A New Look at Economic Indexes For the States in the Third District

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When someone asks, "How's the economy doing?" it's often not clear which measure to point to. Should we refer to the unemployment rate, job growth, or some broader measure like the change in gross domestic product (GDP)? Likewise, if we want to understand where the economy is headed, which statistic should we look at: new unemployment insurance claims, housing permits, or perhaps some stock market index? Each of these statistics has some information. But none has all the information we are looking for, and they sometimes give conflicting signals about where we are in the business cycle. For example, in January and February 1994, employment declined in Pennsylvania, but the unemployment rate went down as well. A partial solution to this dilemma is to com-

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bine several measures into a composite index of current or future economic activity. The Conference Board, a business membership and research organization, publishes monthly coincident and leading economic indexes for the nation. And under the auspices of the National Bureau of Economic Research (NBER), James Stock and Mark Watson have developed alternative coincident and leading indexes for the nation. Using a model based on Stock and Watson's, the Philadelphia Fed developed coincident indexes for the states in the Third Federal Reserve District (Pennsylvania, New Jersey, and Delaware) and leading indexes for Pennsylvania and New Jersey.[1]

A number of factors suggest that revisions of those indexes are in order. For example, there have been changes in the data available for use in the indexes. Moreover, some recent adjustments to the original Stock and Watson model allow us to incorporate quarterly data into the monthly coincident indexes. We have also revised the way we determine trends in the state indexes. Since the leading indexes for the states are forecasts of the coincident indexes, new coincident indexes require a revision of the leading indexes. These revised indexes have some distinct advantages over the original ones.

THE NEW COINCIDENT INDEXES FOR THE THREE STATES

The new coincident indexes for the three states in the Third District are estimated in much the same way as the original indexes. But we have changed some variables included in the indexes and altered the way we determine the long-term trend of the indexes. The cyclical fluctuations in the new indexes are more pronounced than those in our original indexes. And in the new state indexes, differences in the long-term trends more accurately reflect differences in the long-run growth of the states' underlying economies.

The New Coincident Indexes Use the Same Methodology as the Original Indexes. In the late 1980s James Stock and Mark Watson developed an econometric model that estimated changes in the underlying "state of the economy." These changes are not observed directly but are reflected in a number of indicators, such as industrial production or personal income, that are tracked by government agencies or private organizations. Using the estimated changes in the state of the economy, Stock and Watson constructed a coincident index of the national economy. We used the basic Stock and Watson model to construct coincident indexes for each of the three states in the Third District, which we refer to as the economic activity indexes for the states. (See *Estimating the Coincident Indexes*.)

Some issues arise in constructing state indexes that do not arise in constructing a national index. First, fewer monthly indicators are available at the state level than at the national level. Second, even though economic activity indexes are primarily meant to trace cyclical movements in the economy, users are likely to compare the long-term trends in the indexes from one state to another. It is important, then, that these trends be calculated in the same way for each state.

A Limited Number of Monthly Indicators Are Available to Create Composite Indexes at the State Level. The original economic activity indexes for Pennsylvania and New Jersey included data on nonfarm employment, the unemployment rate, average hours worked in manufacturing, and retail sales. Retail sales data were not available for Delaware, and the U.S. Department of Commerce stopped publishing monthly retail sales data for the other two states in 1997. Since

[1]See Theodore M. Crone, "New Indexes Track the State of the States," January/February 1994 *Business Review,* and Theodore M. Crone and Kevin Babyak, "Looking Ahead: Leading Indexes for Pennsylvania and New Jersey," May/June 1996 *Business Review*. These indexes, which are released to the press monthly, are posted on the Philadelphia Fed's web site at http://www.phil.frb.org/econ/regdata.

then, the economic activity indexes for all three states have been based on the three employment-related indicators. One goal in revising the economic activity indexes was to broaden the scope of the indicators used in the model beyond the employment data.

One possibility for expanding the scope of the data was a series of monthly industrial electricity sales by state published by the Department of Energy. While industrial electricity sales do not provide the type of comprehensive measure of industrial output for the states that industrial production provides for the nation, they do provide some measure of industrial activity in a state.

A modification of the Stock and Watson model allowed us to broaden further the scope of the indicators in the economic activity indexes by incorporating variables that are published only quarterly rather than monthly.[2] This modification allowed us to include in the state indexes real personal income minus transfer payments, a variable that has always been a component of the national coincident index.[3] Transfer payments, such as Social Security and veterans' pensions, are excluded from our personal income measure because the economic activity indexes are primarily a measure of state business cycles, and transfer payments are insulated from the business cycle. Personal income less transfer payments is the most comprehensive measure of a state's economy that is available quarterly. It includes wages and salaries as well as interest, rents, and dividend income, all of which are influenced by the business cycle.[4]

With these changes in the components, the economic activity indexes for the states now include five indicators — nonfarm employment, the unemployment rate, average hours worked in manufacturing, industrial electricity sales, and real personal income minus transfer payments. (See *Variables Included in Coincident Indexes* for a comparison of the components of these economic activity indexes with the components of the Conference Board's and Stock and Watson's coincident indexes.)

The Trend in the New Economic Activity Indexes Is Based on Personal Income Growth. Because users will undoubtedly compare growth in the state indexes over longer periods of time, it is important that the long-term growth of the indexes be calculated in the same way for each state. The determination of the long-term trend is not as important for the national index because it is not regularly compared with similar indexes for other countries. In the original Stock and Watson model, the trend in the coincident index was the weighted sum of the trend of the components. Each component's weight de-

[2]Quarterly variables are incorporated into the model by distributing the quarterly change over the three months of the quarter. Alan Clayton-Matthews is responsible for this modification of the Stock and Watson model and also for a C++ program that incorporates the modification. See Alan Clayton-Matthews and James H. Stock, "An Application of the Stock/Watson Index Methodology to the Massachusetts Economy," *Journal of Economic and Social Measurement* Vol. 25, 1998/1999, pp. 183-233, and Alan Clayton-Matthews, *DSFM Manual*, February 23, 1999, mimeo, University of Massachusetts at Boston.

[3]Real personal income data are published monthly at the national level. We deflated nominal personal income published quarterly at the state level by the national CPI to get real personal income.

[4]Although dividend income is less likely than interest or rent to originate in the state in which it is reported, interest, rents, and dividends are not available separately at the state level. Personal income comes out with a lag of about three months, compared with the other variables in the economic activity indexes, so the most recent values of the indexes will always be preliminary. Gross state product (GSP) is theoretically a better measure of output at the state level than personal income. Conceptually, GSP measures all income generated by production in the state, and if it were available on a quarterly or monthly basis and in a timely manner, it would be the appropriate indicator of a state's business cycle. But GSP is available only annually and with a lag of several years. The latest GSP data are for 1998.

Variables Included in Coincident Indexes

Conference Board	Stock and Watson	Economic Activity Indexes Described in This Article
Employees on nonagricultural payrolls	Hours worked by employees in nonagricultural establishments	Employees on nonagricultural payrolls
Real personal income minus transfer payments (monthly)	Real personal income minus transfer payments (monthly)	Real personal income minus transfer payments (quarterly)
Industrial production	Industrial production	Industrial electricity sales
Real manufacturing and trade sales	Real manufacturing and trade sales	
		Average hours worked in manufacturing
		Unemployment rate

