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EMPLOYMENT DECONCENTRATION: A NEW PERSPECTIVE ON AMERICA'S POSTWAR URBAN EVOLUTION

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ABSTRACT

In this study we show that during the postwar era, the United States experienced a decline in the share of urban employment accounted for by the relatively dense metropolitan areas and a corresponding rise in the share of relatively less dense ones. This trend, which we call *employment deconcentration*, is distinct from the other well-known regional trend, namely, the postwar movement of jobs and people from the frostbelt to the sunbelt. We also show that deconcentration has been accompanied by a similar trend within metropolitan areas, wherein employment share of the denser sections of MSAs has declined and that of the less dense sections risen. We provide a general equilibrium model with density-driven congestion costs to suggest an explanation for employment deconcentration.

INTRODUCTION

In 1990, the state of Nebraska and the San Francisco metropolitan area had roughly the same number of people. Of course, what distinguishes San Francisco from Nebraska and makes it recognizable as a metropolis is that its population density is 1600 while that of Nebraska is 20. As Mills and Hamilton (1994) point out, the “two most important measures of an urban area are its total population and its total land area.” Density, therefore, is a central feature of urban areas.

Yet, empirical studies of long-term urban evolution typically differentiate metropolitan areas by their size (usually population size) and ignore differences in their density. The main message of our article is that this omission hides an important regularity in the pattern of postwar U.S. urban evolution. Specifically, we document that during this period, the share of urban employment accounted for by the relatively dense metropolitan areas has declined and, correspondingly, the employment share of less dense metropolitan areas has risen, a trend we label *employment deconcentration*.

There is an extensive literature on population deconcentration. Hoover’s (1941) classic study examined trends in the distribution of total population across U.S. states relative to the distribution of total land area across U.S. states for the decades between 1850-1940. Hoover found that population steadily deconcentrated over this entire period. At the county level, Long and Nucci (1997a) updated an earlier well-known study by Vining and Strauss (1977) and documented that geographic concentration of population declined between 1890 and 1910 but rose between 1910 and 1970. Concentration declined during the 1970s, but this decline proved to be temporary and the trend toward greater population concentration reasserted itself between 1980 and 1995.[1]

In contrast to this literature, we focus on trends in the geographic concentration of employment across metropolitan counties and find that employment has deconcentrated during the postwar period. Thus our findings indicate that metropolitan employment deconcentration has proceeded against a backdrop of increasing population concentration across all U.S. counties. When we look at the trend in the geographic concentration of (metropolitan) population across metropolitan counties, we also find some evidence of deconcentration. It should be borne in mind though that our set of metropolitan counties consists of less than 22 percent of all counties examined by Long and Nucci.

Interest in population trends was heightened during the 1970s and 1980s when the 1970s' reversal in population concentration was discovered. This reversal engendered the "clean break" hypothesis, namely, that the U.S. population trend had undergone a major break with the past (see Long and Nucci (1997b) for a recent review of this literature)). However, as noted earlier, this reversal proved short-lived and population has continued to concentrate geographically. What our results indicate is that within the narrow group of metropolitan counties both population and employment have deconcentrated at least since the 1950s.

Our finding of employment deconcentration also contrasts with that of the urban literature that examines long-term U.S. urban evolution from the perspective of

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[1] Long and Nucci also examined deconcentration trends at the state level between 1890 and 1995, extending the earlier work of Plane and Rogerson (1994) and Hoover. At the state level, Long and Nucci found that population deconcentrated until 1940, increased between 1940 through 1970, and declined thereafter.

metropolitan population size. These studies find that population growth in metropolitan statistical areas (henceforth MSA) has been roughly independent of MSA population size. As a result, they find that population shares of various size categories of MSAs have remained roughly stable over time. Ehrlich and Gyourko (2000), Black and Henderson (1997 and 1999)), and Gabaix (1999) are recent examples of such findings.[2] Thus, while population size-based studies leaves one with the impression that the urban landscape is in some sort of steady state, viewing urban evolution from the perspective of employment or population density leaves one with a distinctly different impression.

We make the case for employment deconcentration (henceforth deconcentration) in six parts. First, we establish the fact of deconcentration by documenting roughly decadal changes, beginning in 1951, in the distribution of employment across almost 300 metropolitan areas ranked by their employment densities. We took the land areas of these MSAs to be what they were in 1983 (roughly the mid-point of our sample period). With land areas so defined, we show that the employment shares of dense MSAs have declined and the employment shares of less dense MSAs have risen. We demonstrate that deconcentration is evident in population shares as well. When MSAs are ranked by their population density, we find that population shares of dense MSAs have declined and those of less dense ones risen. On the other hand, when we rank MSAs by their population size we confirm previous findings of roughly stable population shares. Thus it appears that the choice of whether to rank MSAs by population density or population size matters for characterizing long-term trends in the distribution of urban population. The

[2] Also, Eaton and Eckstein (1997) find a similar pattern for population of urban areas in France and Japan.

evidence suggests that the growth experience of dense MSAs has been systematically different from less dense ones.

Next, we perform checks to ascertain whether our finding of deconcentration is the result of measurement errors in MSA land areas. We consider several different sources of errors. One source applies to MSAs that grew rapidly in employment and geographic size between 1951 and 1983. For these MSAs, our definition of MSA land area understates employment density for early years of the sample and spuriously enhances any genuine negative correlation between growth and employment density. Another source of error stems from lumpiness of counties, which sometimes results in the inclusion of low-density rural areas in MSA definitions. Such inclusions will bias measured employment density downward. If the bias happens to be greater for MSAs that grew rapidly (in terms of employment) in our sample, it will enhance any genuine negative correlation between employment density and employment growth. A third source of error results from a peculiarity of U.S. geography, namely, that the western states tend to have larger counties than eastern states. As a result, two otherwise identical MSAs located in the eastern and western parts of the country will differ in measured density, with the western MSA appearing less dense than its eastern counterpart. A rapid growth of employment in the West will make it seem like less dense MSAs have gained employment share relative to more dense MSAs. To deal with these concerns, we investigate alternative definitions of MSA land area and examine regional deconcentration trends. We find no indication that our finding of deconcentration is being driven by measurement errors.

