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Job Decentralization and Residential Location

This paper addresses an old and central question in urban economics: how does the spatial distribution of employment opportunities influence residential location? Over the past fifty years, both employment and population left central cities for the suburban ring. Between 1960 and 2000, the share of metropolitan Americans who lived in the suburban ring increased from 48 to 68 percent. Over the same period, the share of metropolitan residents who worked outside the city rose from 41 percent to 58 percent. The decentralization of employment and population has led economists to ask whether workers followed jobs out to the suburbs or jobs followed workers. Answering this question is complicated by the fundamental simultaneity of the location decisions of workers and firms.

We adopt a novel approach to disentangling the causal relationship between the location of employment and population. Our main focus is on a single industry—namely, state government—whose primary location is predetermined with respect to current residential patterns. State government is concentrated in capital cities. The choice of capital city was established long before the process of suburbanization began. In many cases, core state buildings, such as the state capitol and the state supreme court, were built in the historic central business district (CBD) well over a century ago and have never been moved. As a result, state workers in capital cities are disproportionately likely to work downtown compared with other workers in the area (75.6 per-

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cent versus 55.4 percent). However, state employees are also present in every major metropolitan area. State workers in noncapital cities are not much more likely than other workers in the area to work in the central city (57.9 percent versus 52.0 percent).[1]

If job location is an important determinant of residential location, we expect state workers in capital cities to be more likely than either state workers in other metropolitan areas or private sector workers in the capital to live in the central city. This set of comparisons naturally suggests a difference-in-differences estimation strategy. By contrasting state workers in capital cities and noncapital cities, we control for socioeconomic characteristics and differences in the taste for urban living that may be unique to state employees. Furthermore, by contrasting state and nonstate workers within metropolitan areas, we control for any relevant structural differences between capital and noncapital cities or their residents.

Our main empirical investigation is based on individual census records from the 1980 Integrated Public Use Microdata Series, or IPUMS (Ruggles and others 2008).[2] We find that state employees in capital cities are 12 to 14 percentage points more likely than state workers elsewhere to work downtown, relative to others in their metropolitan area, and 3 to 4 points more likely to live downtown. We find no observable differences in age, gender, education level or wage rates that could account for this residential pattern. Furthermore, this residential gap is robust to controlling for the industrial distribution of state workers in capital and noncapital cities. These figures imply that adding 1,000 jobs to the typical central city would increase the number of working residents in the central city by approximately 250 people.

Similar to state capitals, other government or government-related employment is characterized by historically determined locations that are very difficult to alter. We extend our basic analysis by considering employment in defense-related industry and at the United States Postal Service. Shortly after the Second World War, Congress specified that defense contractors should locate outside of existing city centers as a countermeasure against conventional or nuclear

1. A rich, related literature in economics, geography, and sociology has focused on potential inefficiencies in capital cities due to rent-seeking behavior. See, for example, Rosen and Resnick (1980); Carroll and Meyer (1983); Ades and Glaeser (1995). However, to the best of our knowledge, this paper is the first to point out the physical centralization of state government activity in capital cities and to assess the implications for residential location.

2. We focus on 1980 for pragmatic reasons. The census did not record individual's location of employment before 1960; metropolitan area of residence is not reported in the 1960 IPUMS; and in 1970, the IPUMS sample reports either metropolitan area of residence or household location (central city versus suburbs), but not both. In 1990 and 2000, IPUMS does not distinguish between working in the CBD or in any other part of the central city.

attack (O'Mara 2006). We use census data to identify workers who are likely to have been affected by this policy and demonstrate that they were significantly more likely to both work and live outside of central cities in 1980.

In prior work, we used the location of postal employment to study the role of spatial mismatch in black employment outcomes (Boustan and Margo 2009). Central to our earlier analysis is the fact that postal processing and distribution plants were located in or near central business districts before the postwar era of employment decentralization and are politically difficult to relocate. As a result, postal clerks are likely to work in central cities, while mail carriers are distributed throughout metropolitan areas. In comparing occupations within the postal service, we find that noncarriers are more likely to work and live downtown. Our estimates using defense and postal workers are very similar in magnitude to our state capital results.

State Capitals as a Natural Experiment for Central City Employment

Our goal is to estimate the impact of employment location on residential location. An ideal experiment for this purpose would randomly allocate the location of a given industry to either the center or the periphery of metropolitan areas and observe where workers in that industry might choose to live. This experiment has two important features:

—Industry location would vary across metropolitan areas. In some areas, the industry would be located in the center, while in others it would be located in the suburbs.

—This variation would be exogenous by design to current residential patterns.

In reality, workers may locate close to firms to minimize commuting costs, and firms may locate close to residential areas, offering workers compensation in the form of a shorter commute. Thus, any observed relationship between worker and firm locations could be driven by either worker or firm decisions. By manipulating industry location, this experiment would focus on worker decisions alone, avoiding concerns about reverse causality.[3] Furthermore, varying industry location across metropolitan areas would help to address selection bias.

3. Of course, one could also imagine a thought experiment in which households are randomly allocated to central versus periphery locations. We focus on how people respond to (quasi-) randomly assigned job locations rather than the reverse because, relatively speaking, it is easier to find real-world analogs to the random assignment of job location rather than it is to residential location. As a result, we estimate only one of the causal parameters of interest—how residential choice responds to employment location, not the reverse.

Industries that tend to locate in the central city—such as finance, insurance and real estate—may be those that benefit most from agglomeration economies. These industries may also employ educated workers who have a preference for suburban living. In this case, selection bias would understate the true relationship between job location and residential location.

Employment in state government provides a real world analog to the experiment described above. Every state has a capital city where core state business is carried out. The location of virtually every state capital, even for former territories, has not changed since the nineteenth century. The one exception, Oklahoma City, was declared the capital of Oklahoma in 1910. In other words, the founding of state capitals long predates—and is therefore plausibly exogenous to—the decentralization of the population to the suburbs, which overwhelmingly occurred in the twentieth century.

Much of the government activity in state capitals takes place in buildings that were constructed in the nineteenth century and remain in the historic central business district. Examples of such buildings are obvious: the state capitol, where state legislatures hold sessions; official state libraries and archives, which are adjuncts to the legislature; and state supreme judicial courts. However, in noncapital cities, there is no inherent reason—and indeed no empirical pattern—for state government workers to be employed in central cities. For example, Bureaus of Motor Vehicles, where individuals acquire or renew their licenses, are often located well outside of central business districts, close to major highways to facilitate access by automobile.

State government satisfies our two experimental criteria: it is an industry whose main location varies across metropolitan areas for historical reasons unrelated to current residential patterns.. However, state capitals were established many years ago and may have evolved differently from other cities over time. As a result, unique aspects of capital cities and their residents may confound our analysis. For instance, workers in capital cities are better educated than the typical American worker. To address potential differences between capital and non-capital cities, we compare state workers to the remainder of the workforce (both private and other public sector workers) in their metropolitan area.

Using within-metropolitan area variation has two main advantages. First, every metropolitan area is configured differently. Because of topography or local politics, central cities vary enormously in size relative to the area as a whole. For a given (square mile) size of the metropolitan area, these differences alone will generate a positive but spurious correlation between the share of any two activities occurring in the city (here, working and residence).

