Are Regional Per Capita Earnings Diverging?

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In the last 10 years, per capita earnings have tended to diverge across U.S. regions after decades of gradual convergence. In 1990, for example, earnings in the states of the New England and Mideast regions were well above the U.S. average. In 1978, however, earnings in both regions had been close to the U.S. average. (See *Definitions of Regions* on page 12.) Meanwhile, the Plains' and Rocky Mountain's 1990 per capita earnings, which were slightly below the rest of the country in 1978, had fallen even farther behind the U.S. average.

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Differences in region-specific factors, such as labor force participation ratios, industry mix, and amenities, result in differentials in real per capita earnings across regions in the long run. It may be that the widening gap in regional earnings after 1978 was caused by changes in these factors. If so, the gap would reflect a permanent adjustment toward a new long-run equilibrium. Alternatively, the widening gap may reflect the effects of powerful, but temporary, shocks to the national economy—energy and agricultural shocks, for example—that affect regions differently.

Does the widening gap in regional earnings indicate a fundamental change in regional economies, or is it just a temporary reversal of the trend toward equality that results from powerful, but transitory, economic shocks?
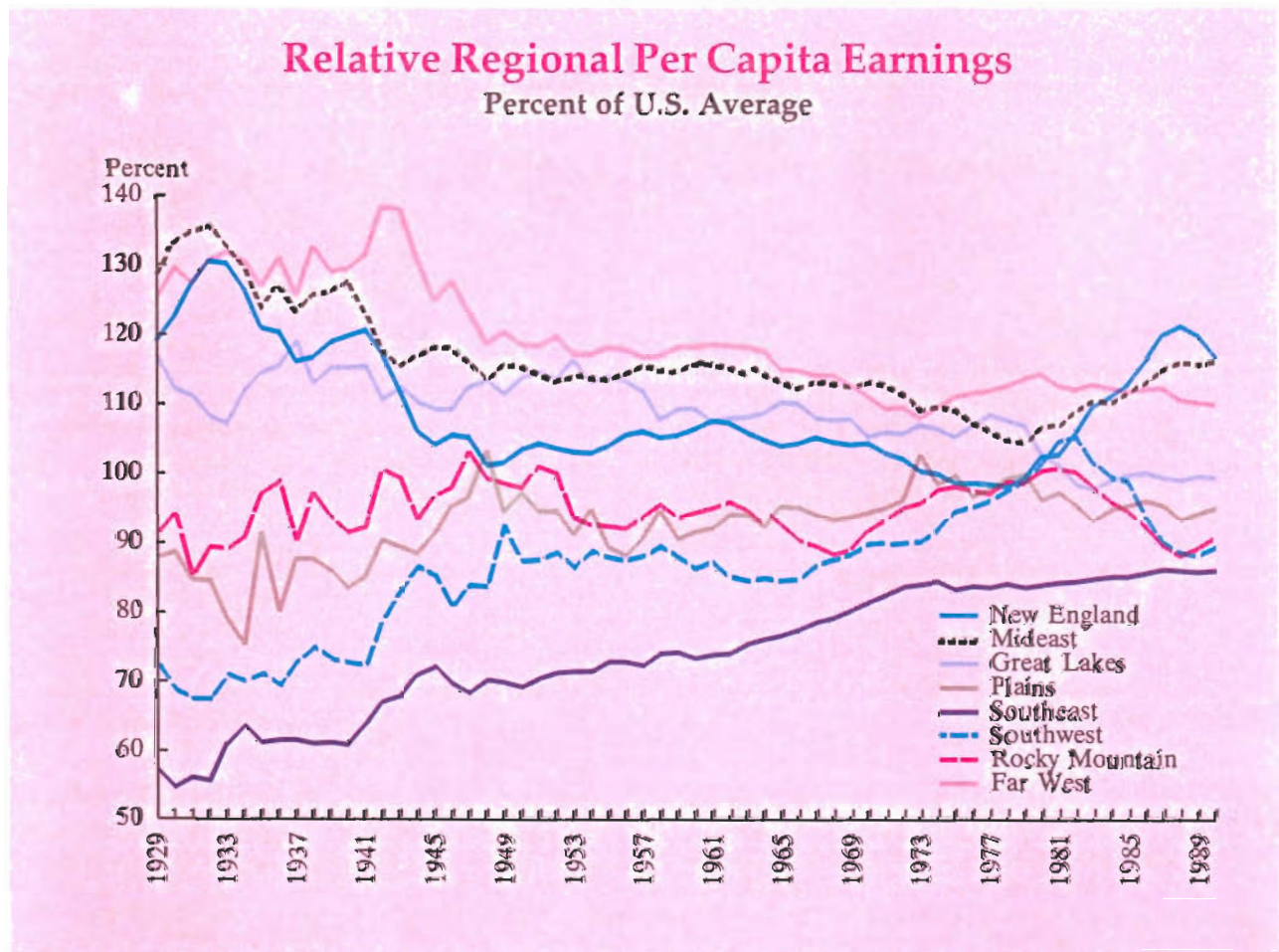
THE CONVERGENCE HYPOTHESIS