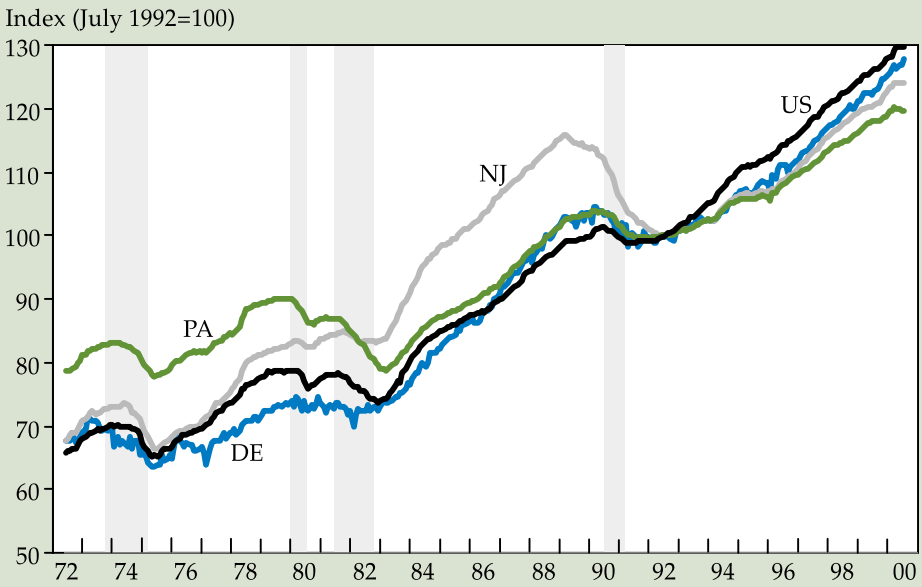
pended on how much it contributed to the average monthly change in the index.[5]

In the national coincident index developed by Stock and Watson, all the components trend up with the economy as a whole, providing the index with a significant positive trend. At the state level, the situation is different. There are fewer monthly or quarterly variables from which to choose, and some of those variables, such as average hours worked in manufacturing or the unemployment rate, show no significant trend. The more these variables reflect the business cycle in a given state, the more they affect the trend of a standard Stock and Watson index. Since these variables show no significant trend, giving them greater weight reduces the long-run growth of the state index. This becomes especially important in comparing indexes between states. If one component has more weight in determining the long-term growth of the index for one state than for another, the two state indexes will not be comparable.

Instead of weighting the components, we used a comprehensive measure of the state's economy to set the trend for the state's economic activity index. The long-term growth in a state's index is set equal to the long-term growth in real personal income minus transfer payments in the state. From July 1972 to July 2000, Delaware's

[5]For example, if, on average, 20 percent of the monthly change in the coincident index as estimated by the model was determined by the change in industrial production and 30 percent of the monthly change was determined by the change in personal income, the long-term trend in the coincident index would be determined 20 percent by the trend in industrial production and 30 percent by the trend in personal income.

FIGURE 1: Economic Activity Indexes



The shaded areas on this graph represent the official NBER recession dates.

new index increased 89 percent, New Jersey's 83 percent, and Pennsylvania's 52 percent (Figure 1).[6]

The New Indexes Show Economic Downturns in Each of the States Corresponding to the National Recessions. The business-cycle dating committee of the NBER determines the official dates for the beginning and end of national recessions. The peaks and troughs of the Conference Board's coincident index correspond exactly to the official recession dates since 1973. The peaks and troughs of Stock and Watson's index correspond to the official dates except for one month's difference at the trough in 1982. We also constructed a national index using variables corresponding to the ones we used in our state indexes.[7] All the peaks and troughs of this index

[6]If we had used the weighted average of the trend in the components to set the trend in the composite index, the long-term growth for Delaware's index would have been unchanged. The growth in New Jersey's index would have been considerably lower (26 percentage points), and growth in Pennsylvania's index would have been somewhat lower (13 percentage points). We reset the trend by making the standard deviation and mean of the log difference of the index conform to the standard deviation and mean of the log difference of personal income over the period covered by the indexes. See Appendix B in the article by Alan Clayton-Matthews and James Stock for the appropriate formula for this conversion (see footnote 2 for complete reference).

[7]Since we did not have a consistent monthly national series of industrial electricity sales from the Department of Energy, we used the series collected by the Federal Reserve System. Also, to keep our national index consistent with the state indexes, we used quarterly personal income data for the index.

are within one month of the official dates of the national recessions (Figure 2 and Table). There are no official dates for recessions and expansions at the state level. Like our national index, however, the indexes for each of the three states in the Third District experienced a decline in the last four national recessions.[8] But if we look at the cyclical peaks and troughs of the state in-

FIGURE 2: Periods of Decline in Economic Activity Indexes

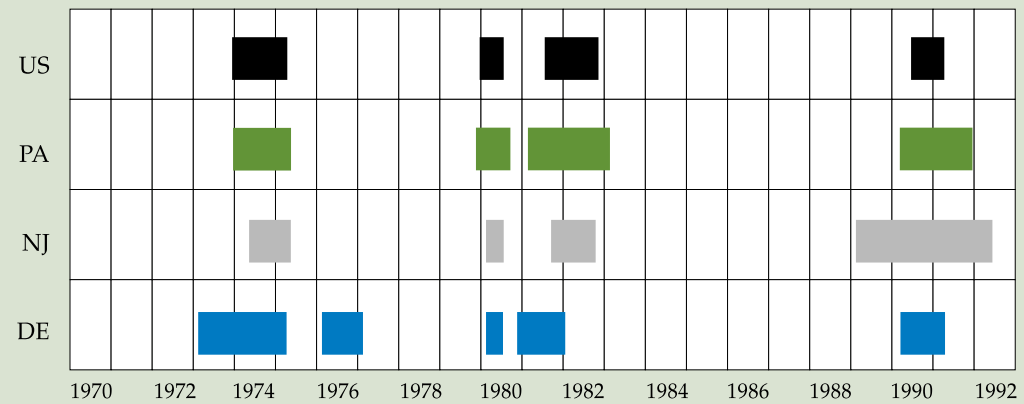


TABLE: Peaks and Troughs of Business Cycles

	Economic Activity Indexes				Official U.S. Recessions
	PA	**NJ**	**DE**	**US***	
Peak	Dec 1973	May 1974	Feb 1973	Dec 1973	Nov 1973
Trough	May 1975	May 1975	Apr 1975	Apr 1975	Mar 1975
Peak			Feb 1976		
Trough			Feb 1977		
Peak	Nov 1979	Feb 1980	Feb 1980	Dec 1979	Jan 1980
Trough	Sep 1980	Jul 1980	Jul 1980	Jul 1980	Jul 1980
Peak	Feb 1981	Sep 1981	Nov 1980	Jul 1981	Jul 1981
Trough	Feb 1983	Oct 1982	Jan 1982	Nov 1982	Nov 1982
Peak	Mar 1990	Feb 1989	Mar 1990	Jun 1990	Jul 1990
Trough	Dec 1991	Jun 1992	Apr 1991	Apr 1991	Mar 1991

*The economic activity index for the U.S. is the one calculated for this article. It is estimated from the same variables as the state indexes except that the industrial electricity data are from the Federal Reserve rather than the Department of Energy.

dexes, these downturns or state recessions do not correspond exactly to the downturns in our national index, and the dates of the downturns differ from one state to another. This indicates that the state economies generally contract and expand with the national economy, but the onset and length of the contractions and expansions in the states differ from those in the nation and in other states.

The peaks and troughs of the new state indexes are close to the turning points in the current versions of our original indexes.[9] The cyclical fluctuations, however, are more pronounced in the new indexes. In every recession in each of the three states, the percentage decline is greater in the new index than in the original one. And in every expansion, the percentage increase is greater in the new index than in the original one. Thus, when measured by the revised indexes, recessions are deeper, and expansions are stronger.

As measured by our new indexes, three of Pennsylvania's four recessions since the early 1970s have begun earlier than the nation's, and all four have been longer in terms of months of economic decline. The longest and deepest decline in Pennsylvania's index was from February 1981 to February 1983. The longest period of decline in any of the state indexes occurred in New Jersey from 1989 to 1992. This downturn lasted 40 months, far longer than the official U.S. recession or the corresponding downturn in our national index. On the basis of the total decline in New Jersey's index, this recession was also the most severe in the state in the last 30 years.[10] Delaware's index indicates that the state experienced a serious downturn between February 1976 and February 1977 that does not correspond to any national recession.[11] Delaware's economic activity index declined 6.3 percent over those 12 months. Most of the decline occurred in the first two months of 1977 when the region suffered from severe winter weather and a temporary shortage of natural gas. The natural gas shortage resulted in some plant closings and a large number of temporary layoffs in Delaware.

The new economic activity indexes confirm that the current expansion has been the longest in the last 30 years in each of the three states. The expansion is likely the longest in each state's history, just as the current national expansion is the longest in American history.