Secondly, comparing workers within metropolitan areas absorbs other omitted local characteristics that may be correlated with the share of activity occurring downtown. For example, a central city might be crime-ridden, encouraging firms and workers to relocate to the suburban ring. We could also imagine characteristics that repel firms from the central city but attract residents. A center city with a high local tax rate may create adverse business conditions, but the collected revenue may be used to fund local government services that attract residents.

Our empirical strategy thus compares the employment and residential locations of state workers in capital and noncapital cities to other, nonstate workers in the same set of metropolitan areas. The key identifying assumption is that state workers in both city types are otherwise identical but for their "assignment" to the state capital. However, as table 1 demonstrates, state workers in capital cities are engaged in different tasks from those of their counterparts in noncapital cities. In the capital, state employees are more likely to participate in government administration and less likely to work in a state-run hospital or university. These differences encourage us to test whether observable characteristics of the state workforce vary between capital and noncapital cities. We estimate:

$$(1) \qquad \mathbf{X}_{ijk} = \alpha + \beta_1(\text{state worker} - \text{capital city})_{ijk} + \alpha_2(\text{state worker})_{ijk} + \beta_3(\text{capital city})_{ijk} + \epsilon_{ijk},$$

where i indexes individuals; j, metropolitan areas; and k, class of worker (state worker or not). $\mathbf{X}$ is a vector of individual characteristics, including race, gender, age, and educational attainment. Our interest is in the coefficient β_1 on the interaction between being a state worker and living in a capital city. The indicator for being a state worker allows state employees to have systematically different characteristics than nonstate workers in all cities. In later specifications, we replace the main effect of living in a capital city with metropolitan area fixed effects, which absorb both the effect of capital city status and other local attributes.

Our sample contains more than 700,000 full-time workers in 127 metropolitan areas, 25 of which are state capitals.[4] Appendix table 1 presents summary statistics for this sample. A list of the capitals that can be identified in the data

4. We focus on individuals between the ages of 18 and 64 who were not in school, living in group quarters, in the armed forces, or in the farm sector. Sample individuals must live in a metropolitan area large enough for place of residence to be revealed in the public use data and must be in the subsample asked to report employment location (around half of all respondents indicated by the MIGSAMP variable).

Table 1. Top Industries for State Workers in Capital Cities and Noncapital Cities, 1980[a]

Industry[b]	*Capital*	*Noncapital*
Colleges and universities	18.67	22.83
General government	15.44	5.18
Hospitals	10.62	17.92
Administration of human resource programs	9.62	7.76
Justice and public order	8.03	8.77
Elementary and secondary schools	7.97	10.96
Administration of economic programs	7.24	4.19
Public finance and taxation	3.68	1.14
Administration of environmental programs	1.55	1.04

Source: 1980 IPUMS 5 percent sample.

a. Sample: Individuals aged 18–64 who are employed full-time for the full-year and are not in school, living in group quarters, in the armed forces, or in the farm sector. Restricted to the subsample asked to report their location of employment and to metropolitan areas large enough for place of residence (central city versus suburb) to be revealed.

b. Industries reflect 1990 census categories using the 1990 IPUMS IND variable.

is presented in appendix table 2. The smallest metropolitan area anchored by a capital city in our sample is Trenton, New Jersey, and the largest is Minneapolis-St. Paul, Minnesota. The median capital area is larger in size than the median noncapital area, contributing 3,900 in contrast to 2,800 observations to the sample. Noncapital cities overtake state capitals at the 75th percentile of the size distribution, a pattern that is driven by the nation's ten largest cities (for example, New York City and Los Angeles).

The top panel of table 2 compares the personal attributes of state workers in capital and noncapital cities relative to other workers in their respective metropolitan areas. The main effects of being a state worker and living in the capital city are large and significant. State workers are older and more educated than the rest of the workforce, and they are also more likely to be female and black. Workers in capital cities are also better educated and more likely to be female, but they tend to be younger than workers in other areas. However, state workers in capital cities do *not* differ from state workers elsewhere along any of these dimensions, with the exception of race. State workers in capital cities are less likely to be black. The other point estimates are orders of magnitude smaller than the main effects and are not statistically significant. If anything, the racial differences will work against our main findings because African Americans are more likely to live in central cities.

The bottom panel of table 2 compares the labor market characteristics of state workers in capital and noncapital cities. While state workers earn 3 percent less than nonstate workers outside of capital cities, this gap is not present in capital cities. We speculate that this discrepancy may reflect the different

Table 2. Are State Workers in Capital Cities Different from State Workers Elsewhere?a

Variable	*= 1 if some college*	*= 1 if college graduate*	*= 1 if female*	*= 1 if black*	*Age*
= 1 if capital	0.011	0.019	0.016	–0.011	–0.912
	(0.004)	(0.011)	(0.005)	(0.012)	(0.154)
= 1 if state worker	–0.022	0.200	0.135	0.082	1.549
	(0.004)	(0.014)	(0.008)	(0.010)	(0.181)
Capital—state worker	–0.001	0.002	–0.003	–0.048	0.033
	(0.007)	(0.019)	(0.013)	(0.014)	(0.344)

	= 1 if married	*ln(wage)*	*ln(wage) industry FE*	*Hours per week*	*Hours per week industry FE*
= 1 if capital	–0.001	–0.032	–0.022	0.178	0.147
	(0.008)	(0.016)	(0.014)	(0.078)	(0.071)
= 1 if state worker	–0.032	–0.032	–0.035	–0.698	–0.326
	(0.006)	(0.012)	(0.012)	(0.012)	(0.111)
Capital—state worker	–0.002	0.033	0.007	–0.505	–0.240
	(0.012)	(0.019)	(0.016)	(0.193)	(0.187)

Source: 1980 IPUMS 5 percent sample. N = 707,506.
FE = fixed effects.
a. Regressions include state fixed effects. Standard errors are reported in parentheses and are clustered at the metropolitan area level.

industrial distributions of state workers by city type. Indeed, adding dummy variables for three-digit Standard Industrial Classification (SIC) industry codes erases the wage differences between state workers in capital and noncapital cities. A similar pattern holds for hours of work per week. We show below that our main results are robust to including a full set of industry dummies.

The similarity of state workers in capital and noncapital cities, at least along observable dimensions, supports our use of a difference-in-differences estimator. However, our strategy requires the additional assumption that the presence of state government in the central business district has no effect on the job locations of private sector and other public sector workers (our control group). We will underestimate the parameter of interest if private firms in state capitals are more likely than firms elsewhere to locate downtown—perhaps because there are employment spillovers in providing services to centralized state employees. Alternatively, we will overestimate the parameter of interest if private firms in state capitals are less likely to locate downtown—for example, if state agencies outbid private firms for the fixed supply of land in the central city.