On the eve of the Great Depression, per capita earnings differed widely across regions. In the New England, Mideast, Great Lakes, and Far West regions, per capita earnings were well above the national average. (See *Relative Regional Per Capita Earnings*.) In the remaining areas, however, they ranged from 43 percent below average (as in the Southeast) to 8 percent below (as in the Rocky Mountain region).[1]

Economists have identified several reasons for the vast inequality of regional per capita earnings in the years before World War II. One reason is the relatively low level of agricultural prices, which depressed earnings in regions where agriculture was relatively important.[2] In addition, national immigration policies virtually halted the influx of cheap labor after World War I, removing the constraints on wage increases in industrial regions that had been employing most of that labor—mainly the Mideast and Great Lakes.

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[1]Earnings are by place of work. Wages and salaries, including tips, commissions, and in-kind receipts, account for the bulk of earnings. The other sources of earnings are proprietors' income and "other labor income," which consists primarily of employers' contributions to private pensions and group insurance plans.

[2]Edgar Hoover and Frank Giarrantani, *An Introduction to Regional Economics* (New York: Alfred A. Knopf, 1984), p. 335.

Relative Regional Per Capita Earnings
Percent of U.S. Average

Legend: New England, Mideast, Great Lakes, Plains, Southeast, Southwest, Rocky Mountain, Far West

The period between 1929 and the late 1970s saw a pronounced trend toward equalization, or *convergence*, of regional per capita earnings. All of the low-income regions made substantial gains, while the high-income regions lost ground. A main source of the convergence during the period was the shift of labor from low-wage agricultural employment to higher-paying nonagricultural jobs.[3] This shift of employment largely occurred *within* regions.

Reinforcing the intraregional shift in the work force was the increased ability of workers to move freely from region to region in search of the highest return. Continuing improvements in communications and transportation technologies since 1929 have given labor and capital more mobility, narrowing the differences in regional per capita earnings. By the late 1970s it appeared as if regional per capita earnings might equalize.

Should We Expect Per Capita Earnings to Be Equal Across Regions? In its crudest form, the issue of regional per capita earnings differentials has been addressed in terms of nominal earnings, or earnings that have not been adjusted for differences in regional living costs. From the viewpoint of households, the possible advantages of working in a region with high nominal earnings depend partly on how expensive it is to live there. Other things being equal, households should be indifferent between a region whose earnings and prices are at the national average and one whose living costs and earnings are, say, 10 percent above the average. Thus, households will choose a region on the basis of real earnings differentials—that is, earnings that have been adjusted for differences in living costs.

Since workers can move freely from region to region, why should differentials in regional earnings persist once we have adjusted for the cost of living? For one thing, differences in the educational or skill level of the work force or in occupation or industry mix might lead to earnings differentials, even after cost-of-living adjustments. For example, real earnings in a region may be higher if the dominant industries there are among those offering their workers higher real wages.[4] To the extent that differences in industry mix influence real earnings, these differences in earnings will persist across regions. Studies that have controlled for the many factors that could affect real earnings find that real earnings are relatively higher in areas with a larger proportion of jobs in the mining, transportation, manufacturing, and government sectors.[5]

Another important factor behind the earnings differentials across regions is the differences in amenities offered by the regions. Workers may trade off real earnings for amenities, accepting lower earnings in high-amenity regions and demanding higher earnings in low-amenity regions. For example, workers seem to care about environmental characteristics, such as the number of sunny days per year, the average annual rainfall, and nearness to large bodies of water. Since these sorts of environmental amenities differ across regions, regional earnings could differ in equilibrium. Economists have found that part of the difference in earnings is due to just such a trade-off.[6]

Even if real earnings per worker were to equalize across regions, earnings per *person*

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[3]George H. Borts and Jerome L. Stein, *Economic Growth in a Free Market* (Columbia University Press, 1964).