Third, we investigate whether deconcentration is simply another facet of a well-known regional trend, namely, the shift of jobs and people from the relatively dense northeastern and midwestern regions of the country, the so-called frostbelt, to the less-dense southern and western parts, the so-called sunbelt. We show that deconcentration is not just the frostbelt-to-sunbelt shift in disguise, but a trend that's shared by both regions.

Just as MSAs differ in employment density, so do areas within an MSA. In the fourth part of our analysis we examine to what extent the shift in employment share from dense MSAs to less dense ones has been accompanied by a similar shift in employment share from dense areas toward the less dense ones *within* individual MSAs. We find that such a shift has indeed accompanied deconcentration. Whatever force makes low-density areas attractive for job creation has worked both across and within MSAs. We document that both trends have contributed importantly to the postwar decline in spatial inequality but deconcentration across MSAs has been somewhat more important than deconcentration within MSAs.

Finally, we present a model of employment determination that suggests an explanation for deconcentration. The model assumes that, *ceteris paribus*, an increase in employment causes congestion costs to rise faster for MSAs with higher employment density than MSAs with lower employment density. In the event of an increase in aggregate (or economy-wide) employment, it predicts a tendency for dense MSAs to grow less rapidly than less dense MSAs and for the employment share of dense MSAs to fall.

THE FACTS OF DECONCENTRATION

Data Source

We use County Business Patterns (CBP) data for the years 1951, 1959, 1969, 1979, 1989, and 1996. The data consist of full- and part-time employees covered by the Federal Insurance Contributions Act (FICA).[3] Data on variables other than employment (population and land area of counties) were taken from the City and County Data Book. Population data are for decennial census years between 1950 and 1990.

We chose metropolitan statistical areas (MSAs) and primary metropolitan statistical areas (PMSAs) as the main geographical unit for our analysis, since MSA and PMSAs boundaries reflect the extent of local labor markets. [4] For each of the six years, we constructed a common set of MSAs by combining counties according to the 1983 definition of metropolitan statistical areas. This procedure selected 653 metropolitan counties making up 297 MSAs. Our choice of MSA land area definition was motivated in part by reasons of comparability (Ehrlich and Gyourko also use this definition) and because it seemed least problematic for the purposes of our study. However, any choice of MSA definition is likely to misrepresent the true land area of some MSAs some of the

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[3] County Business Patterns data reflect employees on the payrolls of covered firms during the first quarter of the year. With the exception of 1951 and 1996, the first quarter for all other years in our sample occurred about one year before business-cycle peaks. The first quarter of 1951 occurred two years before a business-cycle peak. At this writing, the expansionary phase of the business cycle that began in the second quarter of 1991 has not yet reached its peak. Nonetheless, five of the six periods between 1951 and 1994 occurred at about roughly the same phase of business-cycle expansions, and all six periods occurred during an expansionary phase of the cycle. Generally, employees of establishments exempt from FICA, such as most government employees, self-employed persons, and railroad employees, are excluded from County Business Patterns.

[4] Since PMSAs are treated as MSAs in this study, we refer to them as MSAs. We do not consider consolidated metropolitan statistical areas (CMSAs) in this study.

time. As noted in the introduction, we perform several sensitivity checks to ensure that our main finding is not being driven by measurement errors in land area.[5]

Deconcentration

Table 1 displays the basic fact of deconcentration. The table ranks MSAs by their employment densities in each year and reports the cumulative share of employment accounted for by MSAs in the first decile, the first two deciles, the first three deciles, and so on.[6] With only a couple of exceptions, employment share for every cumulative category has declined from one observation year to the next. The 30 most dense MSAs accounted for 54 percent of total employment in 1951 but only 40 percent of total employment in 1996; correspondingly, the cumulative employment share of MSAs below the first decile rose from 46 percent in 1951 to 60 percent in 1996. The top 60 most dense MSAs accounted for 64 percent in 1951 and 59 percent in 1996, and, correspondingly, the cumulative employment share of the MSAs below the second decile rose from 36 percent to 41 percent. Evidently, there is a clear declining trend in the employment share of dense MSAs and a corresponding rising trend in the share of less dense ones.

It is worth noting that since actual employment density of an MSA is not known, average employment density of an MSA is used to group MSAs into the deciles displayed in Table 1. For the purpose of grouping MSAs into deciles, average employment density

[5] Focusing on size rather than density does not get around the problems associated with measurement of MSA land area. For instance, choosing a middle-of-the-sample definition of metro land area will result in too much land being included for the early years and not enough for the later years. As a result, metro employment and population will be overestimated for earlier years and underestimated for later years. Hence, there'll be a *downward* bias in measured growth rates of employment and population over the whole sample period.

[6] The first nine groups have 30 MSAs each and the final group has 27.

is likely to be a reliable indicator of actual employment density. It's also worth noting that measurement errors in MSA land area (and hence in density) that alter the ranking of MSAs *within* a given decile will not affect the *composition* of the decile and therefore will not alter the decile's employment share. But mismeasurement of land areas could misclassify some MSAs that are ranked either at the top or bottom of deciles. The way we deal with the possibility of such misclassifications is to focus on cumulative shares across deciles. Thus, as we move from the top decile to lower deciles, the cumulative employment share increases and therefore the impact of misclassifications diminishes. Unfortunately, the potential to detect deconcentration diminishes as well.[7] A reasonable compromise between these conflicting concerns is to view declining cumulative employment share up to, say, the fifth decile as a reliable indicator of deconcentration. By this criterion, Table 1 shows that there was employment deconcentration during the postwar period.

