Trends in Metropolitan Employment Growth

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Although metropolitan areas account for only 16 percent of the total land area in the United States, they contain almost 80 percent of the nation's population and nearly 85 percent of its jobs. The United States has, on average, 24 jobs per square mile, but metropolitan areas average about 124 jobs per square mile.

The standard explanation for why firms locate in metropolitan areas is that they can lower their production costs by taking advantage of agglomeration economies—efficiency gains and cost savings that result from being close to suppliers, workers, customers, and even competitors. Although population and jobs have grown more within metropolitan areas than outside them, growth has favored smaller metropolitan areas. During the second half of the 20th century, employment has become more evenly distributed across metropolitan areas. Some observers claim that this deconcentration of people and jobs is the result of a greater preference for less urbanized living. Others say it's the result of reductions in urban agglomeration economies due to technological change and government policies, such as the building of interstate highways.

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The analysis presented in this article suggests a third factor: that locating new jobs in the more densely populated metropolitan areas is more expensive because these areas are nearer to using the full capacity of local resources. Adding jobs and people burdens existing support systems, leading to increases in traffic congestion, pollution, and the cost of living. These "congestion costs" are a major cause of the relatively slower growth of the largest metro areas. If the costs of congestion increase proportionately more for the larger and more dense metro areas, growth rates will be greater in the smaller and less dense metro areas.

A study undertaken at the Federal Reserve Bank of Philadelphia used a simple model to account for the postwar growth in employment in metropolitan statistical areas (MSAs). In this model, firms benefit from agglomeration economies that increase with a metro area's employment size but face congestion costs that rise more than proportionately with its density. The study found that metro areas that were less densely populated in 1951 were able to accommodate faster postwar employment growth than denser metro areas. However, growth in the densest metropolitan areas slowed less than the model predicted. This better-than-predicted growth may be the result of an ongoing process of technological change that put these denser areas technologically ahead of less dense ones. This reasoning suggests that technological change may have offset some of the effects of higher congestion costs. In fact, rather than reducing growth in the densest metro areas, as some have suggested, technological change may have promoted it.

TRADEOFF BETWEEN AGGLOMERATION ECONOMIES AND CONGESTION COSTS

Agglomeration Economies Lead to Concentration... Agglomeration economies provide a powerful incentive for the concentration of economic activity. Historically, manufacturing activity has tended to concentrate in certain areas as a means to hold down costs. Nonmanufacturing activities (such as banking, wholesale and retail trade, and services) have found it advantageous to join the cluster, supplying business services to firms or consumer services to residents. Some nonmanufacturing firms have also found it advantageous to locate near other firms in their own industry (e.g., investment banking in New York City and motion pictures in Los Angeles). Consequently, people and jobs have become concentrated in these areas.

An earlier study found that agglomeration economies for manufacturing firms tend to increase with MSA size, up to some point.[1] For example, a 1 percent increase in all inputs of production resulted in an increase of more than 1 percent in output in Peoria (1.9 percent), Cincinnati (1.4 percent), Kansas City and St. Louis (1.3 percent each), and Boston (1.2 percent). But estimates for Philadelphia, the fifth largest MSA in terms of population, indicate that the same 1 percent increase in inputs leads to an increase of only 1 percent in output.[2]

Why would a large MSA such as Philadelphia, which contained almost 5 million people in 1997, offer a smaller return to its manufacturing firms, on average, than Peoria, which contained less than 350,000 people in 1997? The answer lies in the costs to both firms and households that result from increased urban size.

...But Congestion Costs Pave the Way for Deconcentration.[3] The positive effects of agglomeration economies make up one side of the urban size ledger; the negative effects of congestion (more traffic and pollution and higher

[1]See the 1982 article by Gerald Carlino.

[2]These numbers cover the years 1957-77.

[3]Deconcentration refers to a more even distribution of employment among metropolitan areas.

housing costs) make up the other. To offset these higher congestion costs, workers must receive higher wages, and higher wages increase costs to firms. If congestion costs increase proportionately more for denser metropolitan areas, the same percentage increase in jobs raises wages more in dense locations than in less dense ones.