Table 3. State Workers in Capitals Are More Likely to Work and Live in Central Cities[a]

Dependent variable	*Base* *(1)*	*Add industry dummies* *(2)*	*Weight equally* *(3)*	*Include college towns* *(4)*
Panel A				
= 1 if work in city	0.137	0.119	0.124	0.143
	(0.029)	(0.027)	(0.031)	(0.028)
= 1 if work in CBD	0.082	0.051	0.087	0.070
	(0.023)	(0.023)	(0.023)	(0.022)
Panel B				
= 1 if live in city	0.034	0.027	0.031	0.039
	(0.016)	(0.015)	(0.018)	(0.015)

Source: 1980 IPUMS 5 percent sample. N = 707,506.
CBD = central business district.
a. Standard errors are reported in parentheses and are clustered at the metropolitan area level. All regressions include metropolitan area fixed effects and individual-level controls, including a fourth-order polynomial in age and dummies for being female, black, and for each year of completed schooling. The second column adds a vector of dummy variables for each industry using the 1990 industry categories. The rows report coefficients on the interaction between capital city and state worker.

Empirical Results

We begin by demonstrating that state workers in capital cities are more likely to work downtown, a pattern that corresponds to the historical placement of government buildings. Table 3 examines the work and residential locations of state workers in capital and noncapital cities relative to other workers in their metropolitan area. The regressions underlying this table follow the form of equation 1 but replace the dependent variable with an indicator for either working or living downtown. Panel A shows that state workers in state capitals are 12 to 14 percentage points more likely than state workers elsewhere to work in the central city and 5 to 9 points more likely to work in the central business district.[5] These effects are large relative to the sample mean, increasing the probability of working in the central city by 25 percent and doubling the probability of working in the central business district.

If workers based their residential location decisions on their job location we would expect that state workers in capital cities are also more likely to live downtown. We test this proposition in panel B. We find that such workers are indeed 3 to 4 percentage points—or 10 percent—more likely to live downtown. The results are again robust to adding dummy variables for three-digit SIC industry codes or weighting each metropolitan area equally. In the final column

5. It is interesting to note that, with the exception of state workers, employment in capital cities was just as decentralized as anywhere else by 1980. If we replace the metropolitan area fixed effects with state fixed effects, we can identify the main effect of living in a capital city. The resulting coefficient is –0.003 (standard error = 0.027).

(column 4), we add eight university towns to the treatment group, including Ann Arbor, Michigan; Fayetteville, Arkansas; and Lexington, Kentucky. The logic of our research design—namely, that many state buildings were constructed in the nineteenth century and are very difficult to move—may also apply to state universities. This specification yields very similar results.

Our focus on capital cities is motivated by an interest in the relationship between place of work and place of residence. The estimating equation that we have in mind is the following:

$$(2) \quad = 1 \text{ if live in city}_{ijk} = \alpha + \beta(= 1 \text{ if work in city})_{ijk} + \Phi \mathbf{X}_{ijk} + j + k + \epsilon.$$

We need an instrumental variable to predict employment location because of the selection bias created by the match between workers and firms and because of the possibility for reverse causality. That is, rather than job location determining place of residence, residential location may determine place of employment if workers search for jobs close to home. The results in table 3 suggest that a state worker's placement in the capital city is a viable instrumental variable for working in the central city.

Table 4 begins by estimating equation 2 by ordinary least squares (OLS). Working in the city increases the probability of living in the city by 26 percentage points, while working in the CBD only increases the probability of living in the city by 13 points. This pattern appears to be inconsistent with virtually all economic models of urban areas, which have at their core a trade-off between commuting costs and land prices. Such models imply that the attraction of living in the city should be strongest for those who work closest to the center.[6] The contrary evidence found in the OLS regression suggests the presence of a selection bias. Workers with a college degree are 70 percent more likely that those without to be employed in the central business district. Educated workers may prefer to live in the suburbs, despite—rather than because of—their proximity to work.

The second column of table 4 uses the interaction between being a state worker and living in the state capital as an instrumental variable for working in the center city. By comparing state workers in capital and noncapital cities, we aim to minimize the presence of such selection bias. The relationship between working and living in the central city is little changed by this procedure, but the effect of working in the CBD on residential location triples in size. It now appears that working in the CBD increases the probability of liv-

6. This argument might not be strictly true if we think about urban transportation systems and interstate highways, many of which are geared to funnel commuters into the CBD.

Table 4. The Relationship between Place of Work and Place of Residence[a]

Variable	*OLS* *(1)*	*IV* *(2)*	*IV* *Add industry dummies* *(3)*
= 1 if work in city	0.263	0.246	0.239
	(0.025)	(0.135)	(0.139)
= 1 if work in CBD	0.130	0.356	0.548
	(0.012)	(0.223)	(0.380)

Source: 1980 IPUMS 5 percent sample. N = 707,506.

CBD = central business district; IV = instrumental variables; OLS = ordinary least squares.

a. Dependent variable: = 1 if live in city. Standard errors are reported in parentheses and are clustered at the metropolitan area level. All regressions include metropolitan area fixed effects and individual-level controls, including a fourth-order polynomial in age and dummies for being female, black, and for each year of completed schooling. The instrument for working in the central city is an indicator equal to 1 for state workers in capital cities. The third column adds a vector of dummy variables for each industry using the 1990 industry categories.

ing in the city by approximately 36 points, a larger effect than that of simply working in the city. Adding industry dummies further increases the estimated effect of working in the CBD.

Although our estimates are expressed as probabilities that a single individual lives in the central city, the empirical magnitudes can be usefully interpreted as the predicted number of working residents living in the central city for 1,000 new centrally located jobs. Adding 1,000 jobs to the CBD would attract 356 working residents to the central city, while adding 1,000 jobs to the rest of the city would attract 227 working residents; together, these results imply that adding 1,000 jobs to the city as a whole would attract 246 new residents.[7] If one's goal is attract residents to central cities and the policy at hand involves relocating 1,000 jobs, adding these jobs to the historical CBD appears to be a more effective at the margin. Note, however, that the opposite conclusion would be drawn from the OLS specification, illustrating the value of our use of state capitals as a natural experiment.

We estimate the number of residents that stay in the central city for each job that remains. If we assume that the same relationship holds for jobs that *leave* the city (and residents who follow), we can use the parameter to assess the role of employment decentralization in the historical process of suburbanization. While our estimation is based on the 1980 cross section, we apply the resulting parameter to the time series variation in the location of employment. From 1960 to 2000, the share of workers who worked in the city fell from 59.3 to 42.3 percent (17 percentage points). The instrumental variable estimate implies that the share of workers who lived in the city would correspondingly fall by

7. Fifteen percent of city jobs are located in the CBD. Therefore, we calculate the effect of adding 1,000 jobs to the rest of the central city as X in the expression $0.15(356) + 0.85X = 246$.

4.2 points (= 17 × 0.246; second column of table 4). The central city share of the metropolitan population fell by 18.8 points over the same period. Combining the figures, we can infer that employment decentralization explains around 22 percent (= 4.2/18.8) of the observed suburbanization of population from 1960 to 2000. While we view this magnitude as plausible it should obviously be viewed with caution because we are using the results from a single case study to extrapolate to the broader economy over a (needless to say, lengthy) forty-year period of substantial social and economic change.[8]

This caveat aside, our results suggests that employment decentralization per se appears to have been a quantitatively important—but by no means sole—cause of population suburbanization. The bulk of suburban growth occurred after World War II, an era marked by rising real incomes, the diffusion of the private automobile, and new state and federal road building projects. Margo (1992) argues that rising real incomes can account for 40 percent of the movement to the suburbs from 1950 to 1980. According to Baum-Snow (2007), each interstate highway built through a central city reduced urban population by 16 percent. Households were also attracted to the suburbs by their racial and income homogeneity. Boustan (2007) finds that reversing the black migration from the rural South would have slowed the loss of urban white population by 20 percent.