There is a stark contrast between the deconcentration trend shown in Table 1 and the generally accepted view that the size distribution of MSAs has not changed much over time. This raises the question of whether deconcentration is something peculiar to employment. Tables 2 and 3 address this point. Table 2 shows the population shares of MSAs ranked by population density. As is evident, the population share of the first decile has declined from 47 percent in 1950 to 37 percent in 1990. The cumulative population shares have also declined for the other deciles, although the declines are more muted in comparison to the declines in employment shares shown in Table 1. In contrast, Table 3

[7] For instance, for the cumulative share of all 10 deciles, in which *all* MSAs are included, there's obviously no adverse effect from incorrect density rankings. But the employment

shows that population shares of MSAs ranked by population *size* have remained roughly stable. Although there was relatively small declines in the cumulative population shares of MSAs down to the third decile, the shares for the remaining cumulative categories remained virtually unchanged.[8] We take this to be evidence that the contrasting behaviors of employment and population shares displayed in Tables 1 and 3 are the result of differential growth experience of dense as compared to large MSAs.[9]

IS DECONCENTRATION THE RESULT OF MISMEASURED DENSITY?

Errors Due to a Positive Dependence of Metro Land Area on Metro Employment

An important reason for being skeptical of the deconcentration trend shown in Table 1 is that it does not control for changes in MSA land area resulting from an increase in MSA employment. A positive dependence between metro land area and metro employment can make it look like employment shares have shifted toward less dense MSAs. For instance, suppose that growth in MSA employment is unrelated to density. If metro employment and metro land area are positively related, MSAs that grew rapidly between 1951 and

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share of this group is always unity.

[8] Table 3 reports the ratio of cumulative population to total population of MSAs when MSAs are ranked by population size. Ehrlich and Gyourko (2000) examine the size distribution of MSAs population relative to *national* population. They find that the size distribution of MSAs was unchanged in the postwar period. We have replicated their result for the size distribution of our MSAs when we calculate shares based on national rather than total MSA population. However, the distinction between national population and total MSA population does not affect our finding of population deconcentration.

[9] A comparison of Tables 1 and 2 suggests that employment deconcentration is more pronounced than population deconcentration. This, in turn, suggests that the employment-to-population ratio has risen faster for less dense MSAs. In a sub-sample of 134 metropolitan areas for which we could compile long-term demographic trends, the postwar growth in the proportion of working age population was indeed faster for less dense metro areas. The proportion was unchanged at 77 percent for the 33 densest MSAs in the first quartile, but rose from 76 percent to 78 percent for the second quartile and from 75 percent to over 76 percent for the bottom two quartiles.

1983 will have grown in land area as well. Consequently, MSA density, as we measure it, will be artificially low for the years prior to 1983. Since this downward bias will be stronger for MSAs that grew relatively rapidly it would appear that the less dense MSAs grew faster than dense ones.

One way to address this concern is to employ an MSA land area definition from a year that pre-dates the first year for which we have employment data. We regrouped our counties into 159 metropolitan areas based on the 1950 standard metropolitan statistical area (SMSA) definitions. Thus, our new sample is based on counties that were metropolitan in 1950 and excludes all counties that attained metropolitan status between 1950 and 1983. Table 4 reports the results. As is evident, a strong trend toward deconcentration still surfaces in the data. The employment share of the first decile fell from 48 percent in 1951 to 42 percent in 1996; the share of the first two deciles declined from 69 percent to 58 percent and so on. The fact that deconcentration is evident for beginning-of-sample-period area definitions indicates that our finding of deconcentration is not simply the result of a spurious negative correlation between density and growth.

Errors Due to Lumpiness of Counties

Since counties are discrete, lumpy units of land, county-based MSA area definitions are inevitably only approximations of the true MSA land area. In theory, MSA areas should include only areas that are in urban use. However, some counties may contain both rural and urban parts. Whether such "borderline" counties are included in the MSA definition will depend on how extensive is the urban portion of the county. If the county is included in the MSA definition, then MSA employment density will be underestimated because the erroneously included rural portion of the county is likely to have a lower employment density than other portions of the MSA. On the other hand, if the county is excluded from the MSA definition, MSA employment density will be overestimated because the erroneously excluded urban portion is likely to have lower employment density than included areas.

Generally speaking, such errors don't necessarily create a problem for the deconcentration trend reported in Table 1. As explained earlier, the purpose behind looking at cumulative employment shares is to minimize the impact of ranking errors caused by such mismeasurement. However, there might be a problem if the measurement error is *systematically* related to the level of MSA employment. In this regard, small MSAs (small in terms of employment) are more vulnerable to underestimation of density because their actual land area may not extend over the entire county (or, in some cases, counties) in which their central city is located. If employment in small MSAs tends to grow faster than in large MSAs, it would look as if less dense MSAs are growing relatively faster than dense ones.[10]

One way to deal with this problem is use the ratio of MSA employment to *urbanized land area* of the MSA, rather than the MSA land area, as a proxy for the MSA's true employment density. The urbanized land area of an MSA includes the central city and the surrounding area with population density in excess of 1000 people per acre. Thus, the urbanized area of an MSA has somewhat fewer jobs and fewer people and much less land area than the MSA. Arguably, a circumscribed definition of land area may be closer to the truth for small MSAs. Thus, employment density calculated using

[10] There is a tendency for small MSAs to grow faster than larger ones, so this bias is something we need to care about.

urbanized area definitions is likely to be a better proxy for employment density of small MSAs.

Data on land area for the 1980 urbanized areas are available for 284 of the 297 MSAs we used in this study. Table 5 shows the cumulative employment shares of MSAs grouped by deciles (the first nine deciles contain 28 urbanized areas each, while the 10th decile contains 32). Note that shares of employment accounted for by the top deciles are now a lot lower. This reflects the fact that this alternative proxy for employment density increases the density of small MSAs. Hence more of these small MSAs get included in the top deciles leading to a decline in the cumulative employment shares.

Despite this substantial re-ranking of MSAs, the deconcentration trend still comes through. The employment share of the top decile now falls from 35 percent in 1951 to 14 percent in 1996; the employment share of the top two deciles fell from 48 percent to 29 percent, and so on. Indeed, a comparison of Table 1 with Table 5 suggests that the deconcentration is more pronounced with this alternative proxy for employment density.

Errors Due to East-West Bias in County Size

Another concern is that western counties tend to contain more land area than counties elsewhere, which implies that employment densities of western MSAs tend to be lower than employment densities of MSAs elsewhere. Because population and employment in the postwar period have grown rapidly in the West, the regional bias in the measurement of employment density could explain the rapid growth of (apparently) low-density MSAs.