A 1998 study by Gerald Carlino and Satyajit Chatterjee provides a perspective on the cost of increased employment density in MSAs. They found that a 1 percent increase in employment density increased the cost of living 2.1 percent in the Jersey City MSA (the most dense MSA in the study), almost 0.3 percent in the Philadelphia MSA, and 0.04 percent in the Peoria MSA. Thus, the natural growth of the economy over the long run would lead to slower growth of the densest metro areas and faster growth in the less dense areas of the country. Called convergent growth, this process tends to equalize densities across metropolitan areas (see *Size Versus Density*).

EMPLOYMENT: A PATTERN OF DECONCENTRATION

The concentration of national employment decreased from the 1950s to the 1990s. On the basis of employment density in 1951, the top 1 percent of MSAs (or three most dense MSAs) accounted for 14 percent of total employment in the United States.[4] By 1994, the top 1 percent accounted for just 5 percent. Also in 1951, the top 10 percent of MSAs (or 30 most dense) accounted for 42 percent of total employment in the United States. By 1994, the top 10 percent accounted for only 29 percent. On the other hand, the bottom 30 percent of MSAs (or the 90 least dense) accounted for less than 4 percent of total employment in 1951. By 1994, the share of the bottom 30 percent had increased to 7 percent.

We can present the inequality of employment density among MSAs graphically by using a Lorenz curve. If employment were distributed equally across MSA land area, the Lorenz curve would be a diagonal straight line showing, for example, that any group of MSAs that contained 20 percent of total MSA land area would account for 20 percent of total MSA employment. In reality, employment is distributed unequally, resulting in the real-world Lorenz curves, which are bowed above the diagonal line (Figure 1).[5] The more unequal the employment density, the more pronounced that bowed effect will be. The figure shows Lorenz curves for 1951, 1959, 1969, 1979, 1989, and 1994. The one for 1951 is farthest from the diagonal. Over time, the Lorenz curves have moved toward more equal distribution of employment across MSAs.

Another measure, the Theil index, gauges inequality in employment density among MSAs and summarizes it in a single number. Lower values of the index are associated with less inequality. The total inequality among MSAs fell from about 1.6 in 1951 to just below 1 in 1994, a decline of about 38 percent (Figure 2).

The Theil index can be broken down to show inequality between MSAs and within MSAs. The index of inequality within MSAs is a rough

[4]The three were Jersey City, New York, and Chicago. The discussion in the remainder of this article is based on the 1998 study by Satyajit Chatterjee and Gerald Carlino. The employment data are taken from the Census Bureau's *County Business Patterns* for six years: 1951, 1959, 1969, 1979, 1989, and 1994. The official definition of a metropolitan area has changed several times since 1950; thus, this article looks at employment density (employment divided by square miles of land area) for 297 MSAs, based on constant 1983 MSA definitions. In general, MSAs are statistical constructs used to represent integrated labor-market areas that consist of counties containing a central city of at least 50,000 people along with any contiguous counties if such counties meet certain economic considerations.

[5]The Lorenz curves shown in Figure 1 plot the distribution of total *MSA* employment only, not total *U.S.* employment.

Size Versus Density

Sometimes economists have looked at the size (population or number of jobs) of metro areas when considering the benefits and costs of urbanization. A study of urban areas in France and Japan by Jonathan Eaton and Zvi Eckstein found that all cities grow at the same rate regardless of initial population size. Duncan Black and Vernon Henderson also found evidence of parallel growth for cities in the United States in that the relative size distribution of cities was unchanged during the period 1900-50.*

But the cost of urban growth may be related to the density of development rather than some measure of the size of development as in the studies by Eaton and Eckstein and Black and Henderson. Consider two cities, A and B, of equal population size, but A has twice the land area of B. In this case, B has twice the population density that A has, and many of the problems associated with increasing density (such as traffic and pollution) are likely to be greater in B, too. Thus, size alone may not be enough to gauge the costs of development. Population or employment density may be a better measure.