Our results contribute to a long literature in urban economics on the empirical relationship between employment and residential locations. The canonical monocentric model of an urban area begins with the assumption that all production, and therefore all employment, occurs in a central location, such as the central business district (Alonso 1964; Mills 1972). Therefore, suburbanization cannot be driven by changes in employment location by construction. White (1999) summarized a set of more complex models that make the locations of both workers and firms endogenous but noted that the difficulty of the problem has limited their usefulness for quantitative analysis. As a result, the relationship between the spatial distribution of employment and population has become an inherently empirical issue.

In the 1980s and 1990s, a substantial empirical literature applied then-fashionable simultaneous equations methods to estimate the impact of job decentralization on population suburbanization and vice versa (see, for example, Steinnes 1982; Grubb 1982; Palumbo and Hutton 1987; Palumbo, Saks, and Wasylenko 1990; Greenwood and Stock 1990; Thurston and Yezer 1994;

8. One concern about external validity is that the state government may provide more stable employment arrangements than the typical firm in the private sector provides. As a result, workers in state government may be more likely than others to base their residential location decisions on their place of employment.

Boarnet 1994). A standard approach was to posit an econometric model linking, for example, the share of workers living (or working) in the central city to the share working (or living) in the central city and then to use lagged values of the endogenous variables as instrumental variables (for example, the share of workers working in the central city in 1970 as an instrument for the share working in the central city in 1980). All of these studies found that employment followed population to the suburbs, and a substantial minority also presented evidence that households followed jobs (Steinnes and Boarnet are exceptions).

We believe that this earlier empirical literature suffers from two conceptual problems. First, if location decisions are forward looking, it is entirely possible that households will move to the suburbs in expectation that firms will soon do so (and vice versa). The absence, in other words, of a relationship between today's suburbanization of population and yesterday's decentralization of employment does not necessarily rule out the possibility that people follow jobs. More fundamentally, the direction of the relationship hinted at in this literature is not sufficient to establish causality. In particular, if the error term in the regression is serially correlated at the metropolitan area level—which is almost certainly the case—then the use of lagged values of the endogenous variables as instruments will be invalid. Our approach to measuring the impact of employment on residential location avoids these econometric problems and thus (in our view) produces a more reliable estimate of the causal parameter of interest. In thinking about our results, it should be kept in mind that we are estimating a "reduced form" linking one economic outcome—where people live—to another—where they work. As such, we have not attributed employment decentralization or population suburbanization to more fundamental causes.[9]

Robustness Checks

In this section we explore the robustness of our main finding in three ways. In the first check for robustness, we examine differences in the size of the treatment effect of work location on residential location by education and migrant status. In the second and third checks, we develop alternative instrumental vari-

9. Or to put it another way, we are not estimating a structural model linking household and firm location decisions to preferences and technology. For an example of such a structural estimation, see Kopecky and Suen (2007).

ables based on employment in two additional industries for which work location is predetermined or (arguably) exogenous.

Results by Education and Migration Status

Our analysis establishes an empirical relationship between an individual's place of work and place of residence. One model that may give rise to this finding is that workers take into account their (given) work location when selecting their place of residence. However, we cannot directly rule out an alternative model: individuals choose their residential location for other reasons—for example, because of amenities or proximity to family—and then select a job that maximizes wages net of commuting costs conditional on their place of residence. In this case, we would find that state workers in capital cities are more likely to both live and work downtown simply because individuals who are *already* living downtown find work in nearby state buildings. However, we could not accurately describe these workers as having "followed" their jobs to the central city.[10]

Although we can never fully dispel the possibility that residential location precedes job choice, we argue that it is less likely to be operative among certain subgroups of the population—in particular, college graduates and recent migrants. College graduates function in a national labor market, and therefore their employment outcomes are not restricted to a narrow geographic band around where they happen to live (Wozniak 2006). Similarly, recent migrants to a metropolitan area have demonstrated their willingness to participate in a labor market that is much broader (in the geographic sense) than their immediate residential area. If we find a stronger relationship between the place of work and place of residence among these mobile workers, we feel confident in interpreting the relationship as the effect of work location on residential location. On the other hand, we expect the residential locations of married women to be less sensitive to their place of employment because of the need to make joint location decisions with a spouse (Madden 1981). If we continue to find a strong relationship between place of employment and place of residence for

10. An even more complicated alternative is that workers simultaneously determine whether to work in the public or private sector, whether to live in the central city or the suburbs, and the metropolitan area in which to live. In this case, workers who prefer both urban living and the steadiness of state employment may choose to settle in Albany rather than in Buffalo in the state of New York. If this model holds, our difference-in-differences estimator may simply be identifying a group of workers with a strong taste for city life. However, if this were true, we might also expect to see observable differences between state government workers in state capitals as opposed to other workers, and as we demonstrated previously, we generally do not.

Table 5. Heterogeneous Effects of Work Location on Residential Location[a]

Demographic variable	*OLS = 1 if work in city (1)*	*OLS = 1 if live in city (2)*	*IV = 1 if live in city (3)*
A. Migrants			
Main effect	0.138	0.027	0.202
	(0.029)	(0.016)	(0.097)
Interact with recent migrant[b]	–0.008	0.025	0.167
	(0.022)	(0.018)	(0.102)
B. College graduates			
Main effect	0.156	0.025	0.172
	(0.028)	(0.016)	(0.086)
Interact with college graduate	–0.045	0.015	0.153
	(0.025)	(0.025)	(0.147)
C. Ever married women[c]			
Main effect	0.128	0.037	0.285
	(0.028)	(0.017)	(0.106)
Interact with married woman	0.023	–0.017	–0.123
	(0.018)	(0.010)	(0.058)

Source: 1980 IPUMS 5 percent sample. N = 707,506.

IV = instrumental variables; OLS = ordinary least squares.

a. Standard errors are reported in parentheses and are clustered at the metropolitan area level. All regressions include metropolitan area fixed effects and individual-level controls, including a fourth-order polynomial in age and dummies for being female, black, and for each year of completed schooling. The OLS regressions in columns 1 and 2 contain main effects for being a state worker and being a state worker in the capital city along with the interaction of each with the demographic variable in question. Column 3 reports the parallel IV regression in which the main effect of being a state worker in the capital city is used to instrument for working in the central city. The rows report coefficients on being a state worker in a capital city (or working in the central city) and the interaction with the relevant demographic variable.

b. "Recent migrants" include all individuals who moved between counties, states, or countries in the previous five years.

c. "Ever married women" includes women who are currently married, divorced, or widowed. We did not find a significant difference between the responsiveness of single men and women or married men to place of employment. Hence, we compare married women to all other categories in this specification.

this subgroup, we will be concerned that our findings are driven by job searches conducted close to home.

