI. Conclusions

Following Kain (1968), economists have argued that a lack of jobs in the inner-city may be responsible for low and declining labor force participation among black workers. Existing tests of the mismatch hypothesis have yielded contradictory results and have lead to questions of causality. We study the effects of job locations on black employment rates across metropolitan areas, exploiting inter-city variations in industrial composition to develop instruments for job centralization.

A variety of implications of the mismatch hypothesis are examined. The assumption underlying the mismatch hypothesis - that labor is imperfectly mobile within

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[22] We concentrate on this period because the 1990 census makes it impossible to calculate comparable figures and because the increase in incarceration of young, black

metropolitan areas - implies that an increase in the demand for labor in central cities should raise wages in central cities relative to suburban communities. Our estimates confirm this implication. Our main interest is in the effect of job centralization on black employment rates relative to whites. An increase in the fraction of jobs located in the central city raises black employment rates relative to whites. The effects are greatest in large MA's and for the young, for women, and for less educated workers. There is some evidence of greater effects among older workers. Instrumental variables estimates indicate that it is important to control for variations in labor supply to central cities and variations in the boundaries of central cities.

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men makes changes in employment difficult to interpret.

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Appendix - Theory

A shift of labor demand from the suburban industry to the central city industry increases relative wages in the central city. Total differentiation of the wage conditions and rearrangement yields,

$$d\left(w^{cc}-w^{s}\right)=\frac{\left(1-\frac{F''\left(L^{cc}\right)}{F'\left(L^{cc}\right)}\left(L_{s}^{s}+L_{cc}^{s}\right)\right)d\theta^{cc}-\left(1-\frac{F''\left(L^{s}\right)}{F'\left(L^{s}\right)}\left(L_{cc}^{cc}+L_{s}^{cc}\right)\right)d\theta^{s}}{\left(1-\frac{F''\left(L^{cc}\right)}{F'\left(L^{cc}\right)}L_{cc}^{cc}\right)\left(1-\frac{F''\left(L^{s}\right)}{F'\left(L^{s}\right)}L_{s}^{s}\right)-\frac{F''\left(L^{cc}\right)}{F'\left(L^{cc}\right)}\frac{F''\left(L^{s}\right)}{F'\left(L^{s}\right)}L_{s}^{cc}L_{cc}^{s}}.$$

A shift in demand toward the central city industry raises the wage (per efficiency unit of labor) in the central city relative to the suburbs. The importance of a less than infinitely elastic labor supply and demand are evident from this expression. As the (partial) labor demand elasticities ($\left(F''/F'\right)^{-1}$) approach ∞, the denominator diverges to ∞ more quickly than the numerator and the industry shares have no effect on relative wages. The same holds true as the labor supply elasticities (L_j^i) approach infinity.

Appendix - Data

PUMS Data

We employ data from the 5% A-sample and 1% B-sample of the 1980 Census Public Use Microdata Samples. The advantage of the B-sample is that it identifies a greater number of MA's that the A sample. The A-sample contains 5 times as many observations as the B-sample, however, it identifies fewer MA's and in some cases suppresses portions of MA's. We have found that estimates using the 5% A-sample are more precise when we estimate outcomes for specific demographic groups (for example, when employment is estimated by gender, education, and age at the MA-level). Therefore, we use the A-sample to estimate all dependent variables. Because sample size is less of a concern when estimating the independent variables (the fraction of jobs located in the central city of each MA, and the instruments for job location) the B-sample is used to estimate these variables. Use of the B-sample ensures that our independent variables are based on full representative samples of the population in each MA. Experimentation indicates that the precision of the estimates is the only difference between results using the A- and B-samples. We use the PUMS data to estimate employment status, wages, job locations, and to construct our instruments.

At the time of the 1980 census, metropolitan areas were classified as Standard Metropolitan Statistical Agglomerations (SMSA) or Standard Consolidated Statistical Agglomerations (SCSA). SCSA's are defined in terms of economic integration and commuting patterns. We aggregate SMSA's that are within SCSA's to the SCSA level so that the unit of analysis approximates the local labor market. In some metropolitan areas (primarily SCSA's, where each SMSA has a central city) the census designates multiple central cities. If blacks encountered costs from living outside the central cities of an MA but could easily live in any of the central cities, it would be appropriate to use all the central cities as the basis of the analysis. To obtain data for SCSA's with a single (or a minimum number of) central city we classify the central city of the main SMSA as the central city of the SCSA and treat the balance of that SMSA and the remaining SMSA's as outside the central city. We have also performed the analysis treating the central cities of each SMSA as central cities with little effect on the results.