THE NEW LEADING INDEXES FOR THE THREE STATES

Business persons, investors, and policymakers tend to be more interested in where the economy is going than in where it has been, so composite indexes of leading indicators often get more attention than indexes of coincident indicators. Stock and Watson supplemented their national coincident index with an index of lead-

[8]Of course, every decline in a state's index should not be considered a cyclical downturn or recession. Recessions are significant declines in overall economic activity that last several months. We labeled as cyclical downturns or state recessions only those declines in which the period between the peak and trough of the state index was at least four months, i.e., more than one quarter.

[9]The peaks and troughs of the new state indexes are within two months of the corresponding peaks and troughs of the current versions of our original indexes.

[10]New Jersey's economic activity index declined 13.8 percent in the 1989-92 recession. The Pennsylvania state index declined 9.6 percent in the 1981-83 recession. Delaware experienced its most severe recession in 1973-75, when the index declined 11.2 percent.

[11]It is not as easy to recognize recessions in Delaware as in the other two states from the graph of the economic activity indexes because Delaware's index is more volatile from month to month than the indexes for the other two states. The composite index for Delaware is more volatile because the underlying data series for Delaware are more volatile. Delaware is a much smaller state than the other two, and each data series in Delaware's index changes direction more frequently than the series for either of the other two states.

ing indicators, which is a six-month forecast of their coincident index.[12] In the mid-1990s we developed leading indexes for Pennsylvania and New Jersey using the same type of time-series model that Stock and Watson used but different forecasting variables.[13]

The New Leading Indexes for the States Are Based on the Same Basic Model as the Original Indexes but Slightly Different Variables. Our new leading index model uses the economic activity index for each state as well as various state, regional, and national variables to forecast the nine-month-ahead change in the state's economic activity index.[14] This forecast of the nine-month percentage change in the state's current economic activity index is the state's leading index. (See *Variables Included in Leading Indexes* for a comparison of the variables used in our state leading indexes with the variables used in Stock and Watson's and the Conference Board's leading indexes.)

In the original leading indexes for Pennsylvania and New Jersey, we used two state variables — initial unemployment insurance claims and a six-month moving average of housing permits. We also used a national variable that measured interest rate spreads, that is, the difference in the yield between long- and short-term public debt or between public debt and private debt.[15] In the Pennsylvania model we also included the diffusion index for vendor delivery time from the Philadelphia Fed's *Business Outlook Survey*.

In our new leading index model for each state, we included initial unemployment claims and the index of vendor delivery time as they appeared in the original models. The Census Bureau altered the definition of housing units in January 2000. Therefore, to get a consistent series we included only permits for structures of fewer than five units.[16] The interest rate spread in our new leading index model is the yield on 10-year Treasury bonds minus the fed funds rate, the overnight rate that banks charge one another.[17] With this new model we produced a

[12]This is a vector autoregression (VAR) model in which the past values of all the variables in the system are used to forecast each of the variables in the system. In the forecasting equation for the national coincident index, Stock and Watson used four lags for the coincident index itself and various numbers of lags for the other variables.

[13]See the article by Crone and Babyak (footnote 1 has the complete reference).

[14]In the forecasting equations for the state economic activity indexes, we used four lags on all the variables in the system. In the forecasting equations for the other variables, we followed the Stock and Watson model and included only one lag of each of the variables in the system.

[15]Interest rate spreads are helpful in forecasting the national economy. See Ben S. Bernanke, "On the Predictive Power of Interest Rates and Interest Rate Spreads," Federal Reserve Bank of Boston, *New England Economic Review* (November/December 1990). For Pennsylvania, our original leading index used the difference between the yield on 10-year Treasury bonds and one-year Treasury notes, and for New Jersey, the original index used the difference between the rates on six-month commercial paper and six-month Treasury bills. In 1997 the Federal Reserve Board stopped publishing the six-month commercial paper rate.

[16]According to the new definition, a housing unit does not have to have its own eating facilities; these can be shared. Thus units in many retirement communities in which eating facilities are shared are considered individual housing units under the current definition but not under the previous one. This change in definition mostly affects permits for buildings of five units or more.

[17]We also produced leading indexes using the spread between the yield on 10-year Treasury bonds and one-year Treasury notes. But the spread between the yield on 10-year Treasury bonds and the fed funds rate produced a smaller in-sample root mean squared error for the leading indexes. Our economic activity indexes do not extend far enough back in time to produce out-of-sample root mean squared errors for the leading indexes at the beginning of the 1973-75 recession.

Variables Included in Leading Indexes

Conference Board	Stock and Watson	Leading Indexes Described in This Article
	Stock and Watson's coincident index	The state's economic activity index
Building permits for new private housing units	Building permits for new private housing units	Building permits for new units in buildings of fewer than five units in the state
Initial unemployment claims	Part-time workers in nonagricultural industries because of lack of full-time work	Initial unemployment claims in the state
Vendor delivery performance (National Association of Purchasing Management Survey)		Vendor delivery performance (Philadelphia Fed's Business Outlook Survey of manufacturers in the Third Federal Reserve District)
Yield on 10-year Treasury bonds minus the fed funds rate	Yield on 10-year Treasury bonds minus yield on one-year Treasury notes	Yield on 10-year Treasury bonds minus the fed funds rate
	Interest rate on six-month commercial paper minus rate on six-month Treasury bills	
	Yield on 10-year Treasury bonds	
Average hours worked in manufacturing		
Manufacturers' new orders for consumer goods and materials (constant dollars)		
Manufacturers' new orders for nondefense capital goods (constant dollars)	Manufacturers' unfilled orders for durable goods (constant dollars)	
	Trade weighted nominal exchange rate between the U.S. dollar and the currencies of the UK, Germany, France, Italy, and Japan	
Money supply (M2) in constant dollars		
S&P 500 index of stock prices		
Index of consumer expectations (University of Michigan)		

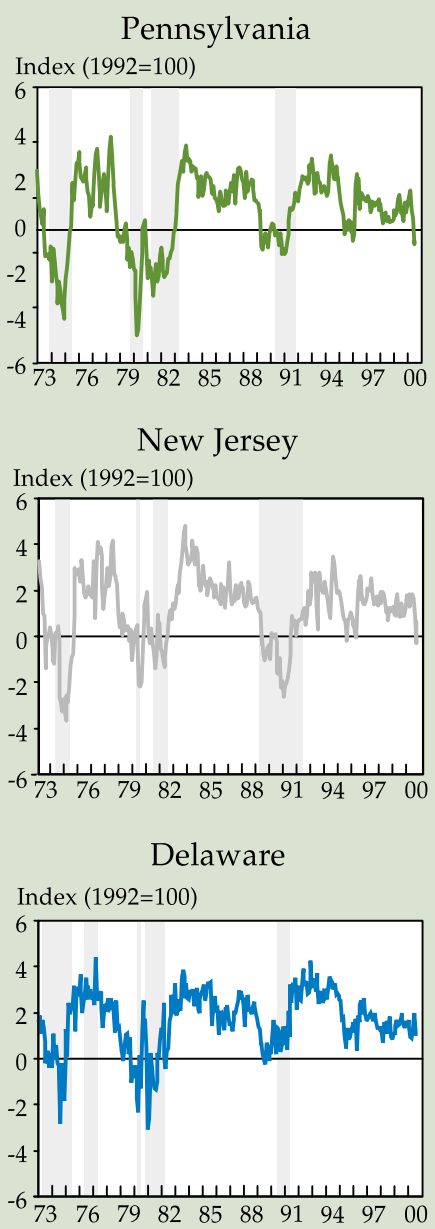
leading index for Delaware as well as for Pennsylvania and New Jersey.

How Have the New Leading Indexes Performed? In judging the performance of a leading index, we have to consider not only how well it predicts recessions and the subsequent expansions but also the number of false recession signals it produces. We must also determine what constitutes a signal of recession or expansion. Our leading indexes are forecasts of the nine-month changes in the state economic activity indexes. If the forecasts were perfect, any negative reading of the index would signal a decline in the state's economy. But forecasts are not perfect, so one might want to observe more than one negative reading of the leading index before predicting a downturn in the state's economy or state recession. For example, a commonly used rule of thumb for the Conference Board's national leading index is that three successive declines signal a recession within the next nine months. Are there any obvious rules of thumb for our leading indexes for the states?