Table 5 replicates our main analysis while allowing for interactions with migration activity, educational attainment, marital status, and gender. Recent migrants and college graduates are more responsive to place of employment than is the rest of the workforce. Having been "assigned" to a job in the central city increases the likelihood that a college graduate or recent migrant lives in the central city by 33 and 37 points, respectively, compared with a base effect of 20 percentage points (see column 3). In contrast, the residential location of married women is less responsive to place of own employment than the rest of the workforce. Taken together, these patterns are more consistent with a model in which workers choose where to live given a known work location rather than a model in which workers search for jobs close to home.

Alternate Case Study: The "Cold War" Instrument

Thus far, we have drawn sharp conclusions about the relationship between job and residential location on the basis of a single case study. It is highly desirable, therefore, to see if the basic findings carry over to other case studies. In this section and the next, we conduct similar exercises for two additional industries whose primary location was either initially determined by or has been kept in place by government rulings.

In the expansion of national defense industries during the cold war, the federal government encouraged firms with defense contracts to locate outside of central cities, which were thought to be prime targets for nuclear attack (O'Mara 2006). Manufacturing plants in defense-related industries are, as a result, more likely to be in the suburbs and—by the logic of our analysis—we might expect their workers to be more likely to live in the suburbs.

The census does not clearly identify workers in defense-related industries. We opt for a narrow definition of *defense-related workers*, focusing on those in the "guided missiles, space vehicles, and parts" manufacturing industry. We exclude industries such as aircraft manufacturing that may conduct substantial business with the federal government but that also have a sizeable civilian component. Although more than 95 percent of workers in the guided missiles industry report working in the private sector, there can be little doubt that these firms had federal contracts.

Table 6 examines the work and residential locations of workers in the guided missiles industry. Each column corresponds to a different choice of control group. In the first column, the comparison group contains around twenty heavy manufacturing industries from farm machinery to household appliances. In the second column, the comparison group is restricted to transportation manufacturing industries (except guided missiles). The third column leaves out ship building, which often takes place at harbors adjacent to the central city and therefore is disproportionately centralized.

Workers in a defense-related industry are 8 to 10 percentage points more likely to work in the suburban ring than are workers in comparable manufacturing industries in the same metropolitan area. Defense workers are also 2 points more likely to *live* in the suburban ring. These results imply that working in the suburbs increases the probability of living in the suburbs by 22 to 24 percent, a very similar magnitude to the results obtained with the state capital instrumental variable.

Workers in a defense-related industry are much more likely than workers in the various comparison groups to hold a college degree; for example, in the

Table 6. Are Workers in a Defense-Related Industry More Likely to Work and Live in the Suburbs?[a]

	All workers			*Without college degree*
Dependent variable	*Electrical machinery, computer, and transport equipment (1)*	*Transport equipment, without guided missiles (2)*	*Transport equipment, without ship building (3)*	*Transport equipment, without ship building (4)*
OLS				
= 1 if work in suburb	0.102	0.098	0.081	0.085
	(0.030)	(0.032)	(0.029)	(0.030)
= 1 if live in suburb	0.023	0.024	0.019	0.035
	(0.014)	(0.016)	(0.016)	(0.016)
IV				
= 1 if live in suburb	0.223	0.249	0.239	0.418
	(0.141)	(0.162)	(0.208)	(0.235)
N	82,166	32,288	29,520	22,518

Source: 1980 IPUMS 5 percent sample. Further restrictions are reported in column headings.
IV = instrumental variables; OLS = ordinary least squares.
a. "Defense-related industry" is narrowly defined here as the manufacturing of "guided missiles, spacecraft, and related parts" according to the 1990 industry categories. Standard errors are reported in parentheses and are clustered at the metropolitan area level. All regressions include metropolitan area fixed effects and individual-level controls, including a fourth-order polynomial in age and dummies for being female, black, and for each year of completed schooling. The first and second rows report coefficients on an indicator for working in a defense-related industry. In the third row, working in a defense-related industry is used as an instrument for working in the central city.

subgroup represented in the regression shown in column 3 (transport equipment, without ship building), 40 percent of defense workers were college graduates versus 14 percent for the comparison group). The fourth column restricts the analysis to workers in this particular subgroup without a college degree. This restriction has no effect on the substantive findings; indeed, the treatment effect of suburban employment on suburban residence for the non-college sample is even larger than in the unrestricted sample.

Alternate Case Study: The Postal Employment Instrument

Because of the difficulty of finding an exact control group for workers in defense-related industry, we turn to a within-industry comparison of two types of postal workers—mail carriers and postal clerks—whose job locations differ for historical reasons. The qualifications for entering the postal service are roughly uniform across these occupations. Job seekers take a civil service exam and available positions are filled by one of the three top-scoring candidates (the so-called Rule of Three), with a preference given to veterans.[11]

11. Mail carriers and postal clerks differ along a few observable dimensions. Mail carriers are less likely to be female (8 versus 25 percent) or black (10 versus 25 percent). They are also slightly

Table 7. Are Postal Clerks More Likely to Work and Live in the Central City?[a]

Dependent variable	*= 1 if non–mail carrier*
OLS	
= 1 if work in central city	0.152
	(0.015)
= 1 if live in central city	0.036
IV	
= 1 if live in central city	0.238
	(0.065)

Source: 1980 IPUMS 5 percent sample. In addition, these regressions are restricted to individuals employed by the U.S. Postal Service. N = 8,669.

IV = instrumental variables; OLS = ordinary least squares.

a. Standard errors are reported in parentheses and are clustered at the metropolitan area level. All regressions include metropolitan area fixed effects and individual-level controls, including a fourth-order polynomial in age and dummies for being female, black, and for each year of completed schooling. The first and second rows report coefficients on an indicator for working in an occupation other than mail carrier. In the third row, working as a non–mail carrier is used as an instrument for working in the central city.

The location of mail carrying follows population patterns. As businesses and households moved out to the suburban ring, mail carriers followed suit. In contrast, noncarriers tend to work in the central city. The centralization of mail processing dates from the early twentieth century, when the bulk of intercity mail was transported by rail. At the time, central post offices were built near the main downtown rail terminal. Even as trucking and air travel eclipsed rail transport, postal facilities have remained downtown and face a number of regulatory and political impediments to relocation.

Boustan and Margo (2009) exploit this contrast between the typical job location of mail carriers and other postal employees to investigate the effect of employment decentralization on the economic activity of urban black residents. Following a similar strategy here, we compare the work and residential location of mail carriers to other postal employees. Table 7 demonstrates that other postal employees are 15 percentage points more likely than mail carriers to work in the central city. Corresponding, these noncarriers are also 3.6 points more likely to live in the central city, which implies that working downtown increases the probability of living downtown by 24 points. The numerical stability of this parameter across the three case studies—state workers, postal workers, and employees in defense-related industry—is remarkable.

less likely to have some college education (31 versus 35 percent). While we control for these and other attributes, we cannot account for any differences in the taste for urban living in these two populations.

Concluding Remarks

Urban economists have long been interested in the relationship between the spatial distributions of employment and population. This paper examines whether working in the central city increases the likelihood of living in the central city, using state workers in capital cities as a natural experiment. Many government buildings in state capitals were constructed in the nineteenth century and have not been (and we believe never will be) moved to an outlying location As a result, state workers in state capitals are more likely to work in the central city than are state workers in other metropolitan areas.