Employment Sample

We estimate employment rates for blacks and non-blacks. The sample included all workers residing in a metropolitan area between the ages of 18 and 65 not currently enrolled in school. The regressions control for the gender, years of completed school, potential experience (age-years of school-6), Hispanic background, race, and marital status[23]. Individuals with imputed values for any of these variables or employment status were dropped from the sample. Individuals who worked in the week prior to the survey and those who were not at work but who held jobs were classified as working. This sample contains 3,685,608 observations total. Breakdowns of the sample by gender and education, by age, and by race are given in appendix table 1. A breakdown of the number of observations for each MA is provided in appendix table 2.

As described in the text, we employ a two stage estimation procedure adjusting for individual characteristics in the first stage, then using the residuals from the first stage regression to estimate employment rates by race for each MA. The sample for the first stage regressions is the one described above containing residents of all MA's. Thus, the effects of individual characteristics on employment status are estimated for the residents of all MA's. Not all MA's were included in the second stage regression. When analyzing the determinants of black employment, MA's with fewer than 50 observations for blacks were excluded from the second stage regressions to reduce noise.

Wage Sample

We estimate the wages of individuals who worked in the central city and suburbs of each MA. The sample selection criteria are similar to those for the employment sample except that this sample included all individuals who worked in MA's (whether or not they lived in an MA). The procedures for determining the place of work are described below. In

[23] Controlling for race in our first-stage regression ensures that the coefficients on the other covariates are not biased. It directly affects the intercept of our second-stage

addition to the criteria above, we further restricted the sample to people who were in the labor force for 40 or more weeks in 1979 and who usually worked 35 or more hours per week. Individuals with positive self-employment or farm income were eliminated from the wage sample. Individuals with imputed earnings or imputed values for the 1979 labor force variables were dropped from the sample as were people whose wage and salary income was less than $40 per week. Individuals with topcoded earnings were assumed to have earnings 1.45 times the topcode value. One concern with our wage measure is that it pertains to the year prior to the survey while our job location variable is for the job in the week prior to the survey. This problem should be minimal because most people do not switch jobs and among people who switched jobs many will continue to work in the same portion of the MA.

Job Location Sample

We estimate the fraction of people employed in the central city of each MA using people between 18 and 65 who were employed in the week prior to the survey. As with the wage sample, we used the state and county group of work to determine the MA of work so our estimates include people who did not reside in their MA of work. Our instrument for job centralization required data on each person's industry. Thus when constructing the instruments we restrict the sample to people who had non-imputed industry codes.

Census Summary Tape File 3C

In addition to the PUMS data, we employ data from the Census STF3C. To maintain confidentiality, the census suppresses whether people resided in the central city or suburbs for residents of smaller MA's and for some of the residents in larger MA's. We

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regression but affects the slope only through its effects on the other covariates.

use the STF3C to determine the fraction of the working age population living in each portion of the MA. We obtain figures on MA population from the STF3C. The land area for each MA is available on the STF3C.

Appendix - Instruments for Job Location for Specific Demographic Groups

We develop separate instruments for the demand for labor in the central city by gender and education. Our instruments for the fraction of workers in each demographic group employed in the central city of each MA are, similar to those for all workers, a weighted average of the fraction of people in each industry who work in the central city. Whereas the weights in the instruments for all workers, were the fraction of the MA workforce in an industry, we impute the fraction of the workers in each gender-education group in each MA employed in each industry to avoid endogeneity. Let $f_{g|i}$ denote demographic group *g*'s share of the national employment in industry *i*. Our estimates of the fraction of workers in group *g* in MA *c* employed in industry *i* are,

$$\hat{f}_{i|gc} = \frac{f_{g|i} f_{i|c}}{\sum_i f_{g|i} f_{i|c}}.$$

As above, $f_{i|c}$ denotes the fraction of all workers in MA *c* that are employed in industry *i*. Let $f_{CC|gi}$ denote the fraction of workers in demographic group *g* in industry *i* employed in central cities estimated from national data. Our instruments for the fraction of workers in group *g* employed in the central city of MA *c*, $\hat{f}_{CC|gc}$, are

$$\hat{f}_{CC|gc} = \sum_i f_{CC|gi} \hat{f}_{i|gc}.$$

Table 1 - Decomposition of Changes in Central City Employment into Within and Between Industry Effects.