The new leading indexes for Pennsylvania, New Jersey, and Delaware are graphed in Figure 3. The shaded areas on the graphs represent the state recessions as determined by our new economic activity indexes, that is, the time between the cyclical peaks and troughs of the coincident economic activity indexes. The experience of the last three decades gives us some idea of how many negative readings of the leading index are likely to precede a recession in each state.

All four recessions in Pennsylvania since the early 1970s have been preceded by at least three consecutive negative readings of the state's leading index. The lead times ranged from one to 11 months. For example, consider the 1990-92 recession in Pennsylvania. The state's leading index registered eight consecutive negative readings from May through December 1989. If we use the rule of thumb of at least three consecutive negative readings as a signal for recession, Pennsylvania's new leading index has not pro-

FIGURE 3: Leading Indexes



The shaded areas on these graphs represent periods of decline in the economic activity indexes for the respective states.

duced any false recession signals. Although there were several negative readings in 1995 and early 1996, there were never three in a row. The preliminary numbers for June and July 2000 were also negative. Pennsylvania's index has not performed as well in signaling recoveries as in signaling recessions. The index signaled the end of the recession in 1991 with eight consecutive positive readings. But there was only one positive reading before the recoveries in 1980 and 1983, and in 1975, the index turned positive only in the first month of the recovery.

New Jersey's new leading index does not have quite as good a record as Pennsylvania's in predicting state recessions. Three of the four recessions in New Jersey since the early 1970s were preceded by a series of two to four negative readings. But the index turned negative only in the first month of the state recession that began in 1989. Moreover, there were two consecutive negative readings in 1995 that were not followed by a downturn. New Jersey's index predicted the state recoveries in 1982 and 1992 with six or more positive readings in a row, but there were no positive readings before the recoveries in 1975 and 1980.

Delaware's new leading index does not perform as well as Pennsylvania's or New Jersey's.[18] It failed to predict the 1976-77 downturn that was specific to Delaware. Of the four remaining recessions since the early 1970s, Delaware's leading index produced five consecutive negative readings prior to the downturn in the state between February and July 1980. There were a few negative readings prior to the 1990-91 recession, including two consecutive ones nine months before the downturn. The index turned negative only after the beginning of the recessions in 1973-75 and 1980-82. Delaware's leading index has a better record at signaling recoveries than recessions. If we exclude the 1976-77 downturn when the index never turned negative, Delaware's leading index turned positive before the beginning of each expansion since the early 1970s. There was only one positive reading before the upturn in mid-1980, but there were at least four positive readings before the other recoveries. Even though Delaware's leading index exhibits a clear cyclical pattern, it has not been a very reliable predictor of recessions and so is less useful than the leading indexes for the other two states.

REVISIONS HAVE MEANT IMPROVEMENTS

Changes in the data available for the economic activity indexes and the leading indexes for Pennsylvania, New Jersey, and Delaware have led us to revise the indexes, and these revisions have resulted in some clear improvements. The scope of the data used in the economic activity indexes is much broader; it includes more than employment-related data. Long-term trends in the state indexes are now comparable, and the cyclical fluctuations are more pronounced, and therefore easier to recognize, in each state's index.

The new leading indexes for Pennsylvania and New Jersey have better records at predicting recessions and recoveries than the latest versions of the original indexes. Revisions also enabled us to construct a leading index for Delaware.

These revised economic activity and leading indexes will supplant the indexes that have been released monthly by the Federal Reserve Bank of Philadelphia. But these new indexes will also need to be revised some day as further improvements are made in modeling indexes and as changes occur in the data available for constructing them.

[18]One reason for the poorer performance of Delaware's leading index is that the state's economic activity index is more volatile from month to month than the indexes for the other two states and, therefore, more difficult to forecast.

APPENDIX: Estimating the Coincident Indexes

The Stock and Watson model assumes that the change in the underlying "state of the economy" is reflected in several indicators but that each indicator is influenced by other forces as well. Thus, for each published indicator (I) in the model there is an equation $\Delta I_t = a + b\Delta S_t + u_t$, where ΔI is the change in the published indicator, ΔS is the change in the unobserved "state of the economy," a and b are parameters, and u is an error term, which includes any change in the published indicator that is unrelated to a change in S. ΔS_t is assumed to follow an autoregressive process, that is, $\Delta S_t = c + d_1\Delta S_{t-1} + d_2\Delta S_{t-2} + e_t$. The model is estimated using standardized log differences, that is, the difference in the log of the variable in period t divided by the mean difference in the log of the variable over the entire sample period. Thus, the parameters a and c do not have to be estimated. From a system of equations with several monthly indicators, Stock and Watson estimate the other parameters in the model and the change in the state of the economy (ΔS_t). The coincident index is set equal to 100 for a particular month (in our case, July 1992) and the estimated changes in the state of the economy are used to construct the level of the index before and after that date.*

Our state models include data on payroll employment, the unemployment rate, average hours worked in manufacturing, industrial electricity sales, and personal income minus transfer payments. The electricity data required a great deal of editing before they could be used in the model. The monthly data are from the Energy Information Administration Form 826. The monthly series, however, does not begin until 1986, and our economic activity indexes go back to 1972. Fortunately, the Department of Energy supplied us with annual data prior to 1986 so we could backcast the monthly series to 1972 and benchmark the backcasted data to the annual series. Moreover, data for some utilities were missing in various months so we used only those utilities for which data were available or could be easily estimated for all months. We used data from four major utilities in Pennsylvania (Duquesne Light Company, PECO Energy, PPL, and West Penn Power Company); three major utilities in New Jersey (Atlantic City Electric Company, Jersey Central Power and Light, and Public Service Electric and Gas Company); and three utilities in Delaware (Delmarva Power and Light, City of Dover, and City of Newark). We backcasted the data for the years prior to 1986 based on the 1986-98 relationship between monthly industrial electricity sales, manufacturing employment, and heating and cooling degree days. We adjusted the backcasted data so that the sum of the months in each year prior to 1986 equaled the annual total made available by the Department of Energy and based on the Energy Information Administration Form 861. For this adjustment we multiplied each month's backcasted data by the ratio of the annual total from the Department of Energy to the sum of the 12 months that we had estimated using manufacturing employment and heating and cooling degree days. After the backcasting we seasonally adjusted the entire series.

In our state models the equations for each of the indicator variables except the unemployment rate is estimated using only the current month's value of the "state of the economy." The equation for the unemployment rate also contains two lags of the "state of the economy" because the peaks of the unemployment rate often lag the troughs of recessions. The coefficient on the current "state of the economy" is statistically significant in each of the equations for the state indexes, indicating that each of these indicators reflects the "state of the economy," or business cycle, in our three states.

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*See James Stock and Mark Watson, "New Indexes of Coincident and Leading Economic Indicators," *NBER Macroeconomic Annual* (1989), pp. 351-94. For a less technical description of the model, see my 1994 *Business Review* article (complete citation is in footnote 1).

From Centralization To Deconcentration: People and Jobs Spread Out

*Gerald A. Carlino**

From the beginning of the 20th century until the end of World War II, the United States experienced an important shift in the distribution of people and jobs. Both population and employment moved from rural to urban areas. In the postwar period, the United States has undergone three other important shifts in the distribution of people and jobs: the movement from the frostbelt to the sunbelt; the movement within metropolitan statistical areas (MSAs) from central cities to suburbs (suburbanization); and the relatively faster growth of jobs and people in small and less dense MSAs (deconcentration). The first two regional shifts—frostbelt to sunbelt and city to suburbs—are well known. The third shift—deconcentration—is not so well known.[1]

An article in an earlier *Business Review* showed that during the postwar period, employment growth favored the nation's less dense metro-

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[1]Deconcentration refers to the slower growth of dense and large MSAs so that the proportion of total MSA population and total MSA employment in dense and large MSAs has declined while the proportion in less dense and smaller MSAs has increased.

politan areas, a trend referred to as the deconcentration of metropolitan employment.[2] Congestion, which results in higher living costs for households and increased production costs for firms, was undoubtedly a major factor in the relatively slower growth of the densest metropolitan areas. This article addresses three questions related to deconcentration: Has there been faster growth of jobs in smaller MSAs as well as less dense MSAs? Do we find the same trends for population as for employment? Is the experience in the frostbelt and sunbelt regions the same?

