Chapter 2

The End of State Income Convergence

The convergence thesis offers a broad and plausible explanation for the widely different rates of state economic development that chapter 1 describes. The most important feature behind the convergence thesis as it applies to the American states is the free flow of productive resources and ideas across state lines. In a market economy with open borders such as in the American states, workers, physical capital, technology, and knowledge have practically unlimited mobility. Freedom of mobility means that productive resources will relocate into areas where profit opportunities arise. Resource mobility should ensure that, in the long run, wages and rates of return on investments would be equalized among regions.

For example, if wages or rates of return are lower in one state than in another, workers and firms face clear incentives to relocate. Labor migration drives wages up and rates of return down in the states that lose workers, and it drives wages down and rates of return up in the states that receive the migrants. Likewise, technology, knowledge, and physical capital flow readily across state borders. If a technological innovation raises productivity in one area, profit-motivated firms in other areas eventually adopt the innovation. In this framework, long-term growth is predominantly determined by demographic and technological factors. Given the same resources and access to technology as well as mobile productive factors, states should converge to a common long-run, steady-state level of income per worker.¹

Empirical analyses of the convergence thesis focus on two types of evidence. First, convergence implies a narrowing in the dispersion of income among states over time. As labor migrates from low-wage to high-wage states and capital flows from high-wage to low-wage states, poor states predictably grow faster than rich states, thereby closing the income gap between rich and poor states.²

Figure 2.1 examines the income dispersion pattern in the American states from 1929 through 1999. The graph plots the coefficient of variation in the log of real income per capita across states for each
year, the appropriate measure to compare dispersion over time.\(^3\) A decline in the coefficient of variation indicates convergence (a narrowing in income differences among states), and an increase in the coefficient of variation indicates divergence (a widening in income differences). As illustrated in figure 2.1, income per capita across states strongly converged between 1930 and the mid-1940s. A slower rate of convergence appears between the mid-1940s and the mid-1970s. The dispersion among the states oscillated within a fairly narrow range until the late 1970s and then diverged until the late 1980s. Convergence reappears in the early 1990s and ends in 1994. It is important to note that the dispersion in income per capita in 1999 was roughly the same as it was 25 years earlier.
The evidence indicating an end to state income convergence is even stronger using data on real income per worker. As shown in figure 2.2, the coefficient of variation in income per worker generally converged between 1969 and 1979, oscillated with a narrow range until the mid-1980s, and then diverged sharply for the remaining data series (through 1999). These two indicators of the dispersion of income among states weigh against the view that the state growth process, at least in the last three decades of the twentieth century, is an exogenous, automatic process driven principally by income gaps that encourage factor migration.4

Barro and Sala-i-Martin (1992, 1995) and Barro (1991, 1997) offered a series of articles and books that popularized the second test...
of the convergence thesis. These works examined both American state and international data. This test uses the regression model specified in equation (2.1):

\[ \text{Income Growth}_i = \beta \ln (\text{Initial Income})_i + \text{Constant} + \epsilon_i. \quad (2.1) \]

Income Growth\(_i\) is the annual growth rate in real per capita income in state \(i\) over a particular period. The independent variable, \(\ln (\text{Initial Income})_i\), measures the natural logarithm of real income per capita at the beginning of the period in state \(i\). \(\epsilon_i\) is the regression error term.

The logic of the Barro-type regression test of the convergence hypothesis is straightforward. If high-income states grow faster than low-income states, we expect a significantly negative sign on the estimated coefficient for \(\beta\). The results are reported in table 2.1 for four models that use the alternative measures of state growth described in chapter 1. These state growth rates are measured for the years 1969 through 1999, the period that income convergence appears to have ended based on the patterns in figures 2.1 and 2.2.