	Fraction of Industry Employment in Central City		Change in Fraction in CC	Within Industry Effect	Industry Employment Shares		Change in Industry's Share	Between Industry Effect
	1979	1989			1979	1989		
			(2)-(1)	$(3)\frac{(5)+(6)}{2}$			(6)-(5)	Formula in note (below)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Agriculture	0.181	0.275	0.094	0.001	0.014	0.016	0.002	-0.001
Mining	0.529	0.537	0.008	0.000	0.006	0.003	-0.002	-0.000
Construction	0.477	0.444	-0.033	-0.002	0.054	0.059	0.004	-0.000
Manufacturing, Non-Durables	0.549	0.493	-0.056	-0.004	0.083	0.063	-0.020	0.000
Manufacturing, Durables	0.443	0.420	-0.023	-0.003	0.148	0.104	-0.044	0.004
Transportation	0.613	0.559	-0.055	-0.002	0.047	0.045	-0.002	-0.000
Communication & Public Utilities	0.641	0.568	-0.074	-0.002	0.033	0.027	-0.005	-0.000
Wholesale Trade	0.573	0.487	-0.086	-0.004	0.048	0.047	-0.001	-0.000
Retail Trade	0.500	0.474	-0.025	-0.004	0.146	0.169	0.023	-0.001
FIRE	0.640	0.579	-0.060	-0.005	0.075	0.078	0.004	0.000
Business and Repair Services	0.566	0.524	-0.042	-0.002	0.048	0.053	0.005	0.000
Personal Services	0.528	0.534	0.006	0.000	0.030	0.032	0.002	0.000
Entertainment	0.522	0.513	-0.009	-0.000	0.009	0.015	0.006	-0.000
Professional Services, Health	0.611	0.606	-0.005	-0.000	0.078	0.086	0.008	0.001
Professional Services, Education	0.480	0.520	0.040	0.003	0.077	0.081	0.004	-0.000
Professional Services, Other	0.639	0.578	-0.061	-0.004	0.049	0.072	0.024	0.002
Public Administration	0.629	0.625	-0.004	-0.000	0.056	0.049	-0.008	-0.001
Total (Sum/ Mean)	0.539	0.515	-0.024	-0.028			0	0.004

Note: Data for 1980 constructed from the 1980 PUMS B-Sample. Data for 1990 from the Journey to Work Subject Summary Tape File. Data are averages of the fraction of workers in each industry employed in central cities and industry employment shares in 241 MA's which can be matched in both years. Between industry effect constructed as $(7)\left(\frac{(1)+(2)}{2}-\frac{(\bar{1})+(\bar{2})}{2}\right)$, where $(\bar{1})\ /\ (\bar{2})$ denotes the (weighted) mean across all industries of (1) / (2).

Table 2. Summary Statistics.

	All MA's		MA's Population>500,000		MA's Population<500,000	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Job & Residential Location Variables						
Fraction of Jobs in Central City	.480	.157	.453	.140	.589	.172
Industry Instrument for Fraction of Jobs in Central City	.487	.018	.490	.015	.474	.023
Fraction of Population Residing in Central City	.362	.158	.344	.130	.435	.226
Employment Rates, Persons 18-65						
Blacks (Unadjusted)	.642	.065	.641	.063	.644	.076
Non-Blacks (Unadjusted)	.716	.036	.719	.034	.705	.045
Black-Non-Black Difference in Employment Rates (Adjusted for Characteristics)	-.055	.051	-.061	.046	-.028	.063
Wages (High Attachment Full Time Workers, 18-65)						
Mean Log Weekly Wage, Persons Working in Central City (Unadjusted)	5.65	.112	5.69	.092	5.55	.118
Mean Log Weekly Wage, Persons Working in Suburbs (Unadjusted)	5.63	.122	5.65	.102	5.54	.142
Central City-Suburban Difference in Mean Log Weekly Wages (Adjusted for Characteristics)	.026	.045	.029	.035	.016	.068
Miscellaneous Variables						
MA Population	4,276,750	5,062,848	4,268,995	5,203,910	294,749	113,821
Fraction of MA Population Black	.134	.081	.137	.073	.121	.015
Central City Land Area (Square Kilometers)	952	1266	1154	1340	142	115
Suburban Land Area (Square Kilometers)	14,091	20,777	16,514	22,475	4365	4328
Number of Observations (Employment Sample/Wage Sample)	195/229		66/163		129/66	