To address this issue we grouped the 297 MSAs in this study into two regions, east and west, and examined employment trends separately for each. The east region consists of 186 MSAs located east of the Mississippi River and the west region consists of 111 MSAs located west of the Mississippi River. Table 6 shows the cumulative employment shares of eastern MSAs grouped by deciles. As is evident, there is a strong deconcentration trend for eastern MSAs, suggesting that the move from east to west is not the sole reason for the deconcentration trend reported in Table 1. Table 7 shows cumulative employment shares for western MSAs. Western MSAs as a group show deconcentration as well.

IS DECONCENTRATION THE FROSTBELT-SUNBELT SHIFT IN DISGUISE?

During the postwar period people and jobs moved from the Midwest and Northeast to the South and West, the so-called frostbelt-to-sunbelt shift. Since the sunbelt region also contains a disproportionately large share of low-density MSAs, deconcentration could simply be the frostbelt-to-sunbelt shift in disguise. However, we show that even within these regions, the less dense MSAs gained employment share relative to dense MSAs.

We took the sunbelt region to consist of 152 MSAs located in the Southeast, Southwest, Rocky Mountain, and Far West regions and the frostbelt region to consist of 145 MSAs located in the New England, Mideast, Great Lakes, and Plains regions. Table 8 shows that deconcentration was quite pronounced in the frostbelt region. The employment share of the first decile declined from 52 percent in 1951 to 40 percent in 1996; the cumulative employment share of the first two deciles declined from 68 percent to 53 percent, and so on. Table 9 shows the experience of the sunbelt MSAs. One can discern a deconcentration trend, although it's not as pronounced as that in the frostbelt or the nation.

That deconcentration is not as pronounced in the sunbelt is not surprising. Whatever force causes high-density MSAs to grow more slowly than low-density MSAs will operate more strongly in the frostbelt than in the sunbelt because frostbelt MSAs are, on average, denser than sunbelt MSAs. In any event, the fact that the frostbelt shows a strong deconcentration trend indicates that the national deconcentration trend is not simply due to faster growth of less dense sunbelt MSAs. Furthermore, as evident in Table 9, as the number of people and jobs rose in the sunbelt, the region's low-density MSAs tended to grow the fastest.

DECONCENTRATION WITHIN METROPOLITAN AREAS

So far we have focused on the differential growth experience of dense versus less dense MSAs. However, employment density differs within MSAs as well. Is it also the case that the low-density areas within MSAs have gained employment share over time? After all, if deconcentration is real and low-density areas exert an attractive force on jobs we should expect a similar trend at work within MSAs. Failure to find deconcentration within MSAs could cast doubt on our other findings.

We refer to deconcentration within MSAs as *decentralization*, i.e., decentralization is the decline in the share of MSA employment accounted for by the relatively dense counties of an MSA (i.e., the counties containing the central city).[11] To study deconcentration and decentralization in an integrated fashion, it's best to view each square mile of metropolitan land as the geographical unit of observation. From this

[11] Decentralization is different from suburbanization. Suburbanization occurs when people and jobs move from the MSA's *central city* to its adjacent suburbs. Since most counties that contain the central city also contain close-in suburbs, it's possible to have suburbanization without decentralization.

disaggregated perspective, deconcentration is a decline in the share of total employment accounted for by square miles with large amounts of employment and a corresponding rise in the share of employment accounted for by square miles with low amounts of employment. But deconcentration in this sense is just a decline in spatial inequality.[12]

Since deconcentration, in this disaggregated sense, is simply a decline in spatial inequality, we can use standard measures of inequality to quantify deconcentration. One such inequality measure is the Theil index. The Theil index has the useful property that the contribution of sub-groups to total inequality (or the contribution of sub-groups to the change in total inequality) can be unambiguously determined (Shorrocks (1980)). This feature is useful in decomposing the overall decline in spatial inequality into decentralization and deconcentration.

Let L be the total number of square miles of metropolitan land area across all MSAs. Let ν be the mean metropolitan employment density and let e_i be the level of employment on the ith square mile of metropolitan land. Then, the Theil index of spatial inequality is:

$$I = \frac{1}{L}\sum_{i=1}^{L}\ln\left(\frac{\nu}{e_i}\right) \qquad (1)$$

Since we have observations only at the county level, we assume that county employment is uniformly distributed over county land area. Thus, (1) reduces to:

$$I = \frac{1}{L}\left\{\sum_{c=1}^{C}L_c\ln\left(\frac{\nu}{e_c}\right)\right\}, \qquad (2)$$

[12] Think of each square mile of metropolitan land as a household and the employment associated with a square mile as income of a household. Then deconcentration is

where C is the number of metropolitan counties, L_c is the number of square miles in county *c*, and e_c is the employment density of county *c*. Further, if we group counties according to the MSA to which they belong, it can be shown that:

$$I = \sum_{m=1}^{M} \frac{L_m}{L} \left\{ \sum_{c}^{C_m} \frac{L_{c,m}}{L_m} \ln \frac{\nu_m}{e_{c,m}} \right\} + \sum_{m=1}^{M} \frac{L_m}{L} \ln\left(\frac{\nu}{\nu_m} \right), \tag{3}$$

where C_m is the number of counties in metropolitan area *m*, $L_{c,m}$ is the number of square-miles in county *c* of metropolitan area *m*, ν_m is the mean employment density of metropolitan area *m*, $e_{c,m}$ is the employment density of county c in metropolitan area *m*, and M is the total number of metropolitan areas. Now, if we define W_m as the Theil index measuring inequality *within* metropolitan area *m* and B as the Theil index measuring inequality *between* metropolitan areas, overall inequality can be expressed as:

$$I = \sum_{m=1}^{M} \frac{L_m}{L} W_m + B \tag{4}$$

If the distribution of employment within any particular MSA is uniform, then *W* is zero for that MSA. Similarly, if average MSA density is the same across all MSAs, then *B* is zero. Perfect equality requires both and would correspond to every square mile of metropolitan land having the same amount of employment.