What we find is that just as jobs have grown less rapidly in MSAs where employment is dense than in MSAs where it is less dense, they have also grown less rapidly in MSAs with more total employment than in those with less. Population has also grown less rapidly in denser MSAs; however, this difference is not as pronounced as that for employment. Employment has spread out faster than population during the postwar period, suggesting that the proportion of the population that is employed grew faster in small and less dense MSAs than in the big and more dense MSAs.

Faster growth in less dense areas is not simply the result of movement to the sunbelt, where metropolitan areas are typically less dense.[3] The postwar trend of slower growth of employment and population in the dense MSAs is found in both the frostbelt and the sunbelt. The same is true of large MSAs in the frostbelt; they grew slower than small frostbelt MSAs. However, in the sunbelt the large MSAs tended to grow faster than the small MSAs in the postwar period. These observations about the sunbelt suggest that it was density, not size, that limited how rapidly metropolitan areas grew in the second half of the 20th century.

JOBS GROW FASTER IN LESS DENSE AND SMALLER LOCATIONS

Within MSAs, jobs have generally grown faster in less dense suburban counties than in counties containing dense central cities. Called suburbanization, this shift to less dense areas within MSAs is a long-standing trend in the United States.[4] A less well-documented trend is that employment has typically grown faster in less dense (and smaller) MSAs than in more dense (and larger) ones. A study that I did with Satyajit Chatterjee attributes much of the trend toward deconcentration of employment to the fact that it is more expensive to locate new jobs in MSAs where employment density is already high.[5] Denser areas are closer to using the full capacity of local resources. In these areas, adding jobs and people burdens existing support

[2]See my 1998 article.

[3]To demonstrate this, we grouped the 297 MSAs used in this article into two regions: frostbelt and sunbelt. The frostbelt consists of 145 MSAs located in the New England, Mideast, Great Lakes, and Plains regions. The sunbelt consists of 152 MSAs located in the Southeast, Southwest, Rocky Mountain, and Far West regions.

[4]In a 1972 study, Ed Mills presents evidence that suburbanization of manufacturing employment started long before 1950.

[5]See the paper by Chatterjee and Carlino. Much of the discussion in this article is based on another study with Satyajit Chatterjee; see Carlino and Chatterjee. The employment data are taken from the Census Bureau's *County Business Patterns* for six years: 1951, 1959, 1969, 1979, 1989, and 1996. The population data are obtained from censuses for 1950, 1960, 1970, and 1990. The official definition of a metropolitan area has changed several times since 1950; thus, this article looks at population and employment growth patterns for 297 MSAs, based on 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 criteria. Employment density is defined as establishment employment of an MSA divided by its square miles of land area; population density is population divided by square miles of land area.

systems, leading to increases in the cost of living. For example, most commuting to work involves trips to and from a metropolitan area's downtown and, more recently, its edge cities. As households locate near these large centers of economic activity to avoid long commutes, they bid up residential rents. Many firms are attracted to these locations, in part because of their accessibility to workers and customers, and competition among firms for these locations will increase business rents as well. Moreover, rents in an entire metropolitan area tend to be driven up when the number of households and firms in that area grows. In fact, the study by Chatterjee and Carlino found that those MSAs that had fewer jobs per square mile in 1951 were able to accommodate postwar employment growth more easily and thus attracted a larger share of new jobs.

Employment Density Has Become More Equal Within and Across MSAs. The regional shifts from city to suburbs and from dense to less dense MSAs have resulted in a more uniform spatial distribution of employment during the postwar period. With the help of the Theil index we can gauge inequality among MSA counties and summarize it in a single number. Zero on the Theil index equals perfect equality; as inequality increases, the index rises.[6] For the nation, the index of total inequality for employment density declined 39 percent from 1951 to 1996 (Table 1A). It declined at only a slightly faster pace for MSA counties in the frostbelt than for those in the sunbelt.[7]

The Theil index can be broken down to show inequality within MSAs and across MSAs. The within-MSA index summarizes differences in employment density among the counties within each MSA. If employment is distributed equally, the within-MSA index equals zero.[8] The change in the index of inequality within MSAs is a rough measure of suburbanization, which occurs when jobs and people move from an MSA's most populous and densest county—the one that contains its central city—to its adjacent less dense and less heavily populated suburban counties. Similarly, the across-MSA index summarizes differences in MSA-wide density among the 297 MSAs included in our study. Again, the across-MSA index would equal zero if each MSA in the United States had the same MSA-wide employment density. We take the change in the index of inequality across MSAs as a measure of deconcentration, which occurs when the growth of jobs and population favors smaller and less dense MSAs.

The second and third lines of Table 1A give us an idea of how much of the reduction in inequality is due to suburbanization and deconcentration. For the nation, the index of inequality within MSAs fell 33 percent from 1951 to 1996. Suburbanization of jobs, a widely documented pattern in the United States, appears to have occurred at only a slightly faster pace in the frostbelt than in the sunbelt.[9] The indexes of inequality across MSAs have also declined during the postwar period, reflecting deconcentration. For the nation, the index for employment density across MSAs declined 42

[6]See Chapter 3 in Edward Wolff's book for a review of the Theil index.

[7]The decline in the inequality index is greater for the nation (-39 percent) than it is for either the frostbelt (-31 percent) or the sunbelt (-28 percent). There was more inequality in the nation in 1951 than within the frostbelt or sunbelt because sunbelt MSAs taken together were less dense than frostbelt MSAs. Thus, the faster growth of the sunbelt led to less inequality in the postwar period.

[8]The Theil indexes are computed as the sum of logarithms of the ratio of actual employment density in each county within an MSA to the MSA's average density.

[9]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 to us, since deconcentration among MSAs, not suburbanization, is the main focus of this article.

TABLE 1: Suburbanization and Deconcentration of Employment

A. 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 (Suburbanization)	0.52	0.35	-33	0.64	0.41	-36	0.46	0.31	-33
Index of Inequality Across MSAs (Deconcentration)	1.05	0.61	-42	0.77	0.56	-27	0.76	0.57	-25

B. Inequality Indexes for Total 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*	1.38	0.91	-34	1.35	0.85	-37	1.22	0.98	-20
Index of Inequality Within MSAs (Suburbanization)	0.77	0.50	-35	0.79	0.50	-37	0.74	0.49	-34
Index of Inequality Across MSAs (Deconcentration)	0.61	0.42	-31	0.55	0.35	-36	0.47	0.49	4

*Total index may not add up to sum of across and within indexes because of rounding.

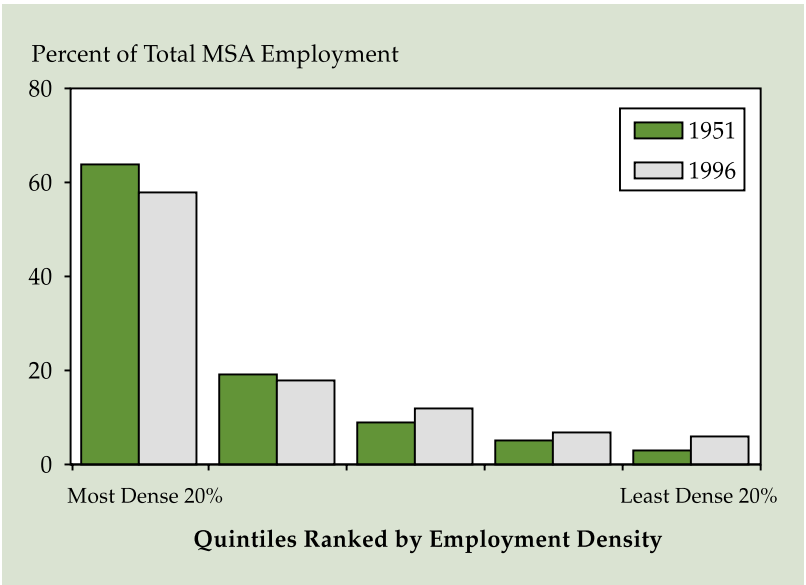
percent from 1951 to 1996. This deconcentration of employment is not simply due to the faster growth of jobs in the sunbelt, where employment density was lower than in the frostbelt; less dense MSAs grew more rapidly than dense MSAs within the sunbelt and within the frostbelt.