We use the interaction between being a state worker and living in the state capital as an instrumental variable for working in the central city. We find that residential location strongly responds to employment location. According to our estimates, moving 1,000 jobs into the central city would encourage 246 working residents to reside in the city. Patterns of very similar magnitude obtain in other industries whose job location is determined by government policy—including defense-related industry or the postal service. Applying our core parameter of interest, we argue that about one-fifth of the suburbanization of population between 1960 and 2000 can be attributed to employment decentralization.

By using a natural experiment to explore a long-standing issue in urban economics, our paper also makes a methodological contribution. While natural experiments have been widely employed in labor economics and public finance, they have been less prevalent in urban economics, perhaps because of a belief that locations are rarely determined by exogenous forces. Although this belief may be true in general, we feel that there are more such experiments in urban economics than generally recognized and that careful examination of the historical record will yield other examples.

Although the primary purpose of this paper is to advance understanding of a central issue in urban economics, our results are also relevant to urban policy in two ways. First, and perhaps most important, our paper provides a useful rule of thumb as to the quantitative effect on a central city's population if jobs are added or subtracted from the urban core, perhaps in response to other local policies—for example, because of changes in the level of business taxes (Bollinger and Ihlanfeldt 2003). Urban politicians have obvious political interests at stake if their constituencies rise or fall in size; urban planners may be concerned with population loss as a harbinger of building decay and neighborhood decline. Some fraction of the incomes of central city residents will be

spent on locally produced goods and services, including owner-occupied housing, thereby generating tax dollars for local government expenditures. Our rule of thumb is that for every *X* jobs added or subtracted to the center city's base, the center's working population will increase by 0.25**X*, or (roughly) one resident for every four jobs.

Secondly, our results have implications for the recent debate over consumption-led urban revival. In particular, Glaeser, Kolko, and Saiz (2001), Glaeser and Gottlieb (2006), and others have suggested that there may be economies of scale in consumption associated with dense populations. Thus, for example, rising incomes might lead consumers to demand certain consumption goods—art museums or symphony orchestras, among others—that might be more efficiently produced in central cities. Investing in the infrastructure associated with the production of such goods, according to the logic of this argument, might lead to a resurgence of downtown areas. However, our results suggest that the current level of employment decentralization will limit any return of residents to urban cores, at least in the short run. That is, unless cities remain productive in the sense of job creation, allowing firms to follow residents back downtown, the draw of a shorter suburban commute will prevent an entirely consumption-led urban revival.

Appendix

Table A-1. Summary Statistics, by Metropolitan Area, 1980[a]

	Mean	*Standard deviation*
Share work in center city	0.556	0.163
Share work in CBD	0.083	0.045
Share live in center city	0.309	0.238
Share state worker, all metro areas	0.047	0.039
Share state worker, capital areas	0.093	0.056

Source: 1980 IPUMS 5 percent sample.
CBD = central business district.
a. Means are measured at the metropolitan area level (N = 127). The last row presents statistics for the metropolitan areas anchored by a capital city (N = 25).

Table A-2. Capital Cities Identified in the Sample

State	*Capital city*
AR	Little Rock
AZ	Phoenix
CA	Sacramento
CO	Denver
CT	Hartford
GA	Atlanta
HI	Honolulu
IA	Des Moines
IN	Indianapolis
LA	Baton Rouge
MA	Boston
MI	Lansing
MN	Minneapolis-St. Paul
NC	Raleigh-Durham
NJ	Trenton
NY	Albany-Schenectady-Troy
OH	Columbus
OK	Oklahoma City
PA	Harrisburg
RI	Providence
SC	Columbia
TN	Nashville
UT	Salt Lake City
VA	Richmond
WI	Madison
	College towns
AR	Fayetteville
AZ	Tucson
KY	Lexington
MI	Ann Arbor
NM	Albuquerque
NJ	New Brunswick
OR	Eugene
TN	Knoxville

Comments

Edward Glaeser: For forty years, economists have argued about whether jobs follow people or whether people follow jobs. Across metropolitan areas, this debate concerns the relative importance of amenities or productivity differences across space. Within metropolitan areas, this debate focuses on the causes of suburbanization. Does the fact that people and jobs have decentralized reflect the allure of suburban living or the advantages of suburban productivity?

Leah Platt Boustan and Robert Margo enter this debate with a straightforward paper about state capitals. They argue, quite plausibly, that the location of capitals is essentially exogenous. State governments chose their locales in the nineteenth century (except for Oklahoma City), and they have not moved since. The changing vicissitudes of urban fortunes have not caused the Texas state government to move to a Houston suburb or the California state government to locate near Hollywood. The capital's golden domes and office buildings are essentially fixed and therefore provide a means for identifying the impact of job location on housing location.

Boustan and Margo's strategy is essentially a simple **difference**-in-differences estimator. They compare state employees in metropolitan areas that are state capitals with employees in areas that are not. They find that in capital cities, state government employees are 8 percent more likely to labor in the central business district and 13 percent more likely to work in the capital itself. They then use this variation to estimate the impact of working in a city on the propensity to live in a city.

The ordinary least squares relationship between these two variables is that workers are 26 percent more likely to live in a city if they work in a city. If the workers labor in a central business district or CBD, they are 13 percent more likely to **live** in a city. Using the interaction between being a state employee and being in a state capital as an instrument, they find that working in a city increases the propensity to live in the city by 25 percent, which is astonishingly close to the ordinary least squares estimate. Somewhat less plausibly, they find that they effect of working in a central business district almost triples, so that working in the CBD increases the propensity to live in a central city by 36

percent. With industry level controls, that coefficient rises to 55 percent, but it is measured with a fair degree of error. The greater precision of the city-on-city estimates, and their stability across regressions, lead me to be more confident about these estimates.

Boustan and Margo then look at demographic subgroups and find effects that are significantly stronger for unmarried women, relative to married women, which makes sense since married women may be more tied to their spouse's place of work. There are also big point estimates of the interactions with being a migrant or college graduate, but these estimates are statistically insignificant. There is some evidence that effects are similar for postal workers.

What problems plague these estimates? State capitals are, of course, different from noncapital cities. Generally governments have spent resources to make their home cities more pleasant. The capital building itself may be, like Bulfinch's Boston dome, a pleasant piece of architecture. Other memorials and parks may be disproportionately present in the capital. In some cases, such as Columbus, Ohio, or Madison, Wisconsin, the state's flagship university is also located in the capital. Surely, these amenities may also be pulling people into the central city.

However, if this pull impacts all workers equally, Boustan and Margo's point estimates will be unbiased. If workers are all the same, then the amenities will draw everyone to the center of the capital and have no disproportionate impact on state government employees. Their difference-in-differences approach will handle the problem, if state workers and other employees have similar tastes.

The problem arises if state workers have a different taste for these amenities. If state workers like the fruits of government spending more than private employees do, which is not entirely implausible, then the capital's amenities will draw them disproportionately into the urban core. In this case, the effect that Boustan and Margo identify as coming from workplace location is the impact of amenities. One imperfect means of addressing this concern would be to control for area-level amenities and interact them with being a state employee.