[4]See Gerald A. Carlino, "Do Regional Wages Differ?" this *Business Review* (July/August 1986).

[5]See Richard P. Voith, "Compensating Variation in Wages and Rents," *Journal of Regional Science* 31 (1991), pp. 127-45.

[6]Jennifer Roback, "Wages, Rents, and the Quality of Life," *Journal of Political Economy* 90 (1982), pp. 1257-78. Studies have found that regional amenity differences tend to be reflected in both land values and wages.

need not equalize. Real per capita earnings depend not only on how much a region's workers earn, but on the number of workers relative to the region's total population. The proportion of a region's population that is employed depends on 1) the fraction of its population that is old enough to work; 2) the percentage of its working-age population that chooses to work (the labor force participation rate); and 3) the proportion of its population that chooses to work and actually finds work. A study by the Federal Reserve Bank of Boston found that differences in the proportion of a region's population that is employed were an important source of differences in regional per capita earnings.[7] Moreover, some of these demographic factors, such as the relative age structure of a region, change slowly over time.

If the factors that affect a region's real per capita earnings remain constant, an equilibrium differential exists between the region's real per capita earnings and the national average, and the region's relative per capita earnings should approach that differential through time. (See *Equilibrium Differentials in Regional Per Capita Earnings*.) As long as the gaps in regional real per capita earnings reflect only such differences as participation ratios, industry mix, and amenities, workers will not have an incentive to migrate from regions with relatively low per capita earnings. If so, relative regional per capita earnings will have converged and the remaining gaps in per capita earnings would reflect equilibrium differentials.[8]

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[7]Lynn E. Browne, "Shifting Regional Fortunes: The Wheel Turns," Federal Reserve Bank of Boston *New England Economic Review* (May/June 1989).

[8]Although real per capita earnings may differ across regions, in equilibrium, wages and rents will adjust to ensure equalization of worker utility across regions.

Equilibrium Differentials in Regional Per Capita Earnings

Differentials in regional per capita earnings have a tendency to converge to an equilibrium. To simplify, assume two regions: a frostbelt region and a sunbelt region. Suppose that, in equilibrium, per capita earnings are $10,000 annually in both regions. Initially, suppose that per capita earnings in the frostbelt are well above $10,000, while per capita earnings in the sunbelt are well below $10,000. This inequality in regional per capita earnings causes workers to migrate from the sunbelt to the frostbelt in search of higher per capita earnings.

Over time, the migration of workers causes an expansion in the frostbelt's labor force and a decline in the sunbelt's labor force. The increased supply of labor causes per capita earnings in the frostbelt to fall. Similarly, the reduced labor force in the sunbelt causes its per capita earnings to rise. If the two regions were the same in all respects, migration from the sunbelt to the frostbelt would continue until per capita earnings are equal to $10,000 in both regions.

But other things are not always equal across regions. For example, suppose workers place a $1000 value on the environmental characteristics that the sunbelt offers. That is, workers will accept relatively lower per capita earnings to live in this region. Similarly, workers must be compensated to live in the frostbelt. In equilibrium, per capita earnings are still $10,000 annually for the nation. But now, the equilibrium per capita earnings are $10,500 in the frostbelt and $9500 in the sunbelt. If the actual differential exceeds $1000, workers would continue to migrate from the sunbelt to the frostbelt until the actual differential in per capita earnings between these two regions is $1000. Once the difference has been reduced to $1000, there is no tendency for the differential to decline any further. This gap in regional per capita earnings reflects the equilibrium differential to which these two regions converge over time.