In the early 1950s, the frostbelt accounted for 71 percent of total metropolitan employment, while the sunbelt accounted for 29 percent. However, by the 1990s, total employment in metro-

politan areas was evenly divided across the two regions. But the deconcentration of employment appears to have occurred at only a slightly faster pace in the frostbelt than in the sunbelt, as shown by the 27 percent and 25 percent declines in their respective across-MSA Theil indexes.

We can gain additional insight into the deconcentration of employment by grouping the 297 MSAs into five groups (quintiles) ranked from highest to lowest employment density. The top 20 percent of MSAs (or 60 most dense MSAs) in 1951 accounted for 64 percent of total metropolitan employment. But the top 20 percent in 1996 accounted for only 58 percent of total metropolitan employment (Figure 1). Similarly, the employment share of the 60 MSAs in the next densest quintile fell from 19 percent in 1951 to 17 percent in 1996. In contrast, postwar employment growth has favored less dense MSAs. Between 1951 and 1996, employment shares of MSAs in the remaining three quintiles increased. In addition, there has been a considerable shift in employment from dense to less dense MSAs within the top quintile. For example, in 1951, the 30 densest MSAs accounted for 84 percent of total employment within the top quintile. By 1996, the share had fallen to 66 percent. Thus, a substantial part of the deconcentration indicated by the Theil index is accounted for by movements from dense to less dense MSAs within the top quintile.

FIGURE 1: Employment Shares Rise In Less Dense MSAs



Total Employment Has Also Become More Equally Distributed Within and Across MSAs. While we have identified an inverse relationship between the *density* of employment in an MSA and subsequent employment growth, economists have more typically looked at the relationship between an MSA's *size* and its employment and population growth. Ranking MSAs by total employment yields markedly different results than ranking them by employment density (see *Size Versus Density*). [10]

Given these differences in the two rankings, do the findings that suburbanization and deconcentration proceeded at about the same rate in the frostbelt and sunbelt hold when we rank MSAs by total employment rather than by density of employment? The Theil index of inequality of total employment for the nation fell 34 percent from 1951 to 1996 (Table 1B). While the index of total inequality fell in both regions,

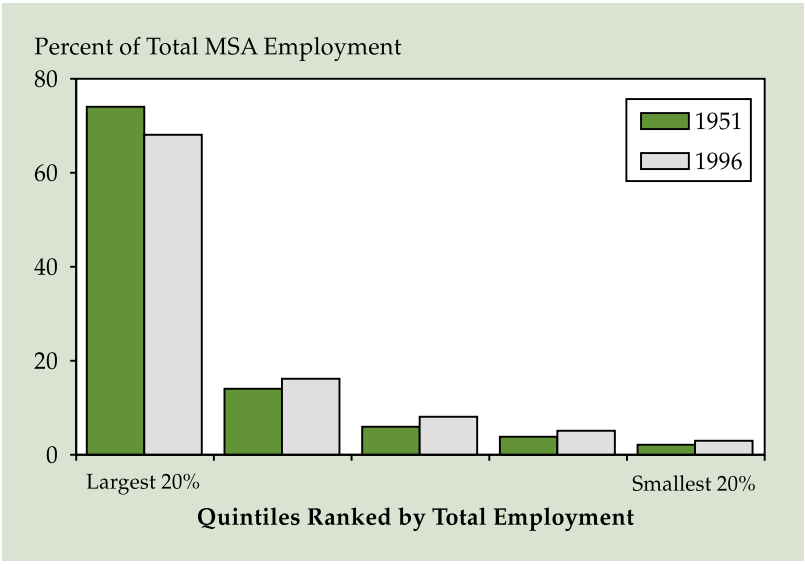
[10]In general, the correlation (based on the Spearman rank correlation) between the ranking based on MSA employment density and the ranking based on MSA employment size is only 0.53.

it declined significantly more in the frostbelt than in the sunbelt. A look at the components of the index based on total employment reveals that suburbanization took place at a slightly faster pace in the frostbelt than in the sunbelt and there was no deconcentration of total employment in the sunbelt. The changes in the index of inequality within MSAs were only slightly higher for the frostbelt than for the sunbelt. However, the index of inequality across MSAs declined 36 percent for the MSAs in the frostbelt; it increased 4 percent for MSAs in the sunbelt.

One reason our results for the sunbelt depend on whether we measure concentration by total employment or employment density is that large MSAs in this region are much less dense than their counterparts in the frostbelt. Average employment density for the 15 largest MSAs in the frostbelt is more than twice the average employment density for the 15 largest MSAs in the sunbelt.[11] Thus, congestion costs associated with growth tend to be lower in the large sunbelt MSAs than in the large frostbelt MSAs. In general, a much stronger correlation exists between employment density and total employment for MSAs in the frostbelt (0.73) than for MSAs in the sunbelt (0.31).[12] Because frostbelt MSAs developed in the 19th century, the technologies of the times, especially transportation technologies, dictated compact metropolitan development. Sunbelt MSAs, on the other hand, are of more recent vintage; they spread out as they developed by taking advantage of greatly improved roads and automobile and truck transportation. The postwar trend of slower growth of employment in dense MSAs is found in both frostbelt and sunbelt. However, employment in the large MSAs in the sunbelt tended to grow faster than in small sunbelt MSAs. Thus, the differences in deconcentration based on total employment between the frostbelt and sunbelt suggest that density rather than size is driving deconcentration.

Again, we can gain additional insight by grouping MSAs according to quintiles, this time based on total employment. The 60 MSAs with the most employment in 1951 (top 20 percent) accounted for 74 percent of total metropolitan employment. But the top 20 percent in 1996 accounted for only 68 percent (Figure 2). As we found for employment density, employment share has shifted toward smaller MSAs within the top quintile, when the quintiles are based on MSA employment. In contrast, the employment

FIGURE 2: Employment Shares Rise in Smaller MSAs



[11]In 1996, there were 1152 jobs per square mile, on average, in the 15 largest MSAs in the frostbelt compared with 515 jobs per square mile, on average, in the 15 largest MSAs in the sunbelt.

[12]Based on the Spearman rank order correlation between MSA employment density and MSA total employment in each region.

share of the 60 MSAs in the next quintile increased from 14 percent in 1951 to 16 percent in 1996. In addition, the collective share of total employment of the remaining three quintiles rose from 26 percent to 32 percent. Thus, for the nation, employment became less concentrated whether we look at employment density or total employment, although the ranking based on total employment shows no deconcentration in the sunbelt.

POPULATION GROWS FASTER IN LESS DENSE LOCATIONS

Like employment, population has become more suburbanized and less concentrated during the postwar period; the less dense and less populated counties within MSAs and the less dense and less populated MSAs account for a greater share of population over time. But because population was already less concentrated than employment in the 1950s, the forces of suburbanization and deconcentration have not been as strong for population as for employment.

Population Density Has Become More Equal Within and Across MSAs. The index measuring total inequality of population density fell 28 percent for the nation from 1950 to 1990 (Table 2A). Total inequality essentially fell about the same amount in the frostbelt (18 percent) as in the sunbelt (17 percent). Density-based measures show that suburbanization of population appears to have occurred at a slightly slower pace in the sunbelt than in the frostbelt: the indexes of inequality for population density within MSAs fell 22 percent in the nation and in the sunbelt and 27 percent in the frostbelt. The indexes for inequality across MSAs, reflecting population deconcentration, have also declined. For the nation, the index of inequality for population density across MSAs declined 29 percent. Density-based measures also show that deconcentration of population appears to have occurred at a somewhat faster pace in the sunbelt than in the frostbelt. In the early 1950s, 65 percent of the metropolitan population was in the frostbelt and only 35 percent in the sunbelt. Now the distribution is even. But as people have settled in the sunbelt, they have favored the less dense areas. Deconcentration nationally is not just the result of more people settling in the sunbelt rather than in the frostbelt; deconcentration has occurred within both regions.