A second problem, related to personal heterogeneity, is that working as a state employee in a state capital may disproportionately attract people who like living in big cities. The location of the workplace may be exogenous, but the workers are not. Those workers who like living in the state capital will be particularly likely to apply for jobs that are located in that area. In that case, the perceived workplace location effect will actually reflect the tastes for living in the urban center. Unless we had some experiment where workers were ran-

domly assigned to state government jobs, I know of no means of addressing this problem.

While these estimates are imperfect, they still have value. After all, it is not as if there are great alternative means of estimating the impact of workplace location on housing location. Despite my concerns, I am perfectly willing to accept that their figure of .25 is a reasonable estimate of the impact of workplace location on job location. What does this value mean for the larger question of the causes of suburbanization?

A .25 figure means that for every job that leaves the city, one-fourth of a worker also leaves the city. That figure should be multiplied up by the total number of people in the worker's household to understand the impact of job decentralization on population decentralization. In two-person families, a one job exodus means an exodus of one-half of a family. But does this mean that one-half of the suburbanization of population can be attributed to an exodus of employers?

Consider the following simple model, where S_{City}^{Job} is the share of the total jobs in a metropolitan area that are in a city and S_{City}^{Homes} is the share of homes that are in the city. Assume that $S_{City}^{Job} = \alpha S_{City}^{Homes} + Z_{Jobs}$ and $S_{City}^{Homes} = \beta S_{City}^{Jobs} + Z_{Homes}$, where α and β are parameters and Z_{Jobs} reflects exogenous forces determining the location of jobs and Z_{Homes} reflects exogenous forces determining the location of homes. Solving these equations reveals

$$S_{City}^{Job} = \frac{1}{1-\alpha\beta}(\alpha Z_{Homes} + Z_{Jobs})$$

and

$$S_{City}^{Homes} = \frac{1}{1-\alpha\beta}(\beta Z_{Jobs} + Z_{Homes}).$$

Boustan and Margo essentially treat state capitals as variation in Z_{Jobs}, which can identify the value of β.

To understand the causes of a change in job and housing centralization, I assume that these exogenous variables have changed over time, which implies the change equations

$$\Delta S_{City}^{Job} = \frac{1}{1-\alpha\beta}(\alpha \Delta Z_{Homes} + \Delta Z_{Jobs})$$

and

$$\Delta S_{City}^{Homes} = \frac{1}{1-\alpha\beta}(\beta\Delta Z_{Jobs} + \Delta Z_{Homes}).$$

The share of job decentralization that is caused by housing decentralization is

$$\frac{\alpha\Delta Z_{Homes}}{\alpha\Delta Z_{Homes} + \Delta Z_{Job}};$$

the share of housing decentralization that is caused by job decentralization is

$$\frac{\beta\Delta Z_{Jobs}}{\beta\Delta Z_{Jobs} + \Delta Z_{Homes}}.$$

To identify the relative importance of the two types of changes, we have two equations, and we know the values of three variables ΔS_{City}^{Job}, ΔS_{City}^{Homes}, and β, but we need to solve for three unknowns α, ΔZ_{Homes}, and ΔZ_{Jobs}. This is not enough information. For example, suppose we know that ΔS_{City}^{Job} was –.4 and ΔS_{City}^{Homes} was –.6 and β equals .5. If α equals zero, then ΔZ_{Jobs} equals –.4 and ΔZ_{Homes} equals –.4. The share of housing decentralization that is caused by job decentralization in that case would equal one-third; the share of job decentralization that is caused by housing decentralization would equal zero. Conversely, if α equals .5, then $\Delta Z_{Jobs} = -.1$ and $\Delta Z_{Homes} = -.4$. The share of housing decentralization that is caused by job decentralization in that case would equal one-fifth; the share of job decentralization that is caused by housing decentralization would equal two-thirds. The exercise yields wildly different answers depending on the value of α and that value is unknown.

This little algebraic exercise is not meant to disparage the important contribution of Boustan and Margo to understanding the roots of urban change. They have provided a new estimate of a potentially important coefficient. However, we are still far from having the full range of parameter estimates needed to get a handle on the roots of suburbanization. Yes, people do follow their jobs, but jobs also surely follow people. Both coefficients are needed to estimate the complete relationship. This is a pressing topic for future research.

Janice F. Madden: Leah Platt Boustan and Robert Margo have developed a creative approach for measuring the extent of residential suburbanization that is caused by job suburbanization. They have an imaginative new way of answering the question: do jobs follow people or do people follow jobs? Although numerous studies have tried to answer this question with a variety of econometric techniques designed to sort out cause from effect, they have all ultimately been plagued by the problem that people may suburbanize in anticipation of job suburbanization or jobs may suburbanize in anticipation of residential subur-

banization. Therefore, simply tracing the order or timing of observed job and residential moves does not show that the move that came first was the cause and the move that came next was the effect.

Boustan and Margo try to solve this problem by comparing the residential locations of employees whose jobs are in the central city and cannot move with the residential locations of employees whose jobs may locate anywhere within the metropolitan **statistical** area (MSA). Specifically, they analyze the residential locations of state workers in MSAs where the state capital is located relative to nonstate workers in state capital MSAs and also relative to state workers in non–state capital MSAs. They find that, on average, state capital employees are 25 percent more likely to reside in the central city than are non–state capital employees in the same MSA and than are state employees located in non–state capital MSAs. They conclude that an employer that locates in the central city, rather than in the suburbs, will cause an additional one-quarter of its employees to reside in the central city (relative to the residential distribution of employees were the same employer to locate in a suburb).

The basic idea is straight forward but clever. Simply, state employees working at the state capital have a predetermined central city work location. Unlike other employers, the locations of state capitals have not adjusted to the locations of potential employees, and there are no expectations that such adjustments will occur. Therefore, the differences between the rates of suburbanization for state employees in the state capital MSAs and the rates for state employees in other MSAs and for nonstate employees in the state capital MSAs measure the residential suburbanization effects of employers changing locations to follow employees. The approach (the key identifying assumption) requires that there are no differences, relevant to residential location preferences, in the selection of employees into state jobs versus nonstate jobs in the state capital MSAs and into non–state capital MSAs versus state capital MSAs among state workers. Therefore, for the greater incidence of central city residential locations of state workers in state capital MSAs to be attributable to their central city workplace locations, it is necessary that state workers in the state capitals not be different from nonstate workers in state capitals and from state workers in non–state capitals with respect to characteristics, other than workplace location, that affect their residential location choices.

Boustan and Margo have not clearly demonstrated that these groups of workers are the same with respect to their residential location preferences, given their workplace. They provide evidence on the similarity of state workers in the state capital MSAs to other workers in the state capital MSAs and to state workers in non–state capital MSAs. I do not find that evidence sufficient, how-

ever, to dismiss completely the possibility that these workers could systematically differ in their residential preferences. Boustan and Margo focus on whether state workers in state capital MSAs are significantly different *both* from state workers in non–state capital MSAs and nonstate workers in the state capital MSAs. This approach does not consider many plausible ways that residential preferences could differ between these groups of workers.