The narrowing differential in regional per capita earnings between 1929 and the late 1970s suggests that perhaps we were approaching such an equilibrium, but the widening of the differentials since then has raised doubts. Recently, several studies have looked at the sources of the gaps in regional per capita earnings and at whether the recent widening is temporary.[9]

WHAT IS THE EVIDENCE?

Studies on regional convergence have sometimes considered per capita income and sometimes per capita earnings, but both variables have exhibited the same pattern of convergence and divergence since the late 1920s.[10] In the Boston Fed study, Lynn Browne reported that the main source of divergence in regional per capita *income* after 1978 was changes in *earnings* per capita, especially earnings in the more locally oriented industries. Changes in other forms of income, such as dividends, interest, and rents, reinforced the basic earnings pattern. In general, shifts in industry mix played a minor role in the changes in relative earnings that occurred after 1978.

Randall Eberts, in a Cleveland Fed study, built on Browne's work by looking at earnings of *individual* workers rather than at earnings that have been *averaged* across all of a region's

residents or workers.[11] He reported that a narrowing of the regional differentials in earnings of workers similar in terms of occupation, skill, and education accounted for much of the convergence during the 1970s. Similarly, a widening of the earnings differentials for similar workers accounted for much of the divergence of regional earnings in the 1980s. Eberts speculated that temporary shocks to the economy from the 1980 and 1981-82 recessions and from the fall in oil prices during the 1980s are probably responsible for this interruption in the long-term trend toward more equal earnings across regions.

Cross-Sectional and Time-Series Evidence. A growing body of research examines per capita earnings (income) convergence at both the national and international levels. These studies have used two approaches—cross sectional and time series. The cross-sectional approach looks at the average rate of convergence across regions, given initial differences. The time-series approach looks at the long-term effects of economic shocks on a region's per capita earnings (income) relative to the national average.

In 1929, regional per capita earnings showed more inequality than could be readily explained by equilibrium differentials alone. For cross-sectional convergence, regions having a relatively low (high) level of earnings per capita should grow relatively quickly (slowly) through time. A study by the National Bureau of Economic Research (NBER) looked for evidence of cross-sectional convergence in real per capita income levels by state for the 1930-88 period.[12]

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[9]The equilibrium differential we are discussing is taken to be characterized by a constant gap. In an endogenous growth framework, however, the gap in the equilibrium differential could be increasing through time. See Robert Lucas, Jr., "On the Mechanics of Economic Development," *Journal of Monetary Economics* 22 (July 1988), pp. 3-42.

[10]See Thomas D. Rowley, John M. Redman, and John Angle, "The Rapid Rise in State Per Capita Income Inequality in the 1980s: Sources and Prospects," U.S. Department of Agriculture, Economic Research Service (January 1991). Income includes interest, rent, and transfer payments, as well as earnings. Earnings, however, accounted for the largest portion of personal income. In 1987, for example, earnings accounted for more than two-thirds of personal income.

[11]Randall W. Eberts, "Accounting for the Recent Divergence in Regional Wage Differentials," Federal Reserve Bank of Cleveland *Economic Review* (Third Quarter 1989), pp. 14-26.

[12]Robert Barro and Xavier Sala i Martin, "Economic Growth and Convergence Across the United States," Working Paper 3419, National Bureau of Economic Research (August 1990).

The study examined the correlation between a state's growth rate of real per capita income over this roughly 60-year period and its level of real per capita income in 1930. Convergence implies a negative correlation between a state's real per capita income in 1930 and its growth rate during the 1930-88 period. The NBER study finds evidence of cross-sectional convergence in state-level data.[13]

Using an approach similar to the one employed in the NBER study, we find evidence of cross-sectional convergence of regional per capita real earnings during the 1929-90 period. Specifically, for every $1000 that a region's real per capita earnings was above (below) the national average in 1929, the region's real growth rate of per capita earnings was lowered (raised) by 0.35 percentage point per year during the 1929-90 period.[14]

Although the cross-sectional approach is one way to examine per capita earnings convergence, this technique may not provide conclusive evidence on convergence. If shocks to the nation's economy have differential and long-lasting effects across regions, these shocks may widen the dispersion in regional per capita

earnings. Until recently, economists have viewed the effects of shocks to the economy as temporary, lasting one year or less. However, recent research reveals that economic shocks to the national economy tend to have highly persistent and long-lasting effects. One recent study found that anywhere from 50 percent to 113 percent of an initial shock to real per capita GNP persists after four years. Even after 100 years, between 19 and 41 percent of a shock still persists.[15]

A shock is an event that causes the level of aggregate per capita income and earnings to deviate from trend. From 1930 through the early 1970s, changes in per capita income and earnings were generally caused by aggregate demand shocks, such as changes in fiscal policy or investment demand. But the shocks of the 1970s occurred largely on the supply side of the economy. One example of a supply shock is the oil price shock that doubled the real price of oil between 1979 and 1980 and reduced per capita income and earnings. Weather-related crop failures are another example of supply shocks that have had adverse effects on the national economy. Of course, some shocks—such as the oil shock in 1986 that lowered the relative price of oil—can have beneficial effects on per capita income and earnings.

Although the 1986 energy shock had beneficial effects on the national economy, it had adverse effects on some regions. Energy shocks influence per capita earnings differently for energy-producing regions than for energy-consuming regions. Per capita earnings would decline in the energy-producing regions and increase in the energy-consuming regions as a result of a 1986-type drop in energy prices.

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[13]Robert Barro has also examined convergence for a cross section consisting of 98 *countries* during the 1960-85 time period. He finds evidence of convergence when the cross-country regression of per capita output growth rates on initial per capita levels includes proxies for human capital development. See Robert Barro, "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics* 151 (May 1991), pp. 407-43.

[14]The result from the cross-sectional estimation is:

$$g_{r,i} = 3.0958 - 0.35R_{i0}$$
$$(14.3) \quad (-5.27)$$

$$R^2 = 0.8222$$

where $g_{r,i}$ represents compound average annual real growth rate in region i from 1929 to 1990 in real per capita earnings, and R_{i0} represents the level of real per capita earnings in region i in 1929 in thousands of dollars. The numbers in parentheses are t-statistics.

[15]Francis Diebold and Glenn Rudebusch, "Long Memory and Persistence in Aggregate Output," *Journal of Monetary Economics* 24 (1989), pp. 189-209. The upper bound (113 percent) of their estimate indicates that the initial effects of a shock may even be magnified.

A study by the Federal Reserve Bank of St. Louis showed that per capita income in the energy-producing states fell from 95.4 percent of the U.S. average in 1978 to 86.8 percent by 1987.[16] Per capita income in the farming states of the West North Central region was also severely affected by the 1981-82 recession and the farm crisis during the first half of the 1980s.[17] According to the St. Louis Fed study, average per capita income in the West North Central region declined from 97 percent of the U.S. average in 1978 to 93 percent in 1987. Other types of shocks that could have differential regional effects include increases in national defense-related expenditures and the introduction of new technologies that favor some regions, such as the development of the high-tech industries that favored New England during the 1980s.

Are the Effects of Economic Shocks on Relative Regional Earnings Temporary? Drawing on the evidence, we can examine the extent to which shocks to relative regional per capita earnings also have persistent effects. As we saw, per capita earnings tended to converge across regions until the late 1970s. We saw also that the introduction of new shocks, such as the oil shocks of the past two decades, affected regional per capita earnings differently. If the differential effects of these shocks are highly persistent, they may, for practical purposes, lead to a permanent widening in the dispersion in regional per capita earnings. Given the evidence that national shocks have differential effects across regions, the effects of these shocks on a region's per capita earnings must be tem-

porary in order for regional per capita earnings to converge over time.

Extending a Philadelphia Fed study by Gerald Carlino and Leonard Mills, we find that, over the entire 1929-90 period, 72 percent of a shock in the Mideast region persisted five years out and 38 percent persisted 10 years out.[18] (See *How Persistent Are the Effects of Shocks?*) Stated differently, if some event raises per capita earnings in the Mideast region an additional $1 above the national average, five years later per capita earnings would be 72 cents above the national average because of that event. Ten years later, per capita earnings in the Mideast region would still be 38 cents above the national average.

The persistence of shocks is less pronounced in the other regions. For example, each dollar shock leads to a 28-cent deviation in New England's relative per capita earnings five years out and to an 8-cent deviation 10 years out. For every region, at least 15 cents of a $1 shock remains five years out.

The regional persistence of economic shocks is not what theory predicts. Workers can move freely from region to region in search of employment, which would tend to dampen the differential regional effects of any shock through

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[16]See Cletus C. Coughlin and Thomas Mandelbaum, "Why Have State Per Capita Incomes Diverged Recently?" Federal Reserve Bank of St. Louis *Review* (September/October 1988).

[17]The West North Central region consists of Iowa, Kansas, Minnesota, Missouri, North Dakota, Nebraska, and South Dakota.

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[18]Gerald Carlino and Leonard Mills, "Have Regional Per-Capita Incomes Converged?" Working Paper 91-18, Federal Reserve Bank of Philadelphia (1991). This article extends the analysis in the working paper by including data for three more years—1988, 1989, and 1990. We examine regional per capita earnings relative to national average per capita earnings to control for the common effect of national economic shocks across regions. A number of recent studies test for *stochastic* convergence (that is, the persistence of shocks to relative output) across *countries*. They generally find that shocks have highly persistent effects, a result inconsistent with cross-sectional convergence. See Andrew Bernard and Steven Durlauf, "Convergence of International Output Movements," Working Paper 3717, National Bureau of Economic Research (May 1991), and Danny Quah, "International Patterns of Growth: I. Persistence in Cross-Country Disparities" (January 1990), mimeo.

time. Are there other factors, then, that help explain the pattern of relative regional per capita earnings over the past half century?

Researchers have recently questioned whether the high degree of persistence found in time series of various measures of income or economic activity may be accounted for by a major event, such as an oil shock, that represents an unusually large departure from their previous trends.[19] Could such a single major disturbance account for the persistence that we find in shocks to relative regional incomes in the 1929-90 period? A number of studies have found that the dispersion in regional per capita

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[19]Pierre Perron, "The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis," *Econometrica* 57 (November 1989), pp. 1361-401.

incomes has increased since 1978.[20] After controlling for a single break in the convergence trend in 1978, we find that persistence is reduced for all regions. The effects of shocks are found to be most persistent in the Southwest region. For every dollar shock to the Southwest's per capita earnings, 33 cents remains after five years and 10 cents after 10 years. Among the other regions, no more than 6 percent of a shock remains 10 years out. In four regions—Great Lakes, Plains, Southeast, and Rocky Mountain—the effects of shocks are essentially gone within 10 years.

In an earlier study on per capita income, Richard Easterlin reported that a break in the convergence trend occurred in 1946.[21] Indeed, inspection of the data on relative regional per capita earnings reveals that such a break may have occurred after World War II. After controlling for such a break, we find a substantial reduction in the persistence of shocks occurring during the 1929-90 period. The results

How Persistent Are the Effects of Shocks?

(Estimated proportion of a shock to relative regional earnings that remains 5 and 10 years out)

	1929 - 1990		1929 - 1990 (Break in 1978)[a]		1929 - 1990 (Break in 1946)[b]	
	5 yrs	10 yrs	5 yrs	10 yrs	5 yrs	10 yrs
New England	0.28	0.08	0.25	0.06	0.23	0.05
Mideast	0.72	0.38	0.25	0.03	0.31	0.05
Great Lakes	0.25	0.06	0.11	0.01	0.10	0.01
Plains	0.15	0.04	0.08	0.01	0.02	0.00
Southeast	0.25	0.04	0.02	0.00	0.07	0.00
Southwest	0.58	0.29	0.33	0.10	0.33	0.10
Rocky Mtn.	0.20	0.04	0.10	0.01	0.11	0.01
Far West	0.33	0.13	0.17	0.03	0.13	0.02

[a]Controls for a break in trend in 1978.

[b]Controls for a break in trend in 1946.

Source: Extension of Gerald Carlino and Leonard Mills, "Have Regional Per-Capita Incomes Converged?" Working Paper 91-18, Federal Reserve Bank of Philadelphia (1991).

are similar to what we found when we incorporated a break in 1978. Thus, after controlling for breaks in first 1978 and then 1946, we find that shocks during the 1929-90 period did not have highly persistent effects on relative regional per capita earnings. This finding is important, since even if the shocks that occurred over the past 60 years had increased the dispersion in regional per capita earnings, the effect in most cases was not highly persistent.

The time-series analysis confirms the usual convergence view that the initially poor regions tended to catch up to rich ones over time. During the 1929-45 period, regions that had per capita earnings above the national average in 1929 grew less rapidly than regions with per capita earnings below the U.S. average. (See *The Trend Rate of Convergence Slows After 1946.*) For example, per capita earnings in the New England region were above the national average in 1929, but the region had an annual growth rate 1.7 percent per year below the national average growth during the 1929-45 period. Similarly, per capita earnings in the Southwest region were below the national average in 1929, but the region had an annual growth rate 2.2 percent above national average growth during the same period.

During the postwar period, a slowdown in the rate of convergence is indicated for most regions.[22] For example, growth in the Mideast region was almost 1 percent per year below national average growth in the 1929-45 period, but equal to the national average on an average annual basis during the 1946-90 period.

CONCLUSION

Regional per capita earnings, which varied substantially in 1929, continue to differ today.

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[22]The Great Lakes region is an exception, since it converged at a faster rate during the postwar period. The rate of convergence in the New England region reverses from -1.7 percent per year in the 1929-45 period to slightly positive in the 1946-90 period This reversal in New England's rate of convergence is an anomaly, since per capita earnings in the region were still above the national average in 1946. Similarly, the rate of convergence in the Rocky Mountain region changes from 0.8 percent per year in the 1929-45 period to slightly negative in the 1946-90 period, even though per capita earnings were still below the national average in 1946. In the New England and Rocky Mountain regions, however, the rate of convergence in the 1946-90 period is not significantly different from zero.

The Trend Rate of Convergence Slows After 1946

	Per Capita Earnings Relative to U.S. Average in 1929	Rate of Convergence[a] 1929-45 (percent)	Per Capita Earnings Relative to U.S. Average in 1946	Rate of Convergence[a] 1946-90 (percent)
New England	ABOVE	-1.7	ABOVE	0.2
Mideast	ABOVE	-0.9	ABOVE	0.0
Great Lakes	ABOVE	-0.1	ABOVE	-0.4
Plains	BELOW	0.9	BELOW	0.0
Southeast	BELOW	1.4	BELOW	0.6
Southwest	BELOW	2.2	BELOW	0.2
Rocky Mtn.	BELOW	0.8	BELOW	-0.1
Far West	ABOVE	-0.2	ABOVE	-0.2

[a]Estimated average annual rate at which the ratio of regional per capita earnings relative to national per capita earnings changed.

Should we expect per capita earnings to vary across regions? It appears so. Regional differences in labor force participation ratios, industry mix, and amenities result in differentials in real per capita earnings across regions. In fact, the gap that had been narrowing through the late 1970s has widened since.

Does the widening gap in regional per capita earnings after 1978 represent a reversal of the long-run trend toward convergence? Apparently not. After allowing for the possibility that the equilibrium gap widened in the late 1970s, we find that what appears to be a divergence of regional per capita earnings may actually represent a short-run adjustment to a new long-run equilibrium. Once this adjustment has occurred, the gap, although wider, should remain stable provided that there are no further changes in the underlying equilibrium. Moreover, economic shocks that occurred during the entire 1929-90 period have not generally had highly persistent effects on a region's relative per capita earnings.

Definitions of Regions

Region	States
New England	Connecticut Maine Massachusetts New Hampshire Rhode Island Vermont
Mideast	Delaware District of Columbia Maryland New Jersey New York Pennsylvania
Southeast	Alabama Arkansas Florida Georgia Kentucky Louisiana Mississippi North Carolina South Carolina Tennessee Virginia West Virginia
Southwest	Arizona New Mexico Oklahoma Texas
Great Lakes	Illinois Indiana Michigan Ohio Wisconsin
Far West	California Nevada Oregon Washington
Rocky Mountain	Colorado Idaho Montana Utah Wyoming
Plains	Iowa Kansas Minnesota Missouri Nebraska North Dakota South Dakota