Table 10 shows that the total employment inequality across metropolitan land area fell from about 1.6 in 1951 to about 1 in 1996, a 39 percent decline. The second and third rows give us an idea of how much of the reduction in inequality is due to decentralization and deconcentration. The index of inequality within MSAs fell 33 percent from 1951 to

completely analogous to a decline in income inequality.

1996, indicating that decentralization is also a feature of postwar urban evolution. The index of inequality between MSAs declined 42 percent from 1951 to 1996. Thus, deconcentration has been somewhat more important in accounting for a decline in spatial inequality than decentralization. Table 10 also separately reports the findings for the frostbelt and the sunbelt. Both decentralization and deconcentration appear to have occurred at a somewhat faster pace in the frostbelt than in the sunbelt.

DECONCENTRATION: A THEORETICAL FRAMEWORK

The facts presented so far strongly suggest that the rate of growth of employment in a given location is systematically related to that location's employment density. In this section, we develop a model of metropolitan employment determination that provides an explanation for this finding. The model is built around the idea that the marginal cost of goods produced and consumed in a given metropolitan area (i.e., local goods) is rising in the metro area's employment density.

Technology, Endowments, and Preferences

There are M locations indexed by $i = 1, 2, 3, \cdots, M$ and a large number of individuals who live and work in these locations. There is one internationally traded good and M local goods. The location i production function for the traded good is:

$$Y = \lambda \phi_i \beta(N_i) n \qquad (5)$$

Here, n is the number of workers, λ is an economy-wide technology index, ϕ_i is a location-specific technology index (captures the effect of location-specific factors such as ports and infrastructure on location i's production capabilities), and $\beta(N_i)$ is an agglomeration benefit function that depends on total local employment N_i. This function is assumed to be iso-elastic:

$$\beta\left(N_i\right) = N_i^{\nu}, \nu > 0\,. \tag{6}$$

The production function of the local good in location i (a good that can be consumed only by individuals living in that location) is:

$$G_i = \kappa\xi_i(\Gamma(D_i))^{-1} n\,. \tag{7}$$

Here, κ is an economy-wide technology index, ξ_i is a location-specific technology index, and $\Gamma(D_i)$ is a congestion function that depends positively on a location's employment density, D_i. The function is of the exponential form:

$$\Gamma_i = e^{\gamma D_i}, \gamma > 0\,. \tag{8}$$

Thus, according to (7) and (8), higher employment density makes the production of the local good less efficient.

The measure of all individuals is given by N. Individuals locate to maximize utility. The utility that an individual gets from living in location i is given by:

$$U_i = \pi\left(N_i\right) g_i^{\theta} c^{1-\theta}, 0 < \theta < 1\,. \tag{9}$$

Here, g_i and c are the individual's consumption of the local and traded good, respectively, and $\pi\left(N_i\right)$ is an amenity function that depends positively on total local employment. This function is iso-elastic:

$$\pi\left(N_i\right) = N_i^{n}, \eta > 0\,. \tag{10}$$

Equilibrium

Let the traded good be the *numeraire*. Let the price of the local good in location i be p_i and the wage rate in location i be w_i. We assume that all local goods are supplied competitively and the producers of these goods take the employment density in their location as given. Then, the price of the local good in location i will equal its marginal cost:

$$p_i = (\kappa\xi_i)^{-1} e^{\gamma D_i} . \tag{11}$$

A firm that locates in location i to produce the traded good takes the level of local employment and the wage in that location as given. In equilibrium, the wage in each location must be such that the profit from producing the traded good is zero in all locations. These zero-profit conditions imply:

$$w_i = \lambda\phi_i\beta\left(\mathrm{N}_\iota\right) \tag{12}$$

Utility maximization implies that the indirect utility of an individual who chooses to reside in location i is:

$$V_i = \theta^\theta\left(1-\theta\right)^{1-\theta}\pi\left(N_i\right)w_i p_i^{-\theta} . \tag{13}$$

Using (6), (10), (11) and (12), and denoting $H\left(\theta,\lambda,\kappa\right)$ by $\theta^\theta\left(1-\theta\right)^{1-\theta}(\lambda/\kappa)$, S_i by $\xi_i^\theta\cdot\phi_\iota$, $\nu+\eta$ by μ and $\theta\gamma$ by δ, yields:

$$V_i = H\left(\theta,\lambda,\kappa\right)\cdot S_i\cdot N_i^\mu\cdot e^{-\delta D_i} \tag{14}$$

Taking natural logarithms of both sides of (14) and denoting the logarithm of variables by lowercase symbols gives:

$$\upsilon\left(n_i\right) = h + s_i + \mu\cdot n_i - \delta\cdot e^{d_i} . \tag{15}$$

In the monocentric model, the land area of a city as well as its population (and employment) density is positively related to the level of population (and employment).[13] We take both of these dependencies into account through a simple function that relates land area A_i in location i to total employment in location i:

$$\ln(A_i) = \zeta_i + (1-\omega) N_i, 0 < \omega < 1. \tag{16}$$

The fact that ω is between zero and one ensures that both land area and employment density is increasing in total employment. The constant term ζ_i takes into account the extent of physical and policy-induced constraints on urban development across different MSAs. Higher values of ζ_i reflect an increasingly accommodative stance toward urban development.

Using (16) and denoting $s_i + (\mu / \omega) \cdot \zeta_i$ by σ_i, the logarithm of the indirect utility of a worker residing in location i can be expressed as:

$$\upsilon(d_i) = h + \sigma_i + \left(\frac{\mu}{\omega} \cdot d_i - \delta \cdot e^{d_i}\right. \tag{17}$$

It is easily verified that the function $\upsilon(d_i)$ resembles an inverted U with a peak at the density level $D^* = \mu / \omega\delta$. In equilibrium, the utility available to workers residing in location i must be the same as that which they can obtain in any other location. Figure 1 plots the $\upsilon(d_i)$ function along with a horizontal line representing the utility available at other locations. Thus, A and B are possible equilibrium points with positive density. But at A, the $\upsilon(d_i)$ curve cuts the horizontal line from below, so equilibrium A is not stable

[13] See, for instance, Brueckner (1986).

with respect to a small perturbation in d_i; the only stable equilibrium with positive density is B.