For the nation, the 60 densest MSAs (top 20 percent) in 1950 accounted for 58 percent of total metropolitan population. The top 20 percent in 1990 accounted for 55 percent of total metropolitan population (Figure 3), a modest decline. But as with employment, population has shifted

FIGURE 3: Population Shares Tend to Rise In the Least Dense MSAs

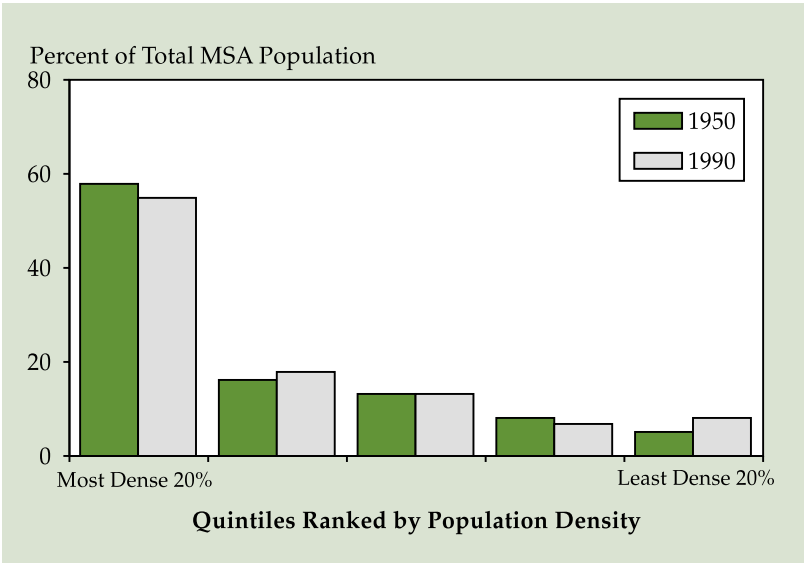


TABLE 2: Suburbanization and Deconcentration of Population

A. Inequality Indexes for Density of Metropolitan Population

	Nation			Frostbelt Region			Sunbelt Region		
Index/Year	1950	1990	Percent Change	1950	1990	Percent Change	1950	1990	Percent Change
Index of Total Inequality*	1.03	0.74	-28	0.96	0.79	-18	0.77	0.64	-17
Index of Inequality Within MSAs (Suburbanization)	0.27	0.21	-22	0.37	0.27	-27	0.23	0.18	-22
Index of Inequality Across MSAs (Deconcentration)	0.75	0.53	-29	0.59	0.53	-10	0.55	0.45	-18

B. Inequality Indexes for Total Metropolitan Population

	Nation			Frostbelt Region			Sunbelt Region		
Index/Year	1950	1990	Percent Change	1950	1990	Percent Change	1950	1990	Percent Change
Index of Total Inequality*	0.82	0.70	-15	0.87	0.67	-23	0.68	0.74	9
Index of Inequality Within MSAs (Suburbanization)	0.40	0.30	-25	0.46	0.33	-28	0.34	0.27	-21
Index of Inequality Across MSAs (Deconcentration)	0.42	0.40	-5	0.41	0.34	-17	0.33	0.46	39

*Total index may not add up to sum of across and within indexes because of rounding.

considerably to the less dense MSAs within the top quintile. In 1950, the 30 densest MSAs accounted for 81 percent of total population within the top quintile. By 1990, the share had fallen to 67 percent. Thus, a substantial part of the deconcentration indicated by the Theil index is explained by movements to less dense MSAs within the densest quintile. In contrast, the 60 MSAs in the next quintile experienced the largest absolute increase in the number of people:

their share increased from 16 percent in 1950 to 18 percent in 1990. Although the population shares of MSAs in the next two quintiles were mostly unchanged, the population share of MSAs in the least dense quintile rose from 5 percent in 1950 to 7 percent in 1990. Thus, our findings for deconcentration when MSAs are ranked by population density are mostly consistent with the findings when MSAs are ranked by employment density.

But employment has undergone suburbanization and deconcentration at a faster pace than population during the postwar period. Why? In a sample of 18 MSAs, Ed Mills and Bruce Hamilton found that 70 percent of the jobs in these metropolitan areas in 1950 were in central cities, compared with 57 percent of the population. Mills and Hamilton found that between 1950 and 1980, suburbanization of jobs was somewhat faster than that of people, resulting in a reduction in central-city jobs per capita.[13] Thus, one reason employment has undergone suburbanization at a faster pace during the postwar period is simply that within metropolitan areas, people were already more evenly distributed than employment. Before the war, firms tended to concentrate in an MSA's central business district (CBD) because the CBD offered access to transportation networks (e.g., ports, docks, and railroad sidings). Firms outbid workers for locations close to the CBD, so workers lived in the suburbs and commuted to the CBD. Improvements in truck transportation and urban roads in the postwar period made it more costly to "ship" workers than to ship their output so firms moved to the suburbs. Similarly, one reason that jobs grew faster in less dense MSAs is that in the early 1950s, population was already more evenly distributed across MSAs than was employment. Recall, for example, that in the early 1950s, the 60 densest MSAs accounted for 64 percent of total metropolitan employment, compared with 58 percent of total metropolitan population.[14]

Total Population Has Become More Evenly Distributed Across MSAs in the Frostbelt but Not in the Sunbelt. The national index of total inequality in the distribution of population fell 15 percent from 1950 to 1990 (Table 2B). The Theil index based on total population for the MSAs in the frostbelt declined 23 percent, while the index for the MSAs in the sunbelt increased 9 percent.[15] The change in indexes of inequality within MSAs indicates suburbanization of total population for the nation and both regions, although the suburbanization of population occurred at a somewhat faster pace in the frostbelt than in the sunbelt. The change in indexes of inequality across MSAs shows that, nationally, deconcentration of population is due to deconcentration within the frostbelt region as well as to a movement of population from the frostbelt to the sunbelt. The sunbelt's growing population continued to concentrate in large MSAs during the postwar period.

What explains the difference between the frostbelt and the sunbelt? In frostbelt MSAs, population density is highly correlated with size, so the faster growth of the less dense MSAs also meant faster growth of small MSAs. In the sunbelt, density is not highly correlated with size, and even the largest MSAs are much less dense than frostbelt MSAs, so people did not have to move to smaller sunbelt MSAs to enjoy lower density. Again, this suggests that density, not size, has been a key factor in deconcentration in the United States.

[13]See Ed Mills and Bruce Hamilton (1994).

[14]Similarly, in the early 1950s, the 60 largest MSAs accounted for 74 percent of total metropolitan employment, compared with 66 percent of total metropolitan population.

[15]As with employment, the rank correlation between population density and total population is much weaker for the MSAs in the sunbelt (0.23) than for MSAs in the frostbelt (0.72).

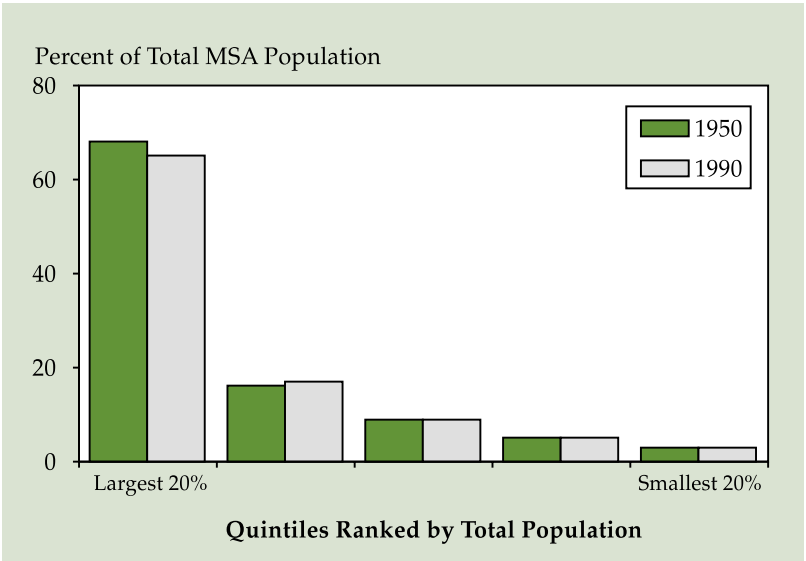
If we look at the population distribution for the nation, the 60 largest MSAs (top 20 percent) in 1950 accounted for 66 percent of total metropolitan population. The share accounted for by the 60 largest MSAs in 1990 fell only slightly, to 65 percent (Figure 4). Unlike employment density, total employment, and population density, the distribution of total population within the top quintile shows very little change. The drop in share among the largest MSAs was matched by the increase in population share for the 60 MSAs in the next quintile. The remaining, less dense quintiles' collective share of population was unchanged over this period.