The ranking of MSAs based on employment size can differ markedly from their rankings based on density (see table below). For example, the Jersey City MSA ranked first in employment density in both 1951 and 1994, but it ranked 27th in level of MSA employment in 1951 and 85th in 1994. The Las Vegas MSA ranked 296th out of 297 MSAs in terms of employment density and 243rd in employment size in 1951. But by 1994, Las Vegas had moved up to rank 50th in terms of employment size, but its density, at 237th, still ranked near the bottom of the distribution.

	1951 Employment			1994 Employment		
MSA	Density	Density Rank	Levels Rank	Density	Density Rank	Levels Rank
Jersey City, NJ	4855	1	27	4636	1	85
New York, NY	2742	2	1	1969	2	3
Chicago, IL	945	3	2	1512	3	2
Bergen-Passaic, NJ	595	4	22	1344	5	35
Newark, NJ	413	5	9	651	11	21
Trenton, NJ	351	9	76	710	10	105
Philadelphia, PA	325	10	5	549	15	4
Pittsburgh, PA	193	19	7	250	38	16
Wilmington, DE	88	49	66	242	40	73
Harrisburg, PA	54	86	60	133	103	72
Ft. Meyers, FL	6	269	292	149	92	134
Las Vegas, NV	2	296	243	52	237	50

*These findings of parallel growth for cities in the United States and France appear to be evidence against convergent growth in which the initially less dense metropolitan areas grow relatively faster than the initially more dense ones. But this difference may be more apparent than real. Both studies look at population size rather than employment density as this study does. Black and Henderson's study stops in 1950, and the period of this analysis is 1951-94. Black and Henderson's notion of "parallel growth" also involves (in part) the entry of new metropolitan areas during the 1900-50 period. Because the 1983 classification of MSAs is used for all years in this article, the number of MSAs is held constant, although some locations that became MSAs in 1983 actually had not achieved MSA status in the earlier years. Thus, Black and Henderson's findings may be consistent with our notion of employment deconcentration in that their "new" urban areas were also locations that were initially less dense.

measure of suburbanization of employment, which occurs when jobs move from the MSA's central city to its adjacent suburbs. This index fell from 0.52 in 1951 to 0.37 in 1994, a decline of almost 30 percent (Figure 2).[6] Suburbanization both of people and of jobs is a widely documented pattern in the United States. But as the Lorenz curves show, a more general pattern of deconcentration of employment among MSAs is also taking place. The index for inequality between MSAs, reflecting deconcentration, fell from 1.05 in 1951 to 0.60 in 1994, a decline of almost 43 percent.

In sum, total U.S. employment has become more evenly dispersed: the most dense MSAs account for a smaller share of employment over time. This statement should not be misconstrued to mean that the largest, most dense MSAs are losing employment. Rather, the less dense MSAs are adding jobs at a faster pace.[7]

FIGURE 1
MSA Employment Becomes More Evenly Distributed

FIGURE 2
Theil Index Shows Downward Trend In Inequality Within and Across MSAs

Index/Year	1951	1959	1969	1979	1989	1994
Theil Index for Total Inequality	1.57	1.42	1.32	1.10	1.05	0.97
Theil Index for Between-MSA Inequality	1.05	0.92	0.85	0.69	0.67	0.60
Theil Index for Within-MSA Inequality	0.52	0.50	0.47	0.41	0.38	0.37

For an explanation of the Theil index, see Edward N. Wolff, *Economics of Poverty, Inequality, and Discrimination*, South-Western College Publishing, Cincinnati, 1997.

[6]Suburbanization is understated, since county-level data are used in the analysis. Most counties that contain the central city of an MSA also contain suburbs that are near the central city. This understatement is of little concern for our purposes, since deconcentration among MSAs, not suburbanization, is the main focus of this article.

[7]Only two highly dense MSAs, New York City and Jersey City, had fewer jobs in 1994 than in 1951.