We assume that all locations are in a stable equilibrium. More formally, the M+1-tuple $\{d_i, \overline{\upsilon}\}$ is a stable equilibrium if (a) $d_i > \ln D^*$ for all i (stability), (b) $\overline{\upsilon} = h + s_i + \mu/\omega \cdot d_i - \gamma \cdot e^{d_i}$ for all i (equal utility), and (c) $\sum_{i=1}^{M} e^{(d_i - \zeta_i)/\omega} = e^n$ (labor market balance). Given a stable equilibrium, equation (17) implies that locations that are more efficient in producing the traded or local goods (i.e., have high ϕ_i or ξ_i) or are more accommodative than other locations (i.e., have high ζ_i) will tend to have higher σ_i and so will tend to be more dense. The equation implies also that changes in the economy-wide technology index λ and κ have no effect on equilibrium densities because such changes affect utility equally in all locations through changes in the constant term *h*.

A key aspect of the model is its implication for changes in equilibrium densities resulting from changes in aggregate employment. Imagine comparing two equilibria, one with (logarithm of) aggregate employment of $n(1)$ and another with aggregate employment of $n(2) > n(1)$ and no difference in any other parameter. Then, the labor market balance implies that there must be at least one location, say *i*, for which $n_i(2) > n_i(1)$ and, so, $d_i(2) > d_i(1)$. Then, the stability and the equal utility conditions imply that $d_i(2) > d_i(1)$ for all i, i.e., density is higher in *all* locations in the second equilibrium. Since all locations are on the falling portion of the $\upsilon(d)$ curves (the stability requirement) and these curves fall *faster* at higher densities (concavity), density must rise *less* for locations with higher density, i.e., for a pair of locations *(i, j)*, $d_i(1) < d_j(1)$ must imply that $d_i(2)-d_i(1)>d_j(2)-d_j(1)$. In other words, rising density causes the cost of the local good to rise proportionately more in more dense locations and so density rises proportionately less in those locations. Since logarithms of density and employment are positively and linearly related, employment rises proportionately less in the more dense locations as well: initial density and subsequent employment growth are inversely related.

Deconcentration

This inverse relationship between employment growth and initial density is the key to our theory of deconcentration. Suppose there are two time periods, t = 1,2. The aggregate employment in the first time period, $n(1)$, is less than aggregate employment in the second time period $n(2)$. Also, suppose that location specific factors change over time, i.e., $\sigma_i(1)$ is potentially different from $\sigma_i(2)$. The economy-wide technology indexes λ and κ may also change over time, but because these parameters do not affect equilibrium densities, such changes can be ignored. Suppose that locations are ordered in such a way that $\sigma_i(1)$ is decreasing in i =1,2,…,M.

Although a location's σ may change over time, assume that the *distribution* of location-specific factors does not; i.e., for every location i in the period 1 there is a location *k (i)* in the period 2 such that $\sigma_i(1)=\sigma_{k(i)}(2)$. Then, the argument in the previous subsection implies that $n_{k(i)}(2)-n_i(1)$ must exceed $n_{k(j)}(2)-n_j(1)$.

Next, rank locations in order of decreasing employment density in the period 2 equilibrium. By equation (17), and the assumption that $\sigma_i(1)$ is decreasing in *i*, they are already so ranked in the period 1 equilibrium. Then, the *i*-th ranked location in period 1 will have the same σ as the *i*-th ranked location in period 2, i.e., the *i*-th ranked location in the period 2 equilibrium will be the location *k(i)*. Since $n_{k(i)}(2) - n_i(1)$ is increasing in i (low-density locations grow faster), it follows that the top F locations, for any $1 \leq F < M$, will lose employment share to the bottom $M - F$ locations over time. In other words, growth in aggregate employment will be accompanied by employment deconcentration in exactly the sense evident in Table 1.

Other Forces Underlying Deconcentration

So far we have focused on the role of increases in aggregate employment for employment deconcentration. We have done so because it seems to be a natural explanation of deconcentration.[14] However, increases in aggregate employment need not be the only factor at work. It's possible that changes in technology, government policies, or tastes may cause deconcentration as well. For instance, Leven (1978) and Coleman (1978) have argued that the federal highway program and the advent of the interstate highway network may have accelerated employment growth in previously remote and poorly connected low-density MSAs. In terms of our model, this would correspond to a change in the distribution of ϕ (and hence σ) wherein the proportion of locations with relatively low ϕ declines. Such a change in the distribution of ϕ implies deconcentration.

Changes in technology and preferences may also underlie deconcentration. Some researchers have argued that agglomeration economies have declined because of continuing innovations in production, transportation, and communications technologies,

[14] In Chatterjee and Carlino (forthcoming), a calibrated version of the model presented in this paper was used to show that the two-and-half-fold increase in aggregate postwar employment is indeed a powerful force favoring employment deconcentration.

and this decline has favored smaller locations (Garnick and Renshaw (1980) and Carlino (1985)). Beale (1977, 1982) suggested that a change in people's preferences in favor of less urbanized living may have made less populated areas more attractive. In terms of our model, these changes would correspond to a reduction in the agglomeration economy parameter α and the amenity parameter η, respectively. While the theoretical effect of changes in these parameters on concentration appears to be ambiguous, it's possible that such changes may have contributed to deconcentration as well.

CONCLUSIONS

Two kinds of domestic movements of jobs and people have been recognized to be important in the postwar period. The first is the movement from central cities to suburbs (suburbanization) and the second has been the movement from the frostbelt (eastern, northeastern, and north central) to the sunbelt (southern and western) regions. To these two well-known urban and regional trends we add a third: the deconcentration of employment and population. That is, the decline in the employment and population shares of dense metropolitan areas in favor of less dense metropolitan areas. A variety of sensitivity checks ensures that our deconcentration findings are not driven by errors in measuring employment density. To interpret this finding, we presented a theory of employment deconcentration in which increases in aggregate metropolitan employment led to deconcentration. In the model, increases in aggregate metropolitan employment lead to deconcentration because congestion costs rise proportionately faster for dense metropolitan areas compared to less dense ones.