The first two columns in table 2.1 use the growth in real income

### TABLE 2.1. Barro-Type Test for State Income Convergence, 1969–99

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Growth in Income per Capita</th>
<th>Growth in Income per Worker</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continuously Compounded(^a)</td>
<td>Least Squares(^b)</td>
</tr>
<tr>
<td>ln (Initial Income)</td>
<td>-0.009</td>
<td>-0.005</td>
</tr>
<tr>
<td></td>
<td>(-3.85)**</td>
<td>(-1.38)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.104</td>
<td>0.063</td>
</tr>
<tr>
<td></td>
<td>(4.61)**</td>
<td>(1.83)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.27</td>
<td>0.05</td>
</tr>
<tr>
<td>F-statistic</td>
<td>14.71**</td>
<td>1.92</td>
</tr>
<tr>
<td>Number of observations</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

\(^a\)The continuously compounded growth rate is computed as \(\ln(X_{1999}/X_{1969}) / 30\), where \(\ln\) is the natural logarithm, \(X_{1999}\) is real income in 1999, \(X_{1969}\) is real income in 1969, and 30 is the number of years in the sample.

\(^b\)The least squares growth rate is computed by regressing the natural logarithm of income in each state on a linear time trend as follows:

\[ \ln (\text{Real Income per Capita}_t) = \text{Constant} + \beta_{\text{pc}} (\text{Time Trend}_{1969-99}) + u_t, \]
\[ \ln (\text{Real Income per Worker}_t) = \text{Constant} + \beta_{\text{pw}} (\text{Time Trend}_{1969-99}) + u_t, \]

where \(\ln\) refers to the natural logarithm, the subscript \(t\) refers to the value in each year, and \(u_t\) is the random error term. In this specification the estimated coefficients for \(\beta_{\text{pc}}\) and \(\beta_{\text{pw}}\) yield the annual growth rates.

* Indicates significance at the 5 percent level for a two-tailed test. ** Indicates significance at the 1 percent level for a two-tailed test.
per capita, and the second two columns use the growth in real income per worker. In both pairs of results, the two alternative measures of growth are examined, one computed by the continuously compounded method and the other by the least squares method.

The findings from the regression models provide conflicting evidence with respect to the income convergence thesis. The estimated coefficient for $\beta$ is negative and significant in the two models that use the continuously compounded growth rate in income. However, in the two models that use the least squares growth rate, the estimated coefficient for $\beta$ is not significantly different from zero. At this point the seemingly excessive attention to measurement issues becomes highly relevant. The studies by Watson (1992) and Easterly and Rebelo (1993) stress that the least squares growth rate is more robust to differences in the serial correlation properties of the data than the geometric or continuously compounded rate of growth. In other words, the only Barro-type model that supports the convergence thesis appears to be an artifact of the way the growth rate is measured. At a minimum, the findings in table 2.1 reveal that such evidence is not robust with respect to how one calibrates growth.

**Commentary**

The abrupt end to the process of income convergence in the American states begs explanation. In a neoclassical growth framework, regional income differences reflect opportunities that would encourage workers and firms to relocate in search of higher living standards and returns on investments. Why would these wealth-increasing opportunities remain untaken with open state borders and relatively low costs of relocation? One possibility is simply that such opportunities are too small to motivate further factor migration. That is, the convergence process petered out when the income differential among states fell to a point where it roughly equaled the costs of relocating. In essence, the geographic distribution of income among states reached equilibrium in the mid-1970s. A quick glance at the state income data in tables 1.6 and 1.7 casts doubt on this explanation. These data point to a number of interstate moves by which a worker could potentially increase his or her income by 20 percent or more. Such potential income gains would seem to exceed the cost of relocating.

Other possible explanations for the stalling of state income convergence lie in alternative growth theories. For example, the increasing returns to the knowledge model advanced by Paul Romer (1986) or the core-perimeter model by Krugman (1991) predict regional disparities
in income and income growth rates that can persist for extended periods. The absence of convergence clearly raises the potential relevance of such models to the modern state experience.

Subsequent chapters remain more or less within the neoclassical growth framework, with extensions and modifications that seem to account for the American state experience. Chapter 3 pursues the idea that factor migration is not driven solely by income differences; assessments of state economic risks play a significant role. Chapter 4 pursues the economic consequences of state fiscal policy. The basic idea is simply that tax policies determine after-tax incomes and rates of return and that after-tax differences among the states provide the relevant market signals. In other words, the standard neoclassical model of economic growth attributes most of long-term growth to the automatic forces of convergence. However, state policies exert an impact on that process by affecting underlying payoffs to productive factors.