Note: Estimates weighted by MA population. Employment sample, used to estimate the effect of job centralization on black-white employment differentials, contains 195 MA's. Wage sample, used to estimate the effect of job centralization on central-city-suburban wage differentials contains 229 MA's.

Table 3. Job Centralization and Central City-Suburban Wage Differentials.

	WLS	WLS	WLS	WLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fraction of Jobs in Central City	.063		.151		.112		.195	
	(.022)		(.034)		(.055)		(.084)	
MA Population>500,000		.092		.218		.248		.368
		(.027)		(.055)		(.084)		(.125)
MA Population<500,000		.006		.077		-.016		.019
		(.038)		(.051)		(.079)		(.114)
Fraction of People Residing in Central City			-.102				-.133	
			(.031)				(.062)	
Population >500,000				-.147				-.281
				(.056)				(.116)
Population <500,000				-.080				-.049
				(.040)				(.068)
R^2	.039	.065	.085	.110				

Note: Standard errors in parentheses. Regressions weighted by MA population. Sample includes 226 SMSA/SCSA's. Dependent variable is regression-adjusted central city-suburban difference in log wages. Regressions without separate effects for large and small MA's include log of MA population. Regressions with separate effects for large and small MA's include a dummy variable for population over 500,000, the log of MA population, and the log of MA population interacted with population over 500,000.

Table 4. Job Centralization and Black-White Employment Differentials.											
	WLS1	WLS1	WLS2	WLS2	WLS	WLS	IV1	IV1	IV2	IV2	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Fraction of Employment in Central City	.108 (.025)		.303 (.055)		.272 (.051)		.239 (.066)		.469 (.136)		
Population >500,000		.143 (.030)		.552 (.072)		.459 (.074)		.431 (.106)		.877 (.186)	.393 (.150)
Population <500,000		.032 (.044)		-.003 (.055)		.011 (.081)		.014 (.104)		-.035 (.201)	
Fraction of People Residing in Central City			-.203 (.051)		-.230 (.048)				-.352 (.116)		
Population >500,000				-.423 (.069)		-.380 (.067)				-.710 (.167)	
Population <500,000				.039 (.042)		-.028 (.078)				.064 (.167)	
Controls for Black-White Difference in Residential Centralization	No	No	No	No	Yes	Yes	No	No	No	No	No
R^2	.163	.183	.226	.322	.334	.391					

Note: Standard Errors in Parentheses. All regressions weighted by MA population. Sample contains 195 SMSA/SCSA's (except column (11)). Regressions without separate effects for large and small MA's include log of MA population. Regressions with separate effects for large and small MA's include a dummy variable for population greater than 500,000 and an interaction between log of MA population and population greater/less than 500,000. Dependent variable is regression-adjusted black-white difference in adjusted employment rate of persons 18-65 not enrolled in school. Instrument for job location is weighted average of industrial employment locations. Column (11) uses industrial composition in 1939 to construct instruments. This sample includes 58 SMSA/SCSA's.

Table 5. Job Centralization and Black-White Employment Differentials, by Gender, Education, and Age.

	All Persons				Non-College Men				College Men				Non-College Women				College Women			
	WLS1	WLS2	IV1	IV2	WLS1	WLS2	IV1	IV2	WLS1	WLS2	IV1	IV2	WLS1	WLS2	IV1	IV2	WLS1	WLS2	IV1	IV2
Young (18-30)																				
Fraction of Employment in Central City - Large MA's	.181 (.036)	.663 (.086)	.458 (.122)	.902 (.208)	.158 (.047)	.488 (.115)	.605 (.224)	1.218 (.415)	.096 (.042)	.247 (.088)	.254 (.111)	.514 (.233)	.193 (.039)	.669 (.098)	.472 (.110)	1.024 (.231)	.172 (.049)	.478 (.108)	.334 (.148)	.550 (.264)
Fraction of Employment in Central City - Small MA's	.105 (.057)	.012 (.068)	-.0003 (.136)	-.231 (.228)	.119 (.072)	-.004 (.090)	-.113 (.194)	-.585 (.350)	.015 (.066)	-.117 (.080)	-.100 (.148)	-.301 (.238)	.096 (.060)	.053 (.073)	.190 (.151)	.328 (.310)	-.085 (.079)	-.094 (.095)	.207 (.220)	.354 (.323)
R^2	.257	.407			.181	.247			.063	.123			.279	.386			.092	.141		
Middle Age (30-50)																				
Fraction of Employment in Central City - Large MA's	.097 (.026)	.429 (.065)	.473 (.113)	1.012 (.187)	.109 (.033)	.361 (.083)	.672 (.206)	1.410 (.371)	.054 (.030)	.237 (.063)	.146 (.077)	.327 (.162)	.075 (.037)	.353 (.100)	.407 (.114)	1.007 (.254)	.117 (.046)	.249 (.105)	.242 (.133)	.385 (.248)
Fraction of Employment in Central City - Small MA's	.013 (.041)	.001 (.050)	.047 (.124)	.099 (.203)	-.013 (.050)	-.023 (.063)	-.004 (.176)	.010 (.314)	-.032 (.046)	-.084 (.056)	-.066 (.104)	-.123 (.167)	.055 (.057)	.076 (.074)	.226 (.154)	.561 (.332)	.112 (.200)	.141 (.089)	-.085 (.195)	-.160 (.523)
R^2	.135	.273			.123	.183			.041	.114			.060	.111			.075	.088		
Older (50-65)																				
Fraction of Employment in Central City - Large MA's	.111 (.035)	.356 (.092)	.389 (.123)	.784 (.235)	.124 (.041)	.378 (.104)	.442 (.190)	.878 (.366)	.068 (.060)	-.063 (.131)	.065 (.151)	.016 (.335)	.099 (.042)	.314 (.116)	.377 (.119)	.866 (.276)	.055 (.080)	.079 (.185)	-.160 (.233)	-.349 (.435)
Fraction of Employment in Central City - Small MA's	-.049 (.071)	-.051 (.081)	.043 (.180)	.163 (.295)	-.056 (.080)	-.026 (.091)	.192 (.207)	.525 (.342)	.007 (.118)	.086 (.173)	.140 (.245)	.237 (.355)	.013 (.082)	.006 (.095)	.061 (.225)	.161 (.490)	-.315 (.167)	-.361 (.185)	-.398 (.465)	-.480 (.696)
R^2	.284	.327			.239	.280			.065	.076			.209	.232			.070	.073		

Note: Standard errors in parentheses. All regressions weighted by MA population. Dependent variable is black-white difference in regression-adjusted employment rate for persons not enrolled in school. Fraction of jobs in central city measured independently for each gender-education group. Large MA's defined as population over 500,000. All regressions include a dummy variable for population over 500,000, the log of MA population, and the log of MA population interacted with population over 500,000. In addition to these, WLS2 and IV2 estimates include the fraction of population residing in central city and the fraction of the population residing in the central city interacted with population over 500,000.

Table 6. Black-White Difference in Employment Rates and the Implied Effect of Cross-Sectional Variation in Job Centralization, Large MA's

	All		Non-College Men		College Men		Non-College Women		College Women	
	18-65	18-30	18-65	18-30	18-65	18-30	18-65	18-30	18-65	18-30
Black-White Difference, Unadjusted	-.078	-.153	-.151	-.215	-.075	-.101	-.017	-.116	.089	-.023
Black-White Difference, Adjusted	-.059	-.137	-.114	-.186	-.069	-.088	-.057	-.171	.054	-.037
Effect of a 1 Standard Deviation Increase in Jobs in the Central City (14%), IV1 Estimates	0.06	0.064	0.068	0.085	0.025	0.036	0.058	0.066	0.035	0.047
Share of Adjusted Black-White Difference Explained by a 1 Standard Deviation Increase in Jobs in Central City	1.017	0.467	0.596	0.457	0.362	0.409	1.018	0.386	-	1.270
Effect of a 1 Conditional Standard Deviation Conditional Increase in Jobs in the Central City (9.5%), IV2 Estimates	0.083	0.086	0.093	0.116	0.034	0.049	0.090	0.097	0.039	0.052
Share of Adjusted Black-White Difference Explained by a 1 Conditional Standard Deviation Increase in Jobs in Central City	1.407	0.628	0.816	0.624	0.493	0.557	1.579	0.567	-	1.405

Note: Conditional standard deviation control for the fraction of MA population residing in central city.

Table 7. The Effect of Changes in Job Centralization on Black-White Employment Differences, Large MA's, 1969-1979

	All		Non-College Men		College Men		Non-College Women		College Women	
	18-65	18-30	18-65	18-30	18-65	18-30	18-65	18-30	18-65	18-30
Change in Black-White Employment Gap, Unadjusted	-0.060	-0.111	-0.065	-0.094	-0.041	-0.049	-0.074	-0.153	-0.106	-0.146
Change in Job Centralization	-0.062	-0.062	-0.071	-0.071	-0.048	-0.048	-0.088	-0.088	-0.047	-0.047
Effect of Decrease in Job Centralization, IV1 Estimates	-0.026	-0.028	-0.035	-0.043	-0.009	-0.012	-0.036	-0.042	-0.012	-0.016
Share of Change in Black-White Employment Gap Explained by Increase in Jobs in Central City	0.433	0.252	0.538	0.457	0.220	0.245	0.486	0.275	0.113	0.110
Effect of Decrease in Job Centralization, IV2 Estimates	-0.054	-0.056	-0.070	-0.086	-0.017	-0.025	-0.083	-0.090	-0.019	-0.026
Share of Change in Black-White Employment Gap Explained by Increase in Jobs in Central City	0.900	0.505	1.077	0.915	0.415	0.510	1.122	0.588	0.179	0.178

Note: Effects based on IV estimates without residential centralization.

Appendix Table 1. Sample Size for Employment Sample.

	Total	Black	Non-Black
Total	3,685,608	413,598	3,272,010
Stratified by Gender and Education			
Non-College Men	1,091,934	143,526	948,408
College Men	704,378	43,922	660,456
Non-College Women	1,297,787	171,967	1,125,820
College Women	591,509	54,182	537,327
Stratified by Age			
18-30	1,219,774	158,753	1,061,021
31-50	1,540,104	169,088	1,371,016
51-65	925,730	85,757	839,973

Appendix Table 2. Sample Size for Employment Sample. MA's by Number of Observations

	Black	Non-Black
0-49 Observations	41	
50-99 Observations	21	
100-249 Observations	27	
250-499 Observations	43	
500-999 Observations	38	
1000-2499 Observations	36	34
2500-4999 Observations	14	83
5000-9999 Observations	8	52
10,000-24,999 Observations	6	39
25,000-49,999 Observations	1	15
50,000-99,999 Observations	1	8
100,000+ Observations		5
Total	236	236

Note: MA's with fewer than 50 observations for blacks were not included in the second stage sample leaving a sample of 195 MA's.

Appendix table 3. First Stage Regressions.

	All MAs	Large MAs	Small MAs
Intercept	-.059	0	-.356
	(.245)		(.358)
Population > 500,000		.069	0
		(.636)	
Share shift index ($\hat{f}_{CC\|c}$)	3.446		
	(.563)		
Population > 500,000		3.18	0
		(.630)	
Population < 500,000		0	3.809
			(.467)
Log(Popluation)	-.079		
	(.007)		
Population > 500,000		-.079	0
		(.009)	
Population < 500,000		0	-.069
			(.024)
Partial R^2 for excluded instruments	.163	.062	.290
F-Statistic for excluded instruments	37.5	12.7	33.3
Critical value at 1% level	6.75	4.71	4.71

Regressions weighted by population.