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Table 1
Cumulative Employment Shares of
MSAs Ranked by Employment Density*

Deciles	1951	1959	1969	1979	1989	1996
1	0.54	0.51	0.49	0.41	0.41	0.40
2	0.64	0.63	0.61	0.61	0.63	0.59
3	0.75	0.75	0.73	0.72	0.71	0.70
4	0.83	0.82	0.80	0.78	0.79	0.77
5	0.88	0.87	0.86	0.84	0.84	0.84
6	0.92	0.91	0.90	0.88	0.88	0.88
7	0.95	0.94	0.93	0.92	0.92	0.91
8	0.97	0.97	0.96	0.95	0.95	0.94
9	0.99	0.98	0.98	0.98	0.98	0.98

*The top nine deciles contain 30 MSAs each and the bottom decile contains 27. Columns may not sum to 1 due to rounding. We do not report the cumulative employment share for the 10th decile since it's always unity.

Table 2
Cumulative Population Shares of MSAs Ranked by Population Density*

Deciles	1950	1960	1970	1980	1990
1	0.47	0.44	0.42	0.38	0.37
2	0.58	0.57	0.56	0.54	0.55
3	0.67	0.67	0.68	0.66	0.65
4	0.74	0.76	0.76	0.74	0.73
5	0.82	0.82	0.81	0.79	0.80
6	0.88	0.87	0.87	0.85	0.86
7	0.92	0.91	0.90	0.90	0.90
8	0.95	0.94	0.94	0.94	0.93
9	0.98	0.97	0.97	0.97	0.97

Table 3
Cumulative Population Shares of MSAs Ranked by Population*

Deciles	1950	1960	1970	1980	1990
1	0.52	0.50	0.50	0.48	0.48
2	0.67	0.67	0.67	0.65	0.65
3	0.77	0.76	0.76	0.75	0.75
4	0.83	0.83	0.83	0.82	0.82
5	0.88	0.88	0.88	0.87	0.87
6	0.92	0.92	0.92	0.91	0.91
7	0.95	0.95	0.94	0.94	0.94
8	0.97	0.97	0.97	0.97	0.97
9	0.99	0.99	0.99	0.99	0.99

*The top nine deciles contain 30 MSAs each and the bottom decile contains 27. Columns may not sum to 1 due to rounding.

Table 4

Cumulative Employment Shares of MSAs
Ranked by Employment Density
Calculated Using 1950 MSA Definitions*

Deciles	1951	1959	1969	1979	1989	1996
1	0.49	0.49	0.45	0.44	0.43	0.42
2	0.69	0.68	0.65	0.62	0.62	0.58
3	0.77	0.75	0.75	0.72	0.71	0.69
4	0.83	0.81	0.81	0.79	0.79	0.79
5	0.86	0.86	0.86	0.84	0.85	0.83
6	0.90	0.90	0.90	0.89	0.90	0.89
7	0.94	0.92	0.93	0.93	0.93	0.92
8	0.96	0.96	0.96	0.95	0.96	0.96
9	0.98	0.98	0.98	0.97	0.98	0.98

Sample contains 159 MSAs. The first nine deciles contain 16 MSAs and the last decile contains 15 MSAs.

Table 5

Cumulative Employment Shares of MSAs
Ranked by Employment Density
Calculated Using Urbanized Area*

Deciles	1951	1959	1969	1979	1989	1996
1	0.35	0.29	0.24	0.19	0.17	0.14
2	0.48	0.50	0.47	0.31	0.37	0.29
3	0.63	0.63	0.57	0.48	0.46	0.37
4	0.74	0.71	0.67	0.59	0.60	0.57
5	0.80	0.77	0.74	0.67	0.67	0.68
6	0.85	0.83	0.83	0.76	0.81	0.82
7	0.91	0.90	0.89	0.88	0.89	0.87
8	0.96	0.95	0.94	0.93	0.94	0.93
9	0.98	0.98	0.98	0.97	0.98	0.97

*The sample contains 284 MSAs. The top nine deciles contain 28 MSAs each and the 10th decile contains 32.

Table 6: Cumulative Employment Shares of Eastern MSAsRanked by Employment Density *

Deciles	1951	1959	1969	1979	1989	1996
1	0.53	0.51	0.48	0.44	0.41	0.39
2	0.66	0.65	0.61	0.58	0.58	0.57
3	0.73	0.72	0.71	0.68	0.68	0.69
4	0.79	0.78	0.78	0.77	0.78	0.76
5	0.86	0.85	0.83	0.82	0.84	0.83
6	0.90	0.89	0.88	0.88	0.88	0.87
7	0.94	0.93	0.92	0.92	0.92	0.91
8	0.97	0.96	0.96	0.95	0.95	0.95
9	0.99	0.99	0.98	0.98	0.98	0.97

*The sample contains 186 MSAs. The top nine deciles have 18 MSAs each and the bottom decile has 24.

Table 7: Cumulative Employment Shares of Western MSAs Ranked by Employment Density *

Deciles	1951	1959	1969	1979	1989	1996
1	0.50	0.49	0.52	0.50	0.51	0.48
2	0.69	0.67	0.68	0.66	0.64	0.63
3	0.76	0.76	0.75	0.72	0.73	0.71
4	0.82	0.82	0.80	0.77	0.78	0.77
5	0.87	0.87	0.86	0.84	0.84	0.83
6	0.90	0.90	0.89	0.88	0.88	0.86
7	0.92	0.93	0.92	0.91	0.91	0.91
8	0.95	0.95	0.94	0.94	0.96	0.94
9	0.97	0.97	0.98	0.97	0.98	0.98

*The sample contains 111 MSAs. The top nine deciles have 11 MSAs each and the 10th decile has 12.