ACCOMMODATING FASTER DECONCENTRATION OF EMPLOYMENT

Earlier we pointed out that disparities in employment density evened out more than disparities in population density during the postwar period. One reason was that MSA population was already less concentrated than MSA employment at the end of World War II. Still, the only way for employment to spread out faster than population is for the proportion of the population that is employed to rise at a relatively faster pace in the small and less dense MSAs. Two factors largely explain why the ratio of employment to population grew at a relatively faster pace in small and less dense MSAs than in large and more dense ones.

The first factor is that the ratio of working age population to total population rose at a relatively faster pace in the small and less dense MSAs. The proportion of the population that is working age fell from 1950 to 1960 as a result of the baby boom, but then began to rise as the first part of the baby-boom generation reached working age in the 1960s. On balance, the ratio of working age adults to total population in the nation increased from 75 percent in 1950 to 77 percent in 1990. In a sample of 134 metropolitan areas we found that postwar growth in the proportion of the working age population in the labor force was faster in less dense metro areas than in dense ones.[16] We can summarize the differential growth in the proportion of the population that's working age by grouping the 134 metro areas into four groups (quartiles) based

FIGURE 4: Population Shares Change Only In Relatively Large MSAs



[16]The sample is limited to 134 MSAs because some areas that were classified as MSAs in 1983 were not classified as MSAs in 1950. In the 1950s fewer people graduated from high school than in later years; therefore, the working age population consisted of people 14 years and older. However, by 1960 the definition of working age changed to the population 16 years and older. The changing definition should not affect the across-MSA comparisons, since the 14 years and over definition applied to all MSAs in 1950.

on employment density. The proportion of the working age population in the labor force changed only slightly—from 77 percent to 78 percent—for the 33 densest MSAs in the top quartile. This proportion was unchanged at 76 percent for MSAs in the next densest quartile. However, the proportion of the population that's working age increased from 75 percent in 1950 to 77 or 78 percent in 1990 for the MSAs in the two least dense quartiles.

The second factor that explains greater deconcentration of jobs than of population is that the labor force participation rate (the fraction of the working age population that wants to work) increased faster in less dense MSAs. For example, younger workers may be moving from large and dense MSAs to small and less dense MSAs, leaving an older population behind. Many of these older people may be retirees who are not in the labor force. Thus, the labor force participation rate would grow relatively faster in the small and less dense MSAs.

In 1950, the participation rate stood at about 55 percent for all four quartiles of the 134 MSAs for which we have data, the same rate as in the nation. Labor force participation rates increased for the nation and for the MSAs in all four quartiles during the postwar period. For the nation, the participation rate rose from 55 percent in 1950 to 69 percent in 1990. However, during this period, the participation rate increased the least (10 percentage points) for the 33 densest MSAs in the first quartile while it increased more (12 to 13 percentage points) for MSAs in the remaining quartiles.

Thus, the proportion of the population that's working age and the labor force participation rate of the working age population both increased at a somewhat faster pace in the less dense MSAs than in the more dense MSAs, allowing differences in employment density to narrow more than differences in population density during the postwar period.[17]

SUMMARY

Researchers have looked at why some counties and MSAs have faster growth of population and employment than others. Typically, researchers who have looked at the relationship between MSA size and growth have had difficulty explaining differential growth. The evidence presented in this article suggests, however, that density is perhaps the most important factor in explaining county or MSA growth. Dense counties and dense MSAs grew less rapidly during the postwar period than their less dense counterparts. Congestion costs that eventually limit urban growth are more closely related to the density of a metropolitan area than to its size, and an ordering of MSAs based on size can differ widely from an ordering of MSAs based on density. Thus, the level of population or the level of employment in a metropolitan area seems less important as a determinant of future growth than an MSA's density.

That some of the slower growth observed for dense MSAs is related to the high costs associated with congestion suggests a role for city planners and policymakers. One way local planners can enhance growth in dense MSAs is by adding public infrastructure to reduce congestion. Similarly, in the faster growing, less dense MSAs, local planners need to make sure that the area's public infrastructure keeps in step with private growth. If local infrastructure is not growing fast enough, the area could become congested more rapidly. Such a situation could retard the growth of an area. Of course, public officials must take care that the benefits of adding infrastructure to a given MSA justify the cost of these projects.

[17]A rise in unemployment rates from 1950 to 1990 in dense MSAs relative to less dense MSAs could also contribute to greater deconcentration of jobs than population in less dense areas. According to the Bureau of Labor Statistics, data on unemployment rates are available for some MSAs beginning in 1969, but there are no consistently measured unemployment rates for MSAs for the years prior to that.

APPENDIX: Size Versus Density

Sometimes economists have looked at the size (population or number of jobs) of metro areas when considering the benefits and cost of urbanization. A study of urban areas in France and Japan by Jonathan Eaton and Zvi Eckstein finds that all cities grow at the same rate regardless of initial population size. Duncan Black and Vernon Henderson also find evidence of parallel growth of population in the United States in that the relative size distribution of cities was unchanged during the period 1900-50. Stephen Ehrlich and Joseph Gyourko find evidence that the size distribution of population in MSAs in the United States has changed very little since 1950.

The finding of parallel growth appears to offer evidence against the finding of convergent growth for employment and population density and for total employment, as discussed in this article. * 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 cited above. The state of Nebraska and the San Francisco MSA have approximately the same number of people, but Nebraska has 20 people per square mile, and the San Francisco MSA has almost 1600. Thus, size alone may not be enough to gauge the costs of development. Population or employment density may be a better measure.

For some large MSAs (e.g., New York City, Chicago, Los Angeles, and Philadelphia MSAs), the ranking based on size is quite similar to the ranking based on density (see table at right). But, the rankings of MSAs based on size can differ markedly from their rankings based on density. For example, the Jersey City, New Jersey MSA ranked first in employment density in 1996, but it ranked 89th out of 297 MSAs in terms of the level of employment. The Trenton , New Jersey MSA ranked 135th in terms of total population, but 11th in terms of population density. The Las Vegas MSA ranked 46th in terms of total employment, but in terms of employment density, it ranked near the bottom of the distribution at 227th.

SIZE VERSUS DENSITY

	EMPLOYMENT (1996) Rank based on		POPULATION (1990) Rank based on	
MSA	**Employment Density**	**Total Employment**	**Population Density**	**Total Population**
Jersey City, NJ	1	89	1	85
New York, NY	2	2	2	2
Chicago, IL	3	3	3	3
Anaheim, CA	4	11	4	14
Bergen-Passaic, NJ	5	36	5	34
San Francisco, CA	6	18	8	27
Los Angeles, CA	7	1	6	1
Nassau, NY	8	14	7	10
Boston, MA	9	6	9	7
Trenton, NJ	10	111	11	135
Newark, NJ	11	26	10	25
Bridgeport, CT	12	56	15	60
San Jose, CA	13	23	17	28
Lake County, IL	14	73	18	88
Cleveland, OH	15	19	16	24
Philadelphia, PA	**16**	**5**	**13**	**4**
Providence, RI	25	62	24	54
Elkhart, IN	50	156	101	212
El Paso, TX	75	96	42	81
Rochester, NY	100	51	100	44
La Crosse, WI	125	239	170	282
Lafayette, LA	150	163	174	182
Columbus, GA	175	169	167	167
Kankakee, IL	200	247	236	284
Las Vegas, NV	227	46	265	62
State College, PA	250	264	251	252
Eugene, OR	275	154	277	148
Casper, WY	297	295	297	295

*The closest that we come to a finding of parallel growth across MSAs is contingent upon using both population and MSA size. This is pretty much what the studies that find evidence of uniform population growth across MSAs have done.

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