ACCOUNTING FOR DECONCENTRATION

The Traditional View. Some observers believe that the faster growth of employment in the relatively less dense MSAs is a continuation of the same forces that first gave rise to suburbanization. To them, agglomeration economies have declined because of continuing innovations in production, transportation,

and communication technologies.[8] The development of the assembly line, for example, revolutionized not only how products were manufactured but also where. Because assembly lines require a horizontal flow of goods, the vertical spaces available in city factories are unsuitable. Moreover, because the price of land is less expensive outside the city, those large open spaces provide relatively cheap sites for constructing assembly-line plants.

More recent developments have also aided both suburbanization and the deconcentration of MSA employment. Dan Garnick and Vernon Renshaw point out that miniaturization and the development of lightweight materials have reduced firms' incentives to locate in the largest MSAs to lower transportation costs. Other observers have argued that the technological forces that brought about deconcentration were reinforced by certain government policies, the most important being the federal highway program.[9] The interstate highway network has connected many previously remote areas of the country with one another and with the nation's largest MSAs. Thus, some technical innovations and government policies have made the smaller and less dense MSAs more attractive for both firms and households.

Despite the speculation that deconcentration represents nothing more than a continuation of the forces that led to suburbanization, there is little independent evidence that these forces are responsible for deconcentration. In fact, another view holds that these forces are irrelevant to deconcentration.

An Alternative View. The alternative view starts with the observation that, after some point, further increases in the number of people and firms in an MSA tend to clog its roads and transportation network. In addition, the cost of transporting goods goes up and the time needed to transport them lengthens, as does the time needed to commute to work or to get to leisure activities.

Of course, the negative effects of congestion brought on by growth in an MSA are only part of the equation. The positive effects of agglomeration economies make up the other. If the net benefits of growth (agglomeration economies less congestion costs) increase proportionately less for more dense metropolitan areas, entrepreneurs will have an incentive to locate plants in less dense MSAs. Over time, growth will favor the less dense MSAs whose agglomeration economies still outweigh their congestion costs.

Evidence. What role has the disproportionate increase in congestion costs played in the deconcentration of MSA employment? To investigate this point, Satyajit Chatterjee and I developed a model of the tradeoff between agglomeration economies and congestion (see *Appendix*). Then, guided by microeconomic studies in the urban and regional economics literature, we selected values for key parameters in the model to reproduce the employment density for each of the 297 MSAs in 1951. However, by 1994, total employment in the nation's MSAs was about 2.5 times higher than in 1951. So we used our model to predict how this employment growth would be distributed across the same 297 MSAs in 1994 (Figure 3). In the figure, the solid line shows the actual distribution of MSA employment density in 1951, ordered from most to least dense, and the dashed line shows the model's prediction for job distribution in 1994. Since the dashed line—the model prediction—lies above the solid line, the model predicts a high degree of deconcentration: the less dense MSAs will attain a relatively larger share of new jobs. With the exception of the two most dense MSAs, Jersey City and New York City, the model predicts that density will increase for all other MSAs during the period 1951-94. However, employment in the less

[8]See the studies by Charles Leven (1978) and Dan Garnick and Vernon Renshaw (1980) and my 1985 article.

[9]See the studies by Charles Leven (1978) and James Coleman (1978).

dense MSAs will increase relatively more than employment in the more dense MSAs. [10]

Actual outcomes for 1994 generally confirm these predictions (Figure 4). The solid line shows actual employment densities in 1994. The data for 1994 are quite close to the predicted values (dashed line) except for the most dense MSAs and the least dense MSAs. The 18 most dense MSAs gained a larger share of employment during the period 1951-94 than predicted (the solid line in Figure 4 lies above the dashed line for these MSAs). In 1951, these 18 MSAs accounted for 34 percent of total national employment. By 1994, their share had fallen to 21 percent. But the model predicted their share would fall to 16 percent. At the other end of the employment density graph, we see that the 38 least dense MSAs gained a smaller share of employment between 1951

FIGURE 3

Employment Is Predicted To Become Less Concentrated...

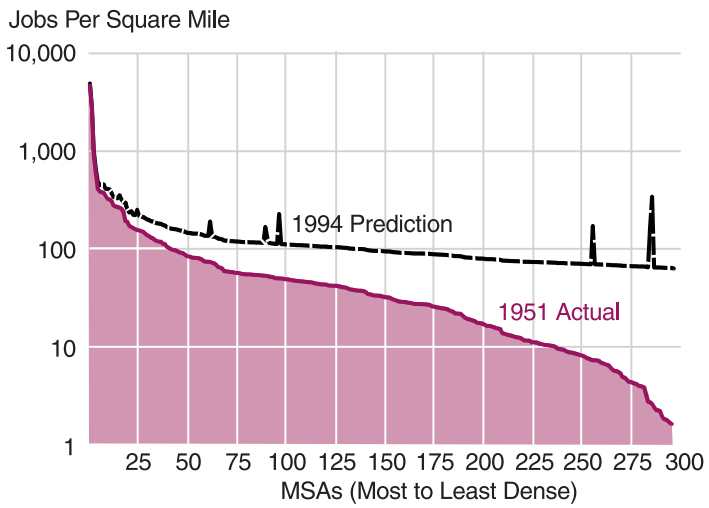
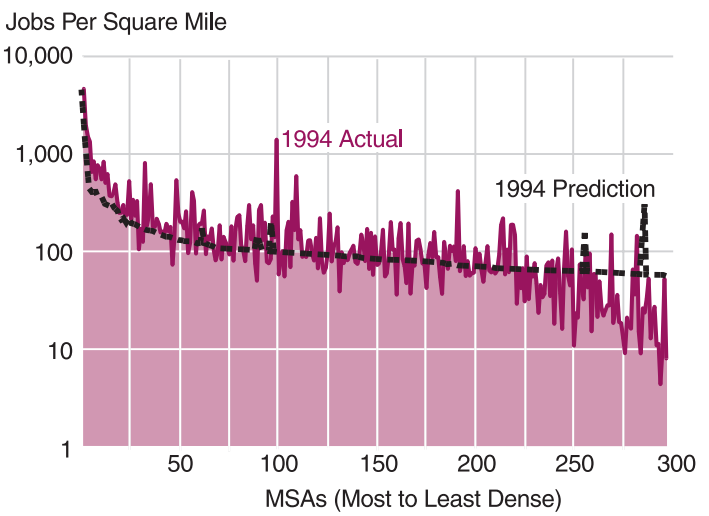


FIGURE 4

...And History Confirms Prediction



[10]The boundaries (and land area) of the MSAs discussed in this article are fixed by their 1983 definitions. In reality, as metropolitan areas grow, the boundaries of some of them spread out.

and 1994 than predicted. In 1951, these 38 MSAs accounted for 1.3 percent of total national employment. By 1994, their share had risen to 3.6 percent. But the model predicted their share would jump to 18 percent.

These discrepancies suggest that other forces, such as more rapid technological change in the densest MSAs, may have mitigated the deconcentration. Recently, some economists have argued that higher densities of people and jobs promote faster innovation and technological change and therefore growth. Economists have suggested an important link between innovation and density. They argue that the concentration of people and jobs in cities and other dense locations creates an environment in which ideas flow quickly among people. For example, the collaborative effort of many educated individuals in a common enterprise may lead to a higher sustained rate of innovation in the design of products.[11]

CONCLUSION

An examination of the data for almost 300 metropolitan areas in the United States shows a pronounced trend of deconcentration of employment from the most dense to least dense metro areas. Many economists have speculated that a decline in urban agglomeration economies accounted for the observed deconcentration of jobs in the postwar period. But our analysis suggests that growth has favored the less dense metro areas not because agglomeration economies have declined but because congestion costs associated with growth have increased faster in more dense locations.

[11]See my 1995 article for a review of this literature, and the article by Edward Glaeser, Hedi Kallal, Jose Scheinkman, and Andrei Shleifer (1992).

APPENDIX: Modeling MSA Growth

The data in this article document a pronounced trend toward spatial deconcentration of employment. Motivated by this finding, Satyajit Chatterjee and I developed a model in which exogenous employment growth causes employment to shift in favor of less dense MSAs because congestion costs increase more rapidly for the initially more dense MSAs.[a] This general equilibrium model is described for both firms and households.

Firms. Production is subject to agglomeration economies, which are assumed to be constant (but not increasing) for those MSAs below a threshold size. Agglomeration economies are taken to increase with employment size once an MSA crosses the size threshold. There is no upper limit on agglomeration economies; beyond the threshold, they are assumed to increase in direct proportion to an MSA's employment. If agglomeration economies confer higher profits in any given MSA, firms in search of higher profits have an incentive to move to the relatively more productive MSAs. This

[a]The model discussed in this Appendix is similar in spirit to models developed by Vernon Henderson.

influx of firms increases the demand for workers and bids up local wages. The increase in local labor costs, in turn, reduces the profits of local firms. Labor costs will continue to rise until profits are once again equalized across MSAs.

Households. For workers, the increase in wages means they can increase their consumption of goods, yielding higher utility for workers in the more productive MSAs. This increase in utility attracts workers to the more productive MSAs; however, the influx of workers increases an MSA's density, and congestion costs rise. These congestion costs are assumed to increase more than proportionately with increases in MSA employment. The increased congestion costs lower real wages, and consumption and utility begin to fall. Congestion costs continue to rise, and real wages will continue to fall until worker utility is once again equal across all MSAs.

Suppose that aggregate MSA employment doubles. How would this increased employment be distributed across MSAs? Beyond the threshold size, increases in agglomeration economies are proportional to an MSA's employment size, and equal percentage increases in employment across MSAs result in equal percentage increases in agglomeration economies across MSAs. But since congestion costs increase more than proportionately with an increase in MSA density, employment growth favors the less dense MSAs. Thus, the model predicts that employment growth will be inversely related to an MSA's density. Dense MSAs also continue to grow, however, because of location-specific advantages.[b]

Calibrating the Model. The numerical specification of the model involves choosing values for four groups of parameters. These four groups are threshold size, agglomeration economies, congestion costs, and location-specific factors. We used existing studies to put bounds on the threshold, agglomeration, and congestion parameters, then selected values from within these bounds to carry out the calibration exercise. In the baseline model, we used 550,000 jobs as the threshold size after which agglomeration economies begin to increase.[c] Recall that below 550,000 jobs, agglomeration economies are taken to be constant but not increasing. Once an MSA crosses the threshold, its productivity is taken to increase 3.4 percent with each doubling of its employment size.[d] The density parameters used in the baseline model suggest that an increase in employment density of 1 percent raises the cost of living 2.1 percent in the Jersey City MSA (the most dense MSA in the study) but only 0.003 percent in the Casper, Wyoming, MSA (the least dense MSA in the study).[e] The values for the location-specific factors were chosen so that the model exactly matches the MSA distribution of employment densities in 1951 (the solid line in Figure 3). The model is then used to predict employment densities for 1994. The calibrated version of the model shows that MSAs that were less densely populated in 1951 were able to accommodate the two-and-a-half-fold increase in employment experienced during the postwar period more cheaply and thus attracted a larger share of these new jobs (the dashed lines in Figures 3 and 4).

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[b]Location-specific factors reflect the fact that MSAs have, for example, a different mix of industries and a different quality of public infrastructure, such as roads, bridges, ports, etc.

[c]We used David Segal's study in determining the baseline and bounds for the threshold employment level.

[d]Leo Sveikauskas' study guided us in setting baseline and bounds for the agglomeration parameters.

[e]The baseline and bounds for the congestion parameters were guided by Jennifer Roback's study. See my paper with Satyajit Chatterjee for more details on the calibration exercises.

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