Table 8: Cumulative Employment Shares of Frostbelt MSAs Ranked by Employment Density*

Deciles	1951	1959	1969	1979	1989	1996
1	0.52	0.51	0.50	0.46	0.42	0.4
2	0.68	0.67	0.66	0.62	0.65	0.63
3	0.75	0.76	0.74	0.72	0.75	0.73
4	0.83	0.81	0.81	0.81	0.82	0.8
5	0.89	0.87	0.85	0.87	0.88	0.86
6	0.92	0.91	0.89	0.91	0.92	0.89
7	0.95	0.94	0.93	0.95	0.95	0.93
8	0.98	0.97	0.96	0.97	0.98	0.96
9	0.99	0.99	0.98	0.99	1	0.98

*The sample contains 145 MSAs and the top nine deciles contain 15 MSAs each and 10th decile contains 10.

Table 9: Cumulative Employment Shares of Sunbelt MSAs Ranked by Employment Density*

Deciles	1951	1959	1969	1979	1989	1996
1	0.42	0.4	0.47	0.45	0.46	0.42
2	0.63	0.63	0.62	0.61	0.61	0.59
3	0.72	0.71	0.71	0.7	0.7	0.67
4	0.81	0.78	0.77	0.76	0.78	0.77
5	0.86	0.84	0.82	0.83	0.83	0.83
6	0.9	0.88	0.88	0.88	0.87	0.87
7	0.93	0.92	0.91	0.92	0.91	0.91
8	0.96	0.94	0.93	0.94	0.94	0.94
9	0.99	0.96	0.96	0.97	0.98	0.99

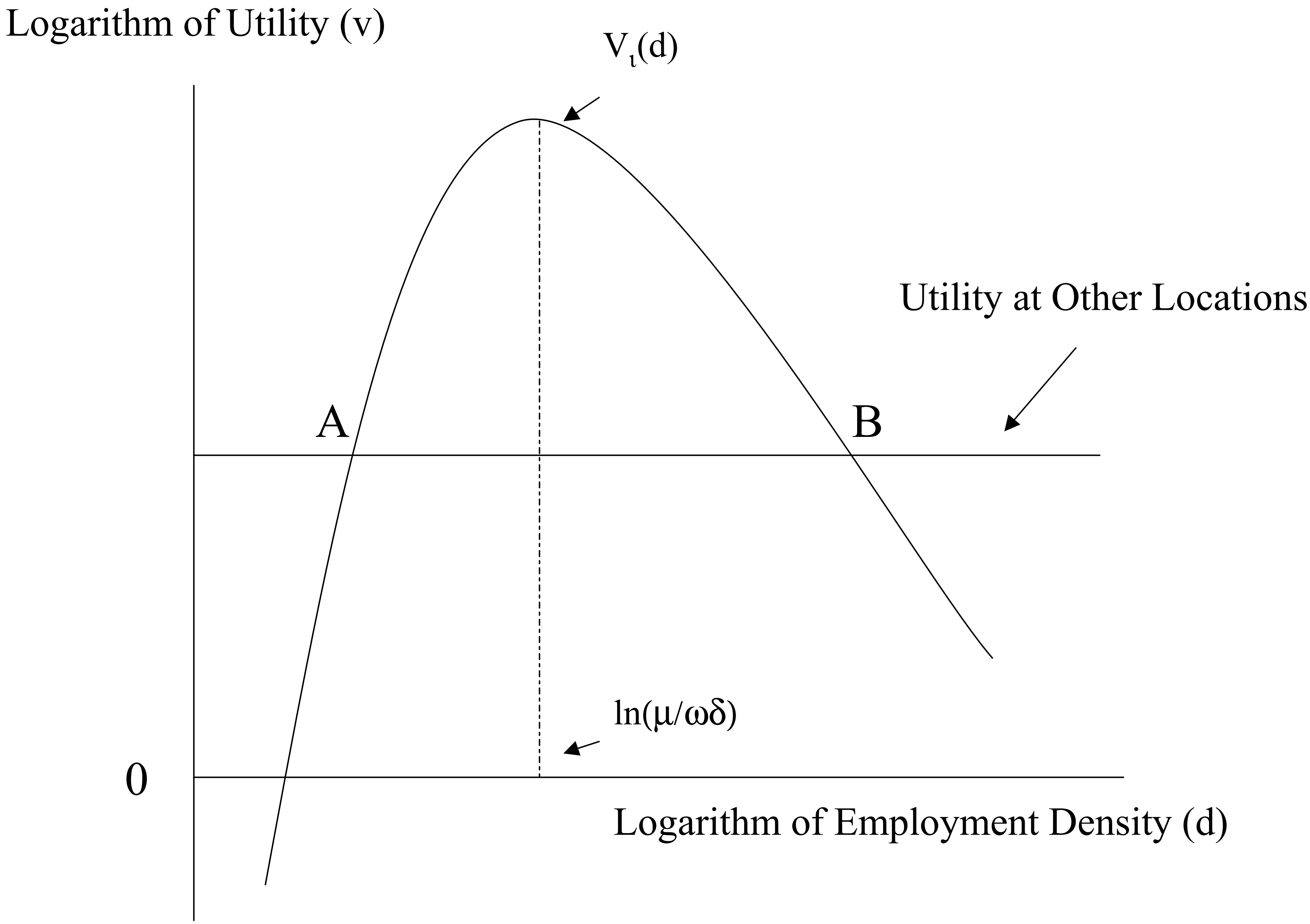
*The sample contains 152 MSAs and the top nine deciles contain 15 MSAs each and the 10th decile has 17 MSAs.

Table 10

Inequality Indexes for Density of Metropolitan Employment

	Nation			Frostbelt Region			Sunbelt Region		
Index/Year	1951	1996	Percent Change	1951	1996	Percent Change	1951	1996	Percent Change
Index of Total Inequality	1.57	0.96	-39	1.41	0.97	-31	1.22	0.88	-28
Index of Inequality Within MSAs (Decentralization)	0.52	0.35	-33	0.64	0.41	-36	0.46	0.31	-33
Index of Inequality Between MSAs (Deconcentration)	1.05	0.61	-42	0.77	0.56	-27	0.76	0.57	-25

Figure 1


Logarithm of Utility (v)
$V_\iota(d)$
Utility at Other Locations
A
B
$\ln(\mu/\omega\delta)$
0
Logarithm of Employment Density (d)