First, there are potential interactions between the characteristics of workers that are more important than the characteristic alone in affecting residential location decisions. For example, the effects of gender are likely to differ by marital and parental status (and vice versa). Boustan and Margo show that state workers outside state capital MSAs are substantially more likely to be female than are other workers in the same MSA, but in the state capital MSA, state workers are slightly less likely to be female. State workers are less likely to be married, both in the state capital and elsewhere. But the characteristics that matter in decisions on residential location and commuting are not marriage alone or gender alone, but the combination of marriage, gender, and parental status.

Second, if state workers have *more* of a characteristic than other workers while workers in non–state capitals have *less* than workers in state capitals, these offsetting differences in a particular characteristic (which yields no statistically significant interaction effect for being a state worker and residing in a state capital in Boustan and Margo's table 2) may still yield systematically different residential location outcomes depending on the connections between the characteristic and residential location preferences or between the characteristic and the potentially differential characteristics of state capital and non–state capital MSAs. For example, consider a situation in which state workers were older than nonstate workers but workers in the state capital MSA were younger than workers in other MSAs. In this case, the interaction effect of being a state worker in a state capital is zero (similar to the situation indicated by the last column in the top panel of Boustan and Margo's table 2). If state capital MSAs have central cities that are less attractive to younger workers (because they do not have an entertainment focus) than are central cities in non–state capital MSAs, then state (that is, older) workers would be more centralized in state capitals, but the difference would not arise from the differential employment locations of state workers in state capitals but from the interactions of differences in characteristics (age) between state workers and nonstate workers (or preferences) and in the (central city) characteristics of state capital and non–state capital MSAs (or choice sets).

Table 8. Characteristics of State Capital and Non–State Capital MSAs, 1980
Percent, except where noted

MSA	Population (1000s)	MSA population: In central city	MSA population: African American	MSA employment in durable manufacturing	Poverty rates
Boston	2,763	25	5	12	9
Minneapolis	2,114	31	2	16	7
Atlanta	2,030	25	19	9	12
Denver	1,619	32	3	10	8
Phoenix	1,509	52	3	14	11
Indianapolis	1,167	60	10	18	9
Columbus	1,093	52	12	13	11
Sacramento	1,014	28	4	4	11
Salt Lake City	936	18	1	11	8
Nashville	851	54	16	11	12
Oklahoma City	834	49	9	10	11
Providence	817	30	4	25	10
Albany	795	15	3	10	10
Honolulu	763	48	2	8	10
Hartford	726	26	8	19	8
Richmond	632	36	19	6	11
Raleigh	531	34	19	10	12
Baton Rouge	494	48	20	4	15
Lansing	472	30	6	17	10
Harrisburg	447	12	5	11	8
Columbia	410	27	20	7	13
Little Rock	394	40	21	10	12
Des Moines	338	63	4	7	8
Madison	324	54	1	6	10
Trenton	308	30	13	12	9
Means					
State capitals	935	37	9	11	10
Remaining MSAs	1,109	29	10	20	12

Source: 1980 IPUMS 5 percent sample.
MSA = metropolitan statistical area.

I am particularly concerned about the interactions between worker characteristics and the differences between state capital and non–state capital MSAs. The state capital MSAs are different from other MSAs in important ways that are likely to affect how a central city job location affects residential decisions of workers. If residential choices are affected by the interactions between worker characteristics (preferences) and MSA characteristics (choice sets), then state capital MSAs can be used to measure the effects of central city work locations that can be generalized to other MSAs only if state capital MSAs are otherwise similar to non–state capital MSAs. Table 8 lists the state capital MSAs

included in the study and some of their characteristics. The two bottom rows of the table show the averages of these characteristics for the included state capitals and also for the remaining MSAs included in the group of the largest 125 in the nation in 1980. The non–state capital MSAs average 20 percent more population (1.109 million versus 935,000), 10 percent lower representation of African Americans (10 percent versus 9 percent), and 20 percent higher poverty rates (12 percent versus 10 percent). Manufacturing accounts for almost twice as much (20 percent versus 11 percent) of private sector employment in non–state capital MSAs. The choice sets are different in state capital MSAs and non–state capital MSAs.

As Boustan and Margo indicate, the nine largest MSAs in the nation are not state capitals, so the state capital results may not reflect the employment location effects for large MSAs. Because many studies have connected suburbanization of residences to flight from central city poverty or African Americans, and because state capitals have fewer African American and poor residents, the state capital results may overstate the employment location effects for MSAs with more African Americans and more poor. Because MSAs with more manufacturing have slower growth and higher central city poverty and because state capital cities have less manufacturing, the state capital results may not reflect the employment location effects for MSAs with more manufacturing.

State capital cities also include a larger share of the MSA residents (37 percent versus 29 percent) than do non–state capital cities. This difference, if it is the result of the state capital being in the central city and state workers being more likely to locate in the central city, is not a problem. If, however, there are more people living in the central cities in state capitals because of other unmeasured characteristics that are not the result of the presence of the state capital (such as less regional political fragmentation), then the state capital is not a good instrument for the effects of central city workplace locations in more suburbanized MSAs.

Boustan and Margo show that state workers in state capitals are substantially less likely to be African American than are state workers outside the state capital and a bit less than are other workers in the state capital. Because African Americans are more likely to reside in cities than whites are, they state that this racial difference in state capitals "work(s) against (their) main findings." If the instrumental variable is working so that the race composition of the MSA does not matter and if the main finding is that the decentralization of jobs causes the decentralization of population, then the statement is correct. If, however, the

main finding is that for every four jobs created in the center, there will be one new worker resident in the central city, then the estimate is too small; more worker residents in the central city would be expected. If there are interactions between the choice set (MSA characteristics such as fewer African Americans in state capital MSAs) and preferences (worker characteristics such as race) that are not accounted for in the analysis, then the effect may work "with the main findings" resulting in an overstatement of the effects of central city employment locations on central city residential locations.

Finally, consider the analyses if the causation is reversed so that workers search for jobs from their residences rather than select residences on the basis of their job locations. State jobs in the central city of state capitals may be of particular appeal to some workers residing nearby who are less likely to commute longer distances. Consider two categories of workers that may be overrepresented among state workers in state capitals, relative to state workers elsewhere and to non–state workers in state capitals. Boustan and Margo show part-time workers to be more prevalent in non–state capital MSAs and among state workers, especially those in state capital MSAs. Part-time workers typically make shorter commutes because their time at work does not justify longer commuting. Virtually all commuting research also finds that mothers take jobs closer to home. Mothers of children under the age of 18 make shorter commutes because the value of their nonmarket time is high and also because the value of proximity is high, for example, when children have unanticipated needs for their parents. Because state workers in state capital MSAs are more likely to be part-time (consistent with the results on hours per week reported in Boustan and Margo's table 2) and may be more likely to be mothers of young children (not considered), then state jobs in the state capital would be correlated with central city residence because they attract nearby part-timers and mothers more than do state jobs in non–state capitals or nonstate jobs in state capitals.

Boustan and Margo's additional results for postal workers and defense plant workers, which give similar estimates of the effects of central city employment locations on residential locations, provide impressive tests of robustness of their findings for state workers in state capital MSA. But these two analyses pose the same set of questions as the analysis of central city residential locations for state workers in state capitals. For the postal workers, in particular, the reverse causality discussed above seems particularly likely.

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