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# Understanding Increasing *and* Decreasing Wage Inequality

Andrew B. Bernard and J. Bradford Jensen

## 7.1 Introduction

Consider two very similar economies (A and B) in 1970, sharing almost all the same markets for inputs and tradables. Economy A has a somewhat higher income per capita, an unemployment rate several points higher, and, most importantly, substantially lower wage inequality. Now move forward 20 years to 1990 and reconsider the same economies. The income gap has narrowed, but has not been eliminated, and the unemployment gap has remained, although both have higher levels. However, the paths of income inequality have been quite different. The formerly more unequal economy (B) has actually experienced a reduction of inequality over the period, while the initially low inequality economy (A) has seen such a large increase that their relative positions have been reversed.

This story does not fit the usual image of the evolution of income inequality during the 1970s and 1980s. A more common impression is that the increase has occurred throughout the U.S. economy and even throughout the industrialized world. This apparently common experience has actually frustrated empirical work into the sources of the overall increase in inequality as researchers have found few industries and few countries where the demand for less-skilled workers has increased.

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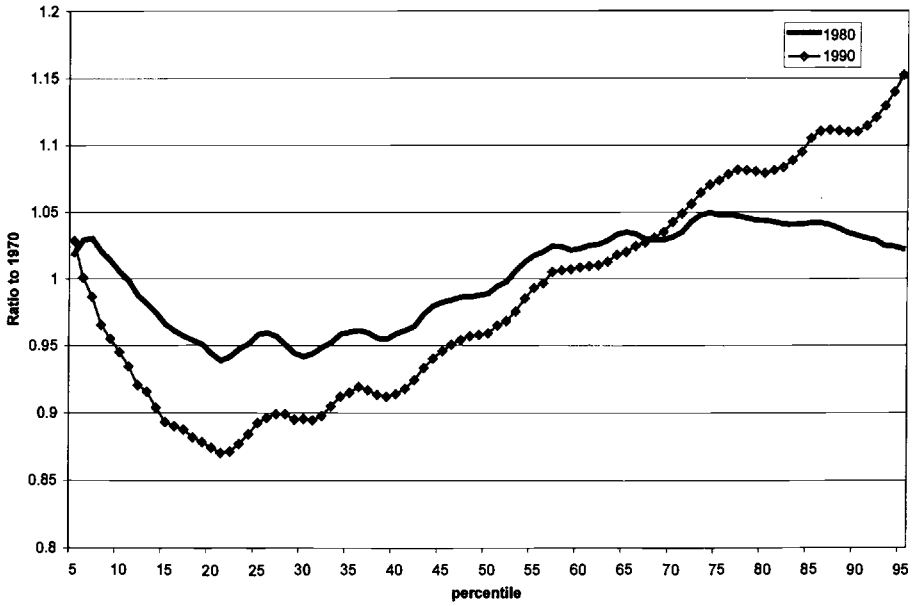


**Fig. 7.1 Changes in the distributions of log wages (centered moving average over 5 percentiles)**

The rise in wage inequality in the United States during the 1980s has been well documented (Levy and Murnane 1992). Figure 7.1 shows the change in log wages in 1980 and 1990 relative to 1970 for male workers from the 5th to the 95th percentiles in the distribution.[1] From 1970 to 1980, wage earners below the 53rd percentile lost ground relative to those above them. The largest relative declines occurred in the 15th to 40th percentiles, while the largest relative gains occurred in the 75th to 90th percentile range. In the 1980s, relative wages declined for the bottom two-thirds of the distribution, while rising sharply for the top wage earners. The relative wage movements remain very similar, even after controlling for observable characteristics such as education, race, location, and experience, as shown in figure 7.2.[2] The bottom half of the distribution declines, in relative terms, between 1970 and 1980, while fully 80 percent of the distribution suffered falling relative wages from 1980 to 1990.

These striking changes in relative wages have generated a large literature by way of explanation. Indeed, the search for culprits has now extended

1. The sample is described in section 7.2. The figure shows the relative wage change for a particular point in the wage distribution, not for an individual worker. The geometric means have been removed for all years. The change in the geometric mean was negative in the 1970s and positive in the 1980s.

2. Figure 7.2 plots the distribution of residuals from the regressions in table 7.3.

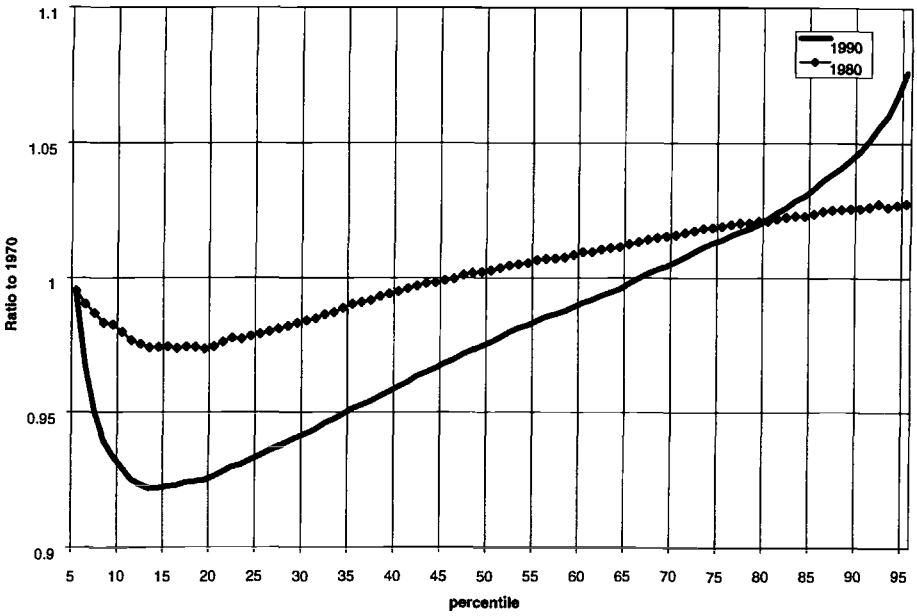


**Fig. 7.2 Changes in the distribution of residual wages**

worldwide and a growing body of papers has attributed rising unemployment in continental Europe to the same forces that are generating rising inequality in the United States and the United Kingdom (e.g., see Berman, Bound, and Machin 1997).[3]

Is it true that wage inequality increases have occurred throughout the industrialized world? Are there actually economies that experienced declines in wage inequality during this period? In this paper we argue that the rise in wage inequality has been far from uniform among a set of economies that are thought to have many more similarities than differences. In particular, examples of economies with declining inequality from 1970 to 1990 are close at hand: Virginia (−7.0 percent), North Dakota (−5.9 percent), North Carolina (−4.0 percent), Hawaii (−4.0 percent), Georgia (−3.9 percent), Mississippi (−2.8 percent), and South Carolina (−1.3 percent). Economies with dramatically rising inequality over the same period include Oregon (24.5 percent), Wyoming (23.2 percent), Michigan (21.9 percent), New York (20.8 percent), and Pennsylvania (20.5 percent).[4]

3. These authors point to inequality increases in some less-developed countries as further evidence of the worldwide aspect of this phenomenon.

4. The inequality measure is the 90-10 difference in log real wages after controlling for education, experience, race, and other characteristics. The numbers are the changes in the 90-10 difference from 1970 to 1990.

We argue that any theory of the rise in income inequality in the United States as a whole should also be capable of explaining the wide variety of outcomes across individual states. In this paper we revisit the debate over the sources of the increase in wage inequality in the United States by focusing on the evolution of inequality in different labor markets. Prior research on inequality has almost always assumed that workers can be pooled across regions in an attempt to identify sources of the increase in relative demand for skilled workers.[5] A key element in our analysis is the extent of integration of U.S. labor markets. If shocks to regions are transmitted quickly throughout the economy, then regional labor markets will provide little additional information in the search for the causes of increasing wage inequality. However, if shocks to regional labor demand (and supply) are only slowly transmitted to the rest of the economy, then we can use them to identify important sources of the increases in wage inequality.

The large literature on wage inequality has identified a set of potential culprits. These typically include (roughly in order of prominence in the literature) skill-biased technological change (Bound and Johnson 1992; Katz and Murphy 1992; Berman, Bound, and Griliches 1994), international trade (Borjas and Ramey 1994, 1995; Wood 1995), immigration (Topel 1993), and labor market institutions such as unions and minimum wage changes (DiNardo, Fortin, and Lemieux 1996; Fortin and Lemieux 1997). One difficulty that previous researchers have encountered is the apparently ubiquitous rise in inequality both within and between groups of workers and industries. This has led to a general consensus among researchers that changing demand across industries, with the possible exception of international trade, has not played a significant role in the rise in wage differentials.[6] Examples of these conclusions appear frequently in the literature on wage inequality:

> It is clear that not very much of the wage changes of the 1980's can be explained . . . by changes in the industrial wage structure or in the incidence of unionism. It is necessary to focus . . . on changes in relative competitive wage levels. (Bound and Johnson 1992, 380)

> Measured changes in the allocation of labor demand between sectors . . . can account for a large minority of the secular demand shifts in

5. Bound and Holzer (1996) also use the PUMS from the Decennial Census to examine the importance of regional shocks on college/high school and black/white wage differentials. They find important effects from local demand shocks as well as supply effects from migration at the top end of the wage distribution. Additional work using regional data to examine inequality include Topel (1993) and Borjas and Ramey (1995). The former uses broad regional measures to discuss the impact of immigration on wages. The latter uses wage data on metropolitan areas to assess the effect of foreign competition on the returns to education.

6. Based on anecdotal evidence (questioning economists at conferences), we have found widespread, if not universal, agreement with the proposition that cross-industry effects are not a significant source of increased inequality. However, it is hard to get individual researchers to identify the citations that are the basis for this opinion.

> favor of groups with rising relative wages. . . . The majority of the required demand shifts in favor of more-educated workers and females reflect difficult to measure changes in within-sector relative labor demand. (Katz and Murphy 1992, 76)
>
> . . . we find that less than one-third of the shift of employment from production to non-production workers can be accounted for by "between-industry" shifts. . . . (Berman, Bound, and Griliches 1994, 368)

In their survey article, Levy and Murnane conclude emphatically: "However, the plight of young, less educated males cannot be viewed primarily as a consequence of deindustrialization. Declines in the relative demand for less educated workers occurred within industries—most dramatically within manufacturing where semiskilled jobs declined at a much faster rate than overall manufacturing employment" (1992, 1372).

Subsequent research has often started from the assumption that industry-level changes in demand are at best small contributors to the overall rise in inequality. However, almost all of the previous work on the inequality rise has focused on the longitudinal aspects of any given data set and ignored variations across geographic units.

Why have economists concluded that changing industry mix, and in particular the loss of manufacturing jobs, was not a major factor in the inequality rise? Research on the rise in inequality has been quite careful about creating appropriate groups by worker characteristics (industry, occupation, education, experience, race, and sex) with the notable exception of location. Katz and Murphy (1992), in their highly influential paper on the topic, divide workers into 12 industries, three occupations, and eight gender-education groups. All these, however, make no distinction for the location of the individual—an appropriate assumption if wages and employment are determined by national integrated labor markets.

In this paper, we construct measures of inequality for each state in the United States. While the identification of individual states with separate labor markets is not ideal,[7] the extent to which individual states experience distinct shocks to the labor market will allow us to identify the importance of those shocks in the widening of the income distribution. One caveat concerns aggregate shocks that do not differ across states. Krugman (1995) and Berman, Bound, and Machin (1997) argue that skill-biased technological change has been pervasive, both within countries and across countries. In our approach, we will miss aggregate shocks that move the wage distribution homogeneously across states.

We concentrate on a set of guiding questions. Does the level of wage

7. Identifying Connecticut as a distinct labor market from those in New York, Massachusetts, or Rhode Island is not correct. This distinction is perhaps still preferable to assuming that the market for labor in Connecticut is integrated with Georgia, Arizona, and so on.

dispersion vary across regions? Are increases in inequality uniform across states? Are increases in inequality proportional to initial inequality? Does this heterogeneity across regions allow us to identify the sources of rising inequality?

The plan for the paper is quite simple. We start by assessing the assumption that regional labor markets are not well integrated, at least in the short or medium term. Then, we provide evidence on the large variation in inequality of both returns to observable characteristics such as education and residual wage inequality (unobservable characteristics) across states at any point in time. We then document the variation in the changes of state residual wage inequality from 1970–90 and attempt to associate these movements with common explanations for the inequality rise.

## 7.2 Evidence on the Integration of U.S. Labor Markets

A key assumption we will maintain in searching for causes of the rise in wage inequality is that labor markets in the United States are integrated only in the long run. There is little recent research on the extent of the integration of labor markets across regions in the United States. Blanchard and Katz (1992) consider the consequences of state-specific shocks on the paths of unemployment, wages, and migration over various time horizons. While their conclusions support the argument that labor markets are integrated in the long run (beyond 10 years), there are substantial disturbances to local labor markets in the short and medium term. Blanchard and Katz find that the effects of an employment shock on the unemployment rate peak at 2 years and are completely dissipated after 6 years. Wages show a more persistent response with the maximal decline occurring 6 years after a negative employment shock and some effects lingering for more than 10 years.

We provide two additional pieces of evidence on the integration of regional labor markets. First, we calculate the returns to different levels of education in each state. Strongly integrated state labor markets should not display large, persistent differentials in education returns. Next, we estimate the relative impact of regional and industry employment shocks to plant-level wages. If integration fails in the near term, we hypothesize that regional employment shocks should have a stronger and more immediate impact on wages than industry shocks.

### 7.2.1 Persistence of Education Premia

For our state-level analyses, the data on wages come from the Public Use Micro Samples (PUMS) from the Decennial Censuses of 1970, 1980, and 1990. The samples of the population available for those years are 1 percent, 5 percent, and 5 percent, respectively. We restrict our attention to

the real weekly wages of nonimmigrant adult males, ages 18–65 inclusive, employed 14 weeks or more during the year and not self-employed. We use a simple wage regression, estimated separately for each state for each year.[8]

$$(1)\quad \ln WW = f(g(\text{experience}), \text{race, education, weeks worked, location}),$$

where $g(\cdot)$ is a quartic in experience and there are two dummy variables for race (black and Hispanic) and four for education (no high school degree, some college, college degree, advanced degree [6+ years of tertiary education]). The location variable is a dummy for residents outside a standard metropolitan statistical area (SMSA).

The education premia are percentage differences from the wages of a male worker with a high school degree in the same state and are reported in table 7.1. The premia show substantial heterogeneity across states. In 1970, workers with a college degree, on average, earned 55 percent more than high school graduates in South Dakota, but only 28 percent more in Utah. The mean state wage premium for a college degree in 1970 was 43 percent and the standard deviation across states was 5.9 percent. Similarly, in 1970, the negative effect of not finishing high school ranged from −11 percent in Nevada to −34 percent in Tennessee.

In 1990, education premia continued to show substantial dispersion across states. The wage premium for a college degree ranged from 27 percent in Wyoming to 52 percent in Texas. The mean and standard deviation across states were 43 percent and 6.2 percent, respectively. The range of premia across states was substantial for all levels of education for all years, suggesting that, at any time, regional labor markets support very different relative returns to education.

The existence of different education premia in any year might be explained by temporary shocks to the regional labor markets. However, the premia are also quite persistent over time. Correlations across decades typically range from 0.5 to 0.8.[9] Except for the "some college" category, all the education premia show significant positive correlations over time. Figures 7.3 and 7.4 show the "advanced degree" and "no high school degree" premia. This evidence suggests that even during 10- or 20-year intervals, labor markets in different states do not adjust to equate the returns to education.[10]

8. Our specification of the log wage regression follows that often employed in the literature on inequality (see Juhn, Murphy, and Pierce 1993; Gottschalk 1997).

9. The single exception is "some college," where the correlation was 0.04 between 1970 and 1980. This result is driven largely by Wyoming and Alaska.

10. One objection to this interpretation is that the variation in state education premia merely reflects the quality of education provided in the state, which is itself persistent over time.

**Table 7.1** **Education Premia by State (%)**

| | No High School Diploma | | | Some College | | | College Degree | | | Advanced Degree (6+ years) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State | 1990 | 1980 | 1970 | 1990 | 1980 | 1970 | 1990 | 1980 | 1970 | 1990 | 1980 | 1970 |
| AK | −20.5 | −18.9 | −27.2 | 10.5 | 17.2 | 9.4 | 35.9 | 37.5 | 39.2 | 51.4 | 47.7 | 50.2 |
| AL | −27.2 | −28.5 | −27.7 | 9.0 | 5.9 | 11.7 | 48.7 | 37.6 | 48.9 | 60.4 | 46.6 | 55.1 |
| AR | −23.5 | −26.0 | −28.8 | 10.2 | 9.2 | 12.7 | 46.4 | 38.9 | 48.4 | 58.8 | 39.4 | 56.5 |
| AZ | −22.2 | −25.4 | −18.2 | 12.7 | 5.2 | 9.8 | 48.7 | 32.2 | 37.8 | 67.7 | 41.4 | 37.4 |
| CA | −28.1 | −23.4 | −16.7 | 12.3 | 8.3 | 12.9 | 45.3 | 34.5 | 41.6 | 66.7 | 44.7 | 49.9 |
| CO | −20.5 | −19.7 | −19.7 | 10.0 | 7.3 | 10.0 | 46.4 | 36.0 | 38.4 | 65.6 | 41.2 | 47.0 |
| CT | −21.3 | −20.2 | −16.5 | 9.9 | 8.4 | 13.2 | 48.2 | 44.5 | 52.2 | 65.2 | 55.8 | 56.3 |
| DC | −18.2 | −21.5 | −24.1 | 8.9 | 7.2 | 8.2 | 54.2 | 49.7 | 42.2 | 82.7 | 71.8 | 59.3 |
| DE | −23.3 | −21.8 | −22.6 | 9.8 | 6.2 | 11.1 | 47.3 | 45.7 | 49.2 | 64.3 | 54.3 | 72.9 |
| FL | −21.4 | −20.6 | −19.7 | 13.6 | 8.5 | 12.1 | 50.1 | 38.3 | 44.2 | 67.3 | 50.3 | 55.4 |
| GA | −25.8 | −29.1 | −27.5 | 13.9 | 9.5 | 14.1 | 50.0 | 40.9 | 43.5 | 61.0 | 46.8 | 47.5 |
| HI | −20.7 | −20.8 | −24.7 | 8.8 | 8.6 | 16.7 | 38.9 | 38.9 | 47.4 | 57.9 | 51.7 | 64.2 |
| IA | −25.7 | −18.1 | −17.7 | 7.6 | 8.3 | 6.6 | 38.3 | 31.4 | 41.4 | 53.8 | 31.7 | 34.2 |
| ID | −24.2 | −19.1 | −15.6 | 3.4 | 4.5 | 16.8 | 33.6 | 26.8 | 36.8 | 51.9 | 34.1 | 53.6 |
| IL | −21.8 | −20.7 | −20.0 | 11.0 | 7.1 | 9.1 | 46.8 | 31.6 | 40.1 | 62.6 | 36.5 | 46.0 |
| IN | −24.6 | −23.7 | −21.0 | 9.8 | 6.0 | 10.8 | 43.9 | 31.1 | 42.1 | 55.7 | 29.6 | 34.4 |
| KS | −23.4 | −19.4 | −18.3 | 7.4 | 7.6 | 13.3 | 43.4 | 34.7 | 47.2 | 59.3 | 35.4 | 42.6 |
| KY | −27.8 | −27.5 | −29.3 | 10.6 | 6.8 | 4.8 | 46.9 | 32.6 | 40.7 | 58.0 | 34.0 | 38.8 |
| LA | −28.7 | −27.1 | −22.4 | 5.4 | 7.4 | 10.4 | 39.7 | 33.5 | 42.4 | 51.5 | 33.0 | 44.9 |
| MA | −22.9 | −22.6 | −21.8 | 9.1 | 8.7 | 10.8 | 44.0 | 39.1 | 44.9 | 59.8 | 51.1 | 52.1 |
| MD | −22.2 | −23.8 | −26.7 | 10.9 | 6.9 | 9.5 | 47.4 | 40.9 | 45.4 | 64.1 | 54.4 | 59.1 |
| ME | −22.2 | −20.2 | −20.4 | 7.9 | 9.2 | 13.0 | 38.4 | 34.4 | 47.0 | 50.7 | 42.9 | 62.1 |
| MI | −19.7 | −18.4 | −17.4 | 12.4 | 9.2 | 6.8 | 43.5 | 31.9 | 36.7 | 58.5 | 37.8 | 35.1 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MN | −23.2 | −19.5 | −19.9 | 10.4 | 7.2 | 9.7 | 42.6 | 32.6 | 42.4 | 60.1 | 39.8 | 40.9 |
| MO | −23.8 | −22.6 | −20.2 | 9.0 | 7.7 | 12.1 | 44.2 | 34.0 | 43.9 | 62.0 | 37.7 | 39.8 |
| MS | −25.1 | −27.0 | −28.3 | 9.8 | 7.8 | 8.5 | 40.5 | 34.7 | 34.3 | 55.3 | 39.4 | 42.2 |
| MT | −23.1 | −17.5 | −21.2 | 2.5 | 3.3 | 8.4 | 29.3 | 22.3 | 31.2 | 46.0 | 29.3 | 36.1 |
| NC | −24.5 | −25.2 | −26.6 | 12.1 | 9.8 | 15.0 | 50.2 | 44.0 | 53.7 | 61.8 | 50.4 | 50.3 |
| ND | −20.3 | −12.4 | −27.5 | 5.9 | 9.6 | 8.4 | 40.0 | 34.1 | 46.1 | 52.3 | 31.9 | 50.9 |
| NE | −24.2 | −26.8 | −21.8 | 9.3 | 8.9 | 8.5 | 41.5 | 35.4 | 39.6 | 55.6 | 34.9 | 43.6 |
| NH | −17.5 | −23.5 | −18.8 | 12.8 | 8.5 | 14.0 | 42.2 | 35.7 | 39.8 | 59.0 | 43.3 | 36.7 |
| NJ | −20.2 | −20.7 | −21.6 | 13.3 | 8.9 | 12.3 | 48.2 | 41.2 | 44.6 | 66.0 | 54.6 | 55.9 |
| NM | −24.3 | −20.9 | −24.7 | 10.9 | 6.0 | 10.0 | 45.6 | 34.8 | 44.5 | 71.0 | 47.4 | 60.8 |
| NV | −16.5 | −15.0 | −10.7 | 7.5 | 8.1 | 13.6 | 35.4 | 29.7 | 49.7 | 58.8 | 41.3 | 52.1 |
| NY | −24.8 | −23.2 | −21.9 | 14.4 | 10.3 | 11.5 | 50.0 | 39.2 | 47.9 | 67.8 | 52.9 | 57.0 |
| OH | −22.8 | −22.1 | −18.3 | 9.9 | 5.8 | 11.2 | 46.6 | 31.6 | 41.4 | 61.3 | 35.4 | 43.9 |
| OK | −23.5 | −22.3 | −24.3 | 10.3 | 7.3 | 12.7 | 45.5 | 37.2 | 41.9 | 60.9 | 39.1 | 46.3 |
| OR | −19.5 | −16.0 | −18.9 | 7.9 | 3.5 | 6.1 | 33.9 | 24.4 | 33.6 | 52.6 | 25.9 | 32.5 |
| PA | −20.0 | −19.9 | −17.9 | 12.3 | 7.1 | 10.3 | 49.2 | 36.1 | 48.8 | 67.1 | 45.4 | 51.9 |
| RI | −21.7 | −23.8 | −22.8 | 9.2 | 4.3 | 8.5 | 42.7 | 35.3 | 36.2 | 58.1 | 47.1 | 53.6 |
| SC | −25.8 | −24.9 | −27.7 | 10.9 | 7.7 | 5.2 | 46.8 | 39.7 | 45.0 | 55.7 | 49.4 | 30.5 |
| SD | −22.8 | — | −24.2 | 5.9 | — | 16.1 | 39.4 | — | 55.3 | 52.8 | — | 41.4 |
| TN | −27.9 | −30.4 | −34.5 | 12.7 | 9.0 | 8.4 | 49.2 | 39.5 | 45.2 | 64.9 | 44.6 | 43.8 |
| TX | −27.1 | −25.0 | −25.2 | 13.2 | 7.8 | 10.7 | 52.4 | 38.8 | 42.6 | 66.9 | 38.4 | 47.1 |
| UT | −26.4 | −13.9 | −20.5 | 3.9 | 4.5 | 3.7 | 31.5 | 26.1 | 27.9 | 54.7 | 31.0 | 32.3 |
| VA | −25.5 | −26.2 | −30.0 | 11.7 | 9.1 | 15.3 | 50.4 | 42.8 | 52.4 | 67.4 | 57.5 | 61.9 |
| VT | −24.0 | −30.0 | −23.1 | 9.0 | 8.6 | 6.0 | 30.4 | 31.8 | 35.4 | 44.8 | 42.3 | 52.0 |
| WA | −22.8 | −14.3 | −14.0 | 7.2 | 7.8 | 9.7 | 37.6 | 28.7 | 42.8 | 51.5 | 33.7 | 43.4 |
| WI | −24.1 | −18.9 | −14.7 | 8.2 | 4.7 | 9.0 | 39.3 | 28.4 | 36.4 | 56.5 | 32.2 | 32.1 |
| WV | −24.3 | −26.1 | −26.8 | 8.5 | 4.5 | 5.5 | 40.4 | 30.9 | 32.6 | 53.0 | 32.5 | 47.5 |
| WY | −21.5 | −13.0 | −12.7 | 5.4 | 3.9 | 24.3 | 27.0 | 22.6 | 48.6 | 40.6 | 21.9 | 46.1 |

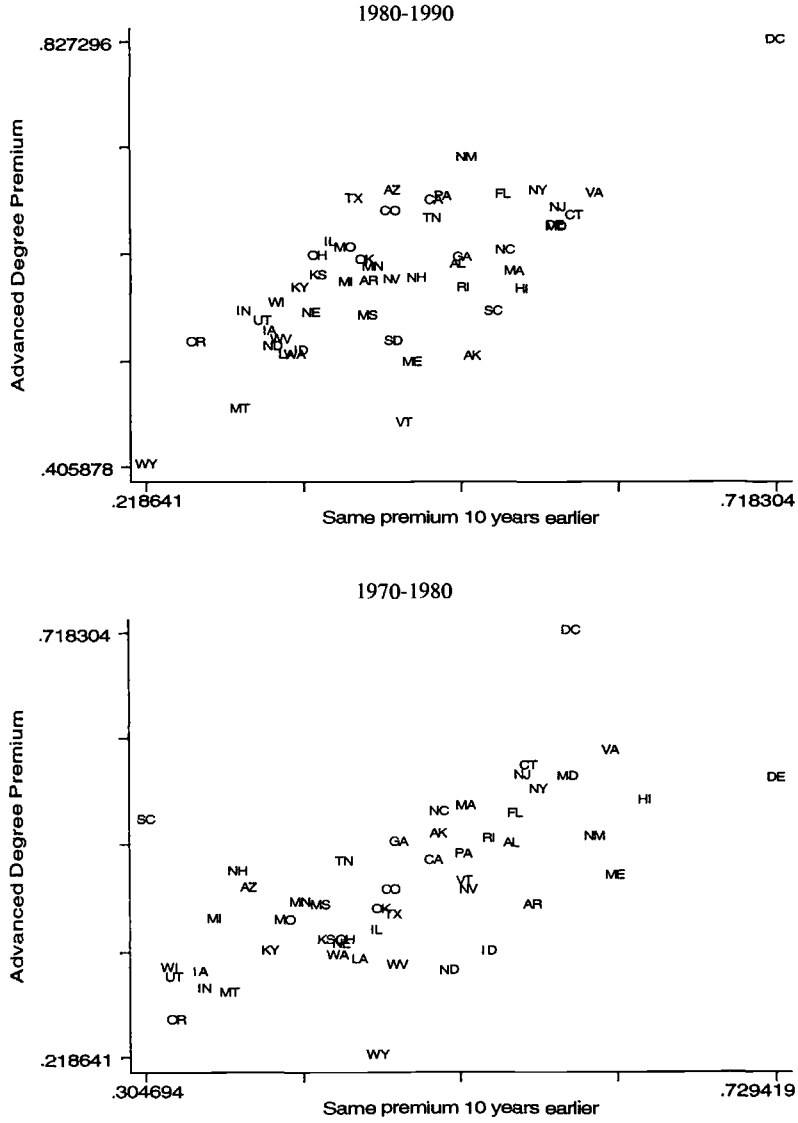


**Fig. 7.3 Persistence of advanced degree premium**

### 7.2.2 State and Industry Employment Shocks

We use plant-level data from the manufacturing sector to explore whether industry or regional employment shocks have a greater impact on wages. We make use of the plant-level data from the Annual Surveys of Manufactures (ASM) from 1972 to 1987, which cover wages and employment and include approximately 50,000 plants each year. We estimate an equation of the form

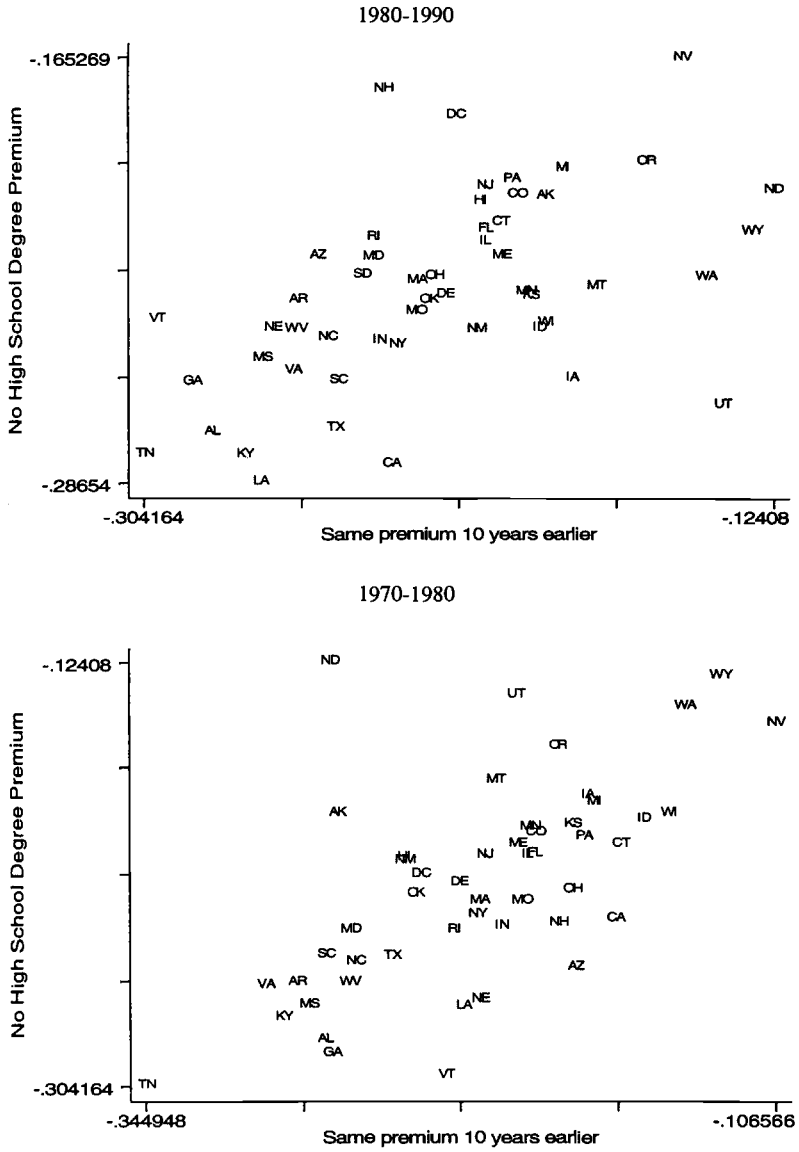


**Fig. 7.4 Persistence of no high school degree premium**

$$(2) \qquad \Delta \ln w_{ispt} = d_t + A(L)\Delta \ln N_{i,\notin s,t} + B(L)\Delta \ln N_{\notin i,s,t} + \varepsilon_{ispt},$$

where $\Delta \ln w_{ispt}$ is the percentage change in wages at plant $p$ in (two-digit) industry $i$ in state $s$ from time $(t-1)$ to $t$; $\Delta \ln N_{i,\notin s,t}$ is the change in employment in the industry outside the state; $\Delta \ln N_{\notin i,s,t}$ is the change in employment in the state outside the industry; $d_t$ is a vector of time dum-

mies; and $\varepsilon_{ispt}$ captures all other shocks to the plant. We include nine annual lags of the employment changes to allow for slow adjustment of wages. The dependent variable is the percentage change in the average real wage per worker at the plant less the average change across all plants. For each plant, the state employment shocks are constructed as the percentage change in employment in the state outside the two-digit-level industry of the plant. Similarly the industry shock is the percentage change in employment in the same two-digit-level industry outside the state. Both types of employment shocks are adjusted to be mean 0 in given year.

In using this specification, we are making the assumption that shocks to individual plants are small relative to the labor market as a whole. In addition, we are assuming that annual changes in the wage are driven exclusively by shocks to labor demand. If, as we suspect, labor-demand shocks to the region regardless of industry are relatively more important than nationwide industry labor-demand shocks, we should expect to see larger coefficients on recent lags of the state employment changes, and lower, delayed responses to industry employment changes.

The results for the regression are presented in table 7.2 and the cumulative effect of a 1 percent negative employment change is shown in figure 7.5. The response path for the two types of wage shocks is quite different and in accord with the prediction that regional labor markets clear much more quickly than national labor markets. Wages immediately fall more than twice as much in response to a state employment shock than an industry shock. The wage response to a 1 percent decrease in state employment peaks at 0.21 percent after 3 years before gradually diminishing. Industry shocks are fully felt only after 8 years. The response of plant wages confirms our hypothesis that labor markets clear only locally in the short run and that shocks are transmitted nationally only after long delays.[11]

In this section, we have assembled evidence that state labor markets are not well integrated in the short or medium term. The persistence of regional employment shocks on relative wages, the magnitude and persistence of the state education premia, and the relative importance of regional rather than industry shocks to employment on local wages all lead us to conclude that shocks to state labor markets will have important effects on the level and distribution of wages.

## 7.3 Returns to Observable Characteristics

The literature on rising wage inequality has identified several distinct trends in the data. As noted by numerous authors, the overall increase in wage dispersion consists of at least two distinct phenomena. One is the increase in returns to observable worker characteristics such as experience

11. We have also run the plant-wage regressions including shock to the own-industry state. The results do not change.

**Table 7.2** **Response of Plant Wages to Employment Shocks**

| | Dependent Variable: Change in Plant Average Wages ($t-1$ to $t$) (%) | | |
|---|---|---|---|
| | Coefficient | $t$-statistic | $p$ |
| State employment change | | | |
| $t$ | 0.0714 | 4.72 | 0.0001 |
| $t-1$ | −0.0063 | −0.39 | 0.6981 |
| $t-2$ | 0.0528 | 3.47 | 0.0005 |
| $t-3$ | 0.0926 | 6.82 | 0.0001 |
| $t-4$ | −0.0674 | −4.58 | 0.0001 |
| $t-5$ | 0.0101 | 0.67 | 0.5023 |
| $t-6$ | −0.0818 | −5.39 | 0.0001 |
| $t-7$ | 0.0483 | 3.25 | 0.0012 |
| $t-8$ | −0.0665 | −4.00 | 0.0001 |
| $t-9$ | −0.0245 | −1.32 | 0.187 |
| Industry employment change | | | |
| $t$ | 0.0272 | 3.49 | 0.0005 |
| $t-1$ | −0.0066 | −0.80 | 0.4222 |
| $t-2$ | 0.0121 | 1.44 | 0.149 |
| $t-3$ | 0.0159 | 2.06 | 0.0397 |
| $t-4$ | 0.0325 | 3.45 | 0.0006 |
| $t-5$ | 0.0195 | 2.13 | 0.0329 |
| $t-6$ | 0.0250 | 2.43 | 0.0152 |
| $t-7$ | 0.0399 | 4.01 | 0.0001 |
| $t-8$ | 0.0259 | 2.56 | 0.0104 |
| $t-9$ | −0.0232 | −1.65 | 0.0998 |

*Notes:* State employment change is the percentage change in employment in the state excluding the industry. Industry employment change is the percentage change in employment in the industry outside the state. All changes are normalized to be mean 0 in every year.

and education. The second is the dramatic rise in within-group inequality, called returns to skill. In the rest of this paper, we concentrate almost exclusively on the increase in the returns to unobserved skill and leave aside the issue of the increasing returns to education. Since, by definition, skill is not directly observable, we follow others in the labor literature (see Juhn, Murphy, and Pierce 1993; Gottschalk 1997) and calculate the returns to skill as the residual from a standard wage regression.

We again estimate the wage regression separately for the 3 census years, pooling the data across states, but allowing for variation in state mean wages.[12] The wage regression is of the form given in equation (1) and the results are given in table 7.3.[13]

12. This might seem odd after our discussion of the magnitude of state education premia. However, none of the results on residual wage inequality are sensitive to whether we estimate individual state regressions or a pooled national regression.

13. Allowing for interaction terms between the experience function and other variables did not change the results on residual inequality.

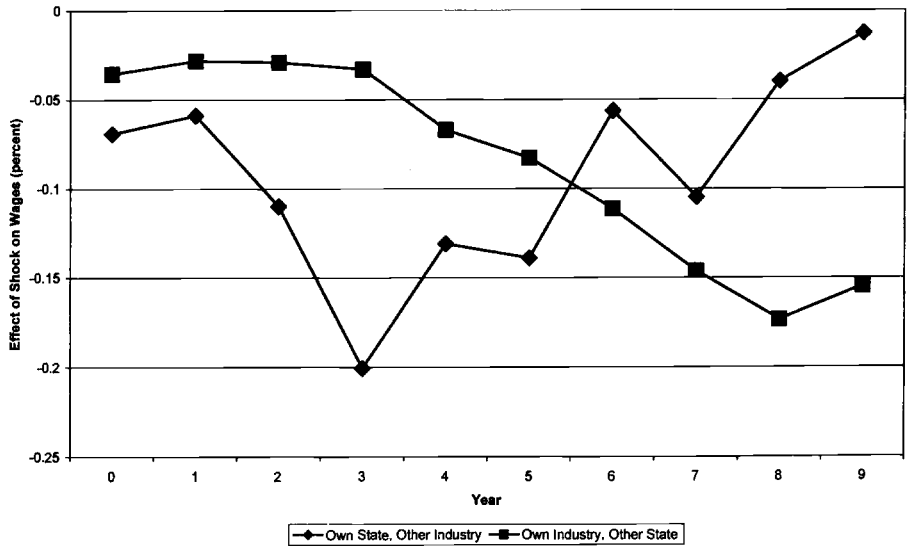


**Fig. 7.5 Response of plant wages to regional and industry employment shocks (cumulative effect of a 1 percent decline in employment)**

The well-known pattern of returns to observable characteristics is evident in these regressions. In 1970, relative to high school graduates, men without high school diplomas earned almost 22 percent less, while college-degree holders earned almost 44 percent more. Men with some college earned a more modest wage premium of 11 percent, while individuals who acquired additional tertiary education gained on average an extra 5 percent above college-degree holders. Observables explain 31 percent of the overall variation in log wages in 1970.[14]

In general, the 1980 results confirm prior research and show a modest decline in the premium for tertiary education relative to high school–diploma holders, as well as a slight worsening of the relative position of men without high school diplomas. By 1990, however, the returns to education had changed significantly. The wages for men without a high school diploma had decreased further, while the returns to a college degree rose over 10 percent, and the returns for further tertiary education had jumped almost 20 percent. In 1990 observable characteristics explained 40 percent of overall wage variation, a sizable increase from both 1970 and 1980.

14. Throughout this paper, we restrict our discussion to the education variables among observable characteristics.

**Table 7.3** **Wage Regressions (log real weekly wages)**

| Variable | 1970 | 1980 | 1990 |
|---|---|---|---|
| Intercept | −0.157*** | −5.70e-6 | −4.70e-6 |
| | (26.00) | (0.013) | (0.012) |
| Black | −0.325*** | −0.262*** | −0.206*** |
| | (98.55) | (167.20) | (138.81) |
| Hisp | −0.227*** | −0.205*** | −0.161*** |
| | (33.48) | (107.66) | (118.45) |
| Exp | 0.161*** | 0.142*** | 0.155*** |
| | (176.70) | (348.86) | (357.82) |
| Exp2 | −8.28e-3*** | −7.39e-3*** | −7.72e-3*** |
| | (107.90) | (201.65) | (207.81) |
| Exp3 | 1.83e-4*** | −1.72e-4*** | −1.74e-4*** |
| | (77.67) | (145.04) | (149.34) |
| Exp4 | −1.49e-6*** | −1.50e-6*** | −1.50e-6*** |
| | (62.98) | (119.73) | (122.52) |
| Nohsd | −0.218*** | −0.231*** | −0.248*** |
| | (91.61) | (189.26) | (205.27) |
| Somecoll | 0.109*** | 0.078*** | 0.112*** |
| | (38.28) | (68.47) | (113.67) |
| BA | 0.436*** | 0.359*** | 0.463*** |
| | (122.51) | (253.57) | (383.99) |
| Advdeg | 0.485*** | 0.438*** | 0.631*** |
| | (103.75) | (249.52) | (411.41) |
| Weekwrk | 3.27e-3*** | 5.95e-3*** | 10.09e-3*** |
| | (26.28) | (118.27) | (223.23) |
| Nonmetro | −0.101*** | −0.090*** | −0.108*** |
| | (43.15) | (75.07) | (101.24) |
| $N$ | 406,536 | 2,094,208 | 2,223,036 |
| $R^2$ | 0.31 | 0.30 | 0.40 |

*Note:* State dummies included. Numbers in parentheses are $t$-statistics.
***Significant at the 1 percent level.

## 7.4 Residual Wage Inequality: The Nation

While the regressions in table 7.3 show part of the story of the increase in inequality, the bulk of the variation in wages remains unexplained by observable worker characteristics. Increasing returns to education explain only part of the overall increase in wage inequality. From the regressions, we calculate the distribution of the wage residual and consider the changes in the distribution over the period. We consider three measures of the residual distribution of log weekly wages, the 90-10 wage differential, the 90-50 wage differential, and the 50-10 wage differential.

The first half of table 7.4 reports the levels and changes in those measures for the 3 years and two intervals from the pooled national regression. Given the large literature on the increase in within-group inequality, it is not sur-

Table 7.4 Changes in Residual Wage Inequality

| | 1970 | | 1980 | | 1990 |
|---|---|---|---|---|---|
| | | | *Pooled National Regressions* | | |
| 90–10 ratio | 1.164 | | 1.209 | | 1.282 |
| Change | | 0.045 | | 0.073 | |
| 90–50 ratio | 0.512 | | 0.535 | | 0.582 |
| Change | | 0.023 | | 0.047 | |
| 50–10 ratio | 0.652 | | 0.675 | | 0.701 |
| Change | | 0.023 | | 0.026 | |
| | | | *Separate State Regressions* | | |
| 90–10 ratio | 1.151 | | 1.202 | | 1.275 |
| Change | | 0.051 | | 0.073 | |
| 90–50 ratio | 0.507 | | 0.531 | | 0.579 |
| Change | | 0.024 | | 0.048 | |
| 50–10 ratio | 0.643 | | 0.671 | | 0.697 |
| Change | | 0.028 | | 0.026 | |

prising that we also find a large increase in residual wage inequality as measured by the 90-10 differential in the 1970s (4.5 percent), and especially in the 1980s (7.3 percent).[15] Changes in the 1970s are split evenly between increases at the top and bottom, while during the 1980s increases in inequality at the top half of the distribution were twice as large as those in the bottom half.

In the second half of table 7.4, we compute our three residual inequality measures after allowing all the returns to observable characteristics to vary across states. This specification lets us see how much of the increase in inequality is due to state-specific changes in the returns to age, education, and so on. Allowing the returns to individual characteristics to vary across states does reduce residual wage inequality for the country as a whole. However, the magnitude of the reduction is quite small and the changes over time are unaffected. For the remainder of the paper, we consider only the distribution from the pooled regression.

## 7.5 Residual Wage Inequality: The States

Thus far we have confirmed the rise in returns to education over time as well as the increase in residual inequality at the national level during both the 1970s and the 1980s. However, in section 7.2, we argued that while regional labor markets are integrated over long horizons, they display substantial evidence of segregation in the short and medium run. To use the information on individual states, we construct measures of the 90-10 differential for every state (plus the District of Columbia) in each of

15. These increases are somewhat smaller than those reported elsewhere (e.g., Katz and Murphy 1992). This difference is most likely due to the fact that we allow the coefficients on individual characteristics to vary over time.

our 3 years (see table 7.5). While the national 90-10 differential was 1.164 in 1970, the same measure for the states ranged from 1.013 in Connecticut to 1.188 in Oklahoma (the median state) to 1.369 in Louisiana and a phenomenal 1.634 in Alaska. The average state 90-10 difference was 1.195 with a cross-state standard deviation of 11.4 percent.

The figures for 1980 and 1990 show similar heterogeneity across states. In 1980, residual inequality ranged from 1.086 in New Hampshire to 1.215 in Utah (median) to 1.603 in Alaska. The state mean had increased to 1.222 with a drop in the standard deviation to 9.1 percent. Ten years later, the average 90-10 differential had increased dramatically to 1.274 and the dispersion remained relatively unchanged (8.3 percent). As with the education premia, the returns to unobserved skill varied widely across states in every year.

### 7.5.1 Increasing and Decreasing Inequality

The variation in the levels of inequality across states dwarfs the changes in national inequality over time. In any of the 3 years, a large number of states have 90-10 differentials substantially above or below the national average. In addition, states follow very different paths over time both in terms of levels and rankings. Georgia starts with the 9th highest level of inequality in 1970, but by 1990 Georgia ranks 32nd and inequality has fallen almost 4 percent in the state. In contrast, New York moves 25 places from 15th lowest to 12th highest with an increase of more than 20 percent in the 90-10 differential. In fact, the changes in state wage inequality show at least as much heterogeneity as the levels themselves.

While there is no doubt that residual inequality was rising at the national level during the 1970s, 18 states actually experienced a decline in inequality during the decade (see table 7.6). At the other extreme, 6 states had inequality increases at twice the national rate. Even during the 1980s, a time of dramatically increasing inequality for the country as a whole (7.3 percent), 2 states saw inequality decrease, and 7 others had increases of less than 3 percent. In fact, 36 states had slower inequality increases than the nation. For the entire 20-year period, while the national 90-10 residual increased over 11 percent, 7 states had net declines in inequality. The locations of states with the highest and lowest inequality changes can be seen clearly in figure 7.6. In both decades, states with larger black circles, representing those with the largest rises in inequality, are geographically clustered around the Great Lakes. On the other hand, the states with the lowest inequality rises, or decreases, are more likely to be in the Southeast.

Increases in inequality are correlated in the 1970s and 1980s. States with higher-than-average inequality increases in the first decade were more likely to also have above-average increases in the 1980s (see fig. 7.7), but they explain only 27 percent of the overall variation in state inequality growth in the 1980s.

**Table 7.5** **Wage Inequality 90-10 Differentials**

| State | 1970 | State | 1980 | State | 1990 |
|---|---|---|---|---|---|
| CT | 1.01310 | NH | 1.08611 | NH | 1.12899 |
| PA | 1.02655 | RI | 1.11204 | RI | 1.15529 |
| WI | 1.04326 | CT | 1.11629 | VT | 1.15984 |
| ME | 1.04486 | PA | 1.12144 | CT | 1.16751 |
| OH | 1.05025 | OH | 1.12743 | MD | 1.16879 |
| IN | 1.05591 | WI | 1.13308 | DE | 1.17011 |
| NJ | 1.06629 | ME | 1.13324 | VA | 1.18657 |
| MA | 1.06794 | VT | 1.13559 | NC | 1.18868 |
| MI | 1.07588 | NJ | 1.13705 | ME | 1.19048 |
| OR | 1.08399 | MA | 1.13778 | MA | 1.19698 |
| IL | 1.09182 | NC | 1.14656 | WI | 1.212 |
| MN | 1.09303 | MN | 1.15227 | SC | 1.21238 |
| NH | 1.10414 | MD | 1.15645 | IA | 1.22263 |
| RI | 1.12168 | IA | 1.16078 | NE | 1.22336 |
| NY | 1.12348 | SC | 1.162 | NJ | 1.22705 |
| MD | 1.12970 | IL | 1.16625 | PA | 1.2311 |
| VT | 1.13820 | NE | 1.16896 | OH | 1.23172 |
| WY | 1.14331 | IN | 1.17185 | SD | 1.23475 |
| UT | 1.14368 | VA | 1.17399 | KS | 1.23572 |
| WA | 1.14643 | KS | 1.17642 | GA | 1.2473 |
| ID | 1.15516 | DE | 1.18211 | WA | 1.24785 |
| KS | 1.16597 | MI | 1.19022 | IN | 1.25021 |
| IA | 1.16600 | NY | 1.20196 | AR | 1.25295 |
| DE | 1.16842 | ID | 1.20926 | MN | 1.25504 |
| AR | 1.18471 | WA | 1.21082 | ID | 1.25917 |
| OK | 1.18845 | UT | 1.21519 | TN | 1.26158 |
| CO | 1.21090 | AR | 1.22184 | AL | 1.26277 |
| NE | 1.21220 | TN | 1.22387 | HI | 1.26464 |
| MO | 1.21952 | MO | 1.2261 | ND | 1.28276 |
| SC | 1.22551 | GA | 1.23226 | IL | 1.28486 |
| NC | 1.22848 | HI | 1.2403 | MI | 1.29513 |
| WV | 1.22918 | OR | 1.24477 | CO | 1.2965 |
| SD | 1.23490 | OK | 1.24943 | UT | 1.29686 |
| CA | 1.23703 | CO | 1.25027 | MO | 1.31029 |
| TN | 1.25293 | ND | 1.25173 | OK | 1.31197 |
| VA | 1.25664 | AL | 1.2536 | MS | 1.32043 |
| AL | 1.26142 | FL | 1.27309 | KY | 1.32224 |
| AZ | 1.26375 | TX | 1.28065 | FL | 1.32839 |
| MT | 1.26999 | WV | 1.28073 | OR | 1.32906 |
| TX | 1.27554 | CA | 1.28309 | NY | 1.33142 |
| FL | 1.28121 | KY | 1.2869 | DC | 1.33349 |
| DC | 1.28421 | MT | 1.29133 | TX | 1.34339 |
| GA | 1.28618 | NV | 1.29379 | NM | 1.35397 |
| NM | 1.30236 | AZ | 1.31669 | CA | 1.35524 |
| HI | 1.30438 | NM | 1.31818 | AZ | 1.35716 |
| KY | 1.30978 | WY | 1.32922 | NV | 1.36228 |
| NV | 1.33925 | MS | 1.32971 | WY | 1.37519 |
| ND | 1.34187 | LA | 1.37362 | WV | 1.38325 |
| MS | 1.34829 | DC | 1.37483 | MT | 1.38571 |
| LA | 1.36953 | AK | 1.60314 | LA | 1.39944 |
| AK | 1.63356 | SD | — | AK | 1.60416 |

*Note:* Residuals from national-level regressions.

**Table 7.6** **Changes in Wage Inequality 90-10 Differentials**

| State | 1970–80 | State | 1980–90 | State | 1970–90 |
|---|---|---|---|---|---|
| **ND** | **−0.09014** | **DE** | **−0.012** | **VA** | **−0.07007** |
| **VA** | **−0.08265** | **MS** | **−0.00928** | **ND** | **−0.05911** |
| **NC** | **−0.08192** | **AL** | **0.00917** | **NC** | **−0.0398** |
| **HI** | **−0.06409** | **MD** | **0.01234** | **HI** | **−0.03974** |
| **SC** | **−0.06351** | **VA** | **0.01258** | **GA** | **−0.03888** |
| **GA** | **−0.05391** | **GA** | **0.01504** | **MS** | **−0.02785** |
| NV | −0.04547 | VT | 0.02425 | SC | −0.01313 |
| NE | −0.04324 | HI | 0.02435 | AL | 0.00136 |
| TN | −0.02906 | LA | 0.02582 | DE | 0.0017 |
| KY | −0.02288 | ND | 0.03103 | TN | 0.00865 |
| MS | −0.01857 | AR | 0.03111 | NE | 0.01116 |
| NH | −0.01803 | KY | 0.03534 | KY | 0.01246 |
| RI | −0.00963 | NM | 0.03579 | VT | 0.02164 |
| FL | −0.00812 | WA | 0.03704 | NV | 0.02303 |
| AL | −0.00781 | TN | 0.03771 | NH | 0.02484 |
| IA | −0.00522 | AZ | 0.04047 | LA | 0.02991 |
| VT | −0.00261 | NC | 0.04212 | RI | 0.03361 |
| LA | 0.00409 | NH | 0.04288 | MD | 0.03908 |
| TX | 0.00512 | RI | 0.04325 | FL | 0.04718 |
| MO | 0.00657 | WY | 0.04596 | NM | 0.05161 |
| KS | 0.01045 | CO | 0.04623 | IA | 0.05663 |
| DE | 0.0137 | ID | 0.04992 | TX | 0.06786 |
| NM | 0.01582 | SC | 0.05038 | AR | 0.06824 |
| MT | 0.02134 | CT | 0.05122 | KS | 0.06975 |
| MD | 0.02674 | NE | 0.0544 | CO | 0.0856 |
| AR | 0.03713 | FL | 0.0553 | MO | 0.09076 |
| CO | 0.03937 | ME | 0.05724 | AZ | 0.09342 |
| CA | 0.04607 | MA | 0.0592 | WA | 0.10143 |
| WV | 0.05156 | KS | 0.0593 | ID | 0.10402 |
| AZ | 0.05295 | IA | 0.06185 | MT | 0.11572 |
| ID | 0.0541 | OK | 0.06254 | CA | 0.11822 |
| MN | 0.05924 | TX | 0.06274 | OK | 0.12351 |
| OK | 0.06098 | NV | 0.06849 | MA | 0.12903 |
| WA | 0.06439 | CA | 0.07215 | ME | 0.14562 |
| MA | 0.06984 | IN | 0.07837 | UT | 0.15318 |
| NJ | 0.07076 | WI | 0.07892 | WV | 0.15407 |
| UT | 0.07151 | UT | 0.08167 | CT | 0.1544 |
| IL | 0.07443 | MO | 0.08419 | NJ | 0.16076 |
| OH | 0.07718 | OR | 0.08429 | MN | 0.16202 |
| NY | 0.07848 | NJ | 0.09 | WI | 0.16874 |
| ME | 0.08838 | MT | 0.09438 | OH | 0.18147 |
| WI | 0.08982 | WV | 0.10251 | IL | 0.19304 |
| **PA** | **0.09489** | **MN** | **0.10278** | **IN** | **0.1943** |
| **CT** | **0.10318** | **OH** | **0.10429** | **PA** | **0.20455** |
| **MI** | **0.11434** | **MI** | **0.10491** | **NY** | **0.20794** |
| **IN** | **0.11593** | **PA** | **0.10966** | **MI** | **0.21925** |
| **OR** | **0.16078** | **IL** | **0.11861** | **WY** | **0.23188** |
| **WY** | **0.18592** | **NY** | **0.12946** | **OR** | **0.24507** |

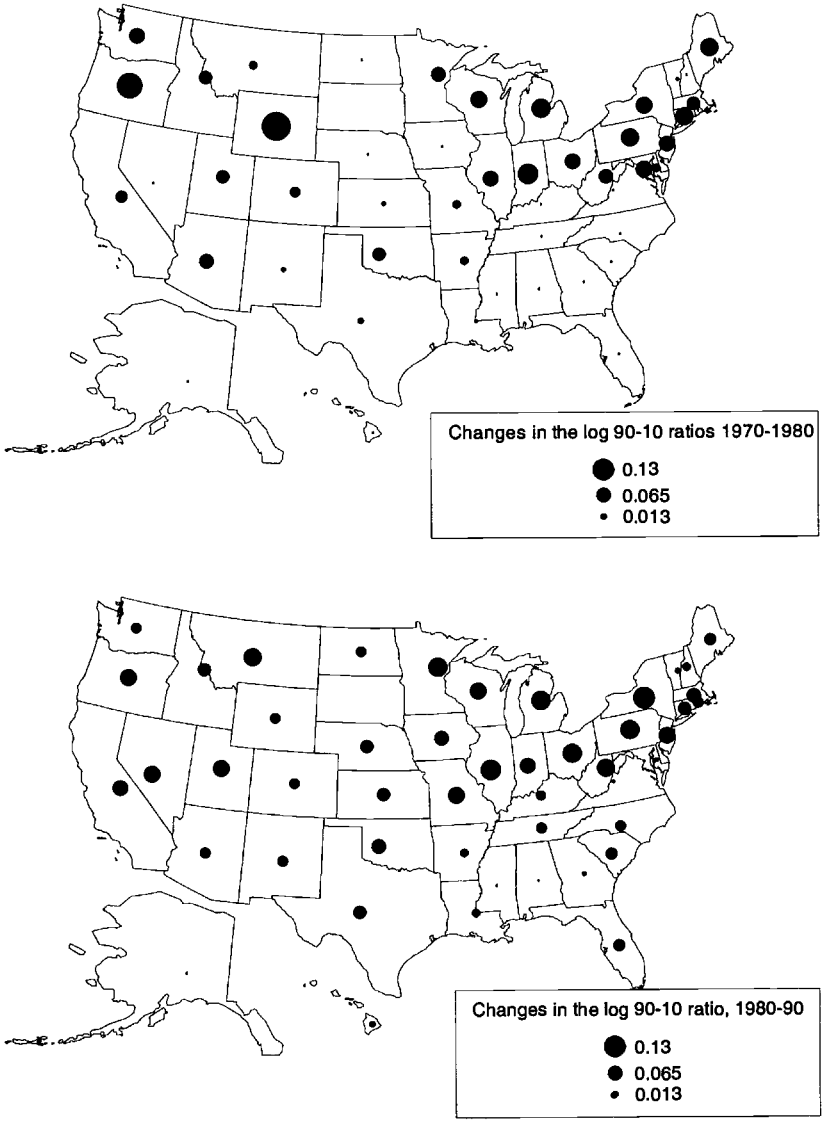


**Fig. 7.6 Changes in inequality**
*Note:* Actual dot sizes vary continuously. The legend provides three reference points.

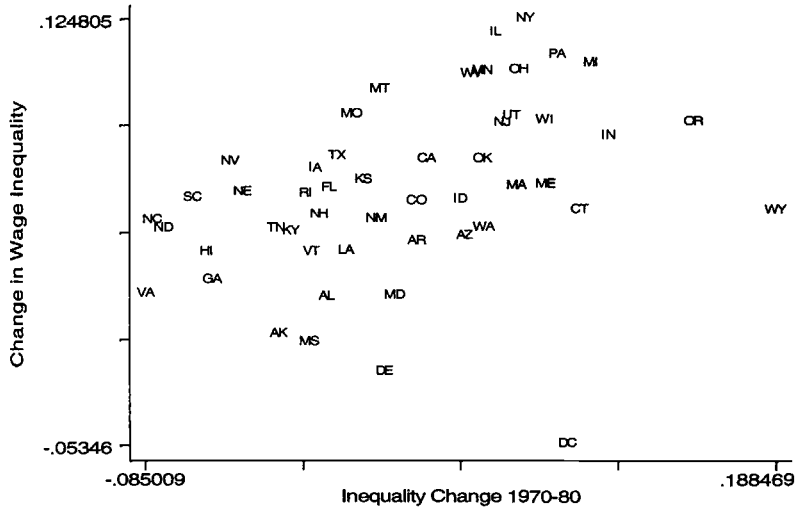


**Fig. 7.7 Persistence in inequality changes**

### 7.5.2 The Extreme States and Their Importance

Table 7.6 reports the state changes in wage inequality sorted by performance during each decade. The 12 extreme states, 6 with big increases and 6 with declines or small increases, are in boldface. The differences between the two groups are striking. The six with the biggest increases in the 1980s (New York, Illinois, Pennsylvania, Michigan, Ohio, and Minnesota) are all large industrialized states that suffered disproportionately from the recession in the beginning of the decade and lost a large number of manufacturing jobs. The six best performers (Delaware, Mississippi, Alabama, Maryland, Virginia, and Georgia) are mostly southern states that expanded manufacturing employment during the decade.

While there is little doubt that states experienced very different changes in residual inequality, it does not immediately follow that this heterogeneity was important for the national increase. To quantify the importance of the individual states, we calculate the 90-10 differential with and without the groups of states that had the biggest and smallest changes. Table 7.7 reports the 90-10 differentials for all states together and two groups of 44 (one without the top 6 and one without the bottom 6).

Excluding the 6 states with the lowest growth in wage inequality, the overall increase for the United States would have been 19.6 percent higher during the 1970s and 9.6 percent higher in the 1980s. The states that had the largest increases in wage inequality during the 1980s had an even larger effect on the aggregate measure. Inequality increases would have been 36 percent lower in the 1970s and 23 percent lower in the 1980s without the

**Table 7.7** **Impact of States with Largest and Smallest Inequality Increases**

| | 1970 | 1980 | 1990 |
|---|---|---|---|
| *90-10 Difference (levels)* | | | |
| All states | 1.164 | 1.210 | 1.282 |
| Excluding six smallest | 1.154 | 1.209 | 1.289 |
| Excluding six largest | 1.204 | 1.228 | 1.285 |
| *90-10 Difference (changes)* | | | |
| All states | | 0.046 | 0.073 |
| Excluding six smallest | | 0.055 | 0.080 |
| Excluding six largest | | 0.025 | 0.056 |

**Table 7.8** **Mean Reversion in State Residual Wage Inequality**

| | Dependent Variables | |
|---|---|---|
| | Inequality Change, 1970–80 | Inequality Change, 1980–90 |
| Intercept | 0.536 | 0.241 |
| | (6.406) | (2.928) |
| Initial inequality | −0.428 | −0.154 |
| | (−6.083) | (−2.272) |
| $R^2$ | 0.429 | 0.080 |
| $N$ | 49 | 49 |

*Note:* Numbers in parentheses are $t$-statistics.

increases in these 6 states. These results suggest that the heterogeneity in state outcomes was an important determinant of national inequality.

### 7.5.3 Mean Reversion

It is possible that the heterogeneity in state outcomes merely represents a mean reversion to a common level of inequality. Regressing the change in inequality on the initial level, we find that in the 1970s states with higher-than-average initial levels of inequality showed decreases, or smaller increases, while low-inequality states tended to experience more rapid increases (see table 7.8). States with 10 percent higher initial levels in 1970 had, on average, a 4.3 percent lower rise in inequality over the following decade. Initial levels explain over 40 percent of the variation in state performance.[16]

In contrast, in the 1980s initial levels explain only 8 percent of the subsequent movement in inequality across states. The relationship between initial wage differentials and subsequent changes was still negative, but on

16. When additional variables are added to the specification, the coefficient on lagged levels is no longer negative for either decade.

average a 10 percent higher initial wage differential in 1980 was associated with only a 1.5 percent lower increase over the following decade. We can conclude that the variation in state performance in the 1980s was not simply a result of mean reversion in inequality.

## 7.6 The Explanations

The preceding sections show that shocks to regional labor markets persist over the short and medium run and that states had vastly different outcomes in terms of wage inequality during the 1970s and 1980s. In this section, we reconsider existing explanations of the rise in wage inequality using state-level data. As mentioned at the outset, the dominant explanations for the national inequality increase center on the use of skill-biased technology, changes in product demand due to international trade, supply shifts due to immigration, and shifts in labor market institutions. We construct state-level variables to proxy for each of the explanations.

### 7.6.1 Skill-Biased Technological Change

One problem with the hypothesis that skill-biased technological change has been the source of the rise in overall wage inequality is the lack of direct evidence. Krueger (1993) argues that the use of computers is associated with a wage premium, but DiNardo and Pischke (1997) offer a compelling argument that computers themselves have not changed the wage structure. Since we do not have direct measures of technology either by state or for individual workers, we follow Berman, Bound, and Griliches (1994) and Bernard and Jensen (1997) in using measures of the capital stock as a proxy for inputs that are complements to skills. A further limitation of these measures is that they are only available for the manufacturing sector from the ASM and Census of Manufactures, and as a result may not capture technology upgrading in other sectors.[17] With these caveats, the hypothesis of skill-biased technological change implies a positive relationship between increases in capital per worker and inequality within the state.

We consider two measures of skill-biased technology for each state, the log levels of machine and equipment stocks per worker in the manufacturing sector in the state (*Machine*) and the log level of computer investment per worker in manufacturing in the state (*Computer*). The data are constructed from the preceding Census of Manufactures (i.e., the 1967 census for 1970, the 1977 census for 1980, and the 1987 census for 1990).[18]

17. In an alternative view of skill-biased technological change, Acemoglu (1998) models the increase in skill-biased technology as an endogenous response to the supply of skills. If he is correct, our measures of computers and machines will not correctly proxy for the changes in skill-biased technology.

18. The computer investment data are not available for 1970.

### 7.6.2 International Trade

Ideally we would be able to measure import and export prices for all goods produced in a state. Instead we use state-level import and export exchange rates (*Import* and *Export*). To calculate the import exchange rate for a state, we start by constructing industry import exchange rates for each four-digit manufacturing industry. The industry import exchange rates are given by the sum of real exchange rates indices (U.S. dollars/foreign currency)[19] across countries weighted by that country's average share in imports in the industry over the preceding 3 years,

$$EXCHIM_i = \sum_c \frac{IMP_{c,i}}{IMP_i} \cdot EXCH_c. \tag{3}$$

The state import exchange rate is the weighted sum of industry import exchange rates with the weights given by the share of the industry in total shipments from the state, averaged over the sample,

$$I_{st} = \sum_i \frac{TVS_{s,i}}{TVS_s} \cdot EXCHIM_i. \tag{4}$$

The expected relationship between the state import exchange rate and inequality is negative. A strengthening dollar means cheaper imports in goods that are produced in the state. If a state contains industries that experience substantial import penetration, and imports are generally produced with less-skilled labor, then state-level inequality should rise.

The state export exchange rate is constructed in a comparable fashion:

$$EXCHEX_i = \sum_c \frac{EXP_{c,i}}{EXP_i} \cdot EXCH_c. \tag{5}$$

The state export exchange rate is the weighted sum of industry export exchange rates with the weights given by the share of the industry in total exports from the state,[20]

$$X_{st} = \sum_i \frac{EXP_{s,i}}{EXP_s} \cdot EXCHEX_i. \tag{6}$$

If exports are skill-intensive products, as found in Bernard and Jensen (1995, 1997) we should expect to see a positive relationship between the state export exchange rate and inequality.

The main difficulty with both exchange rate measures stems from the

19. The exchange rates are nominal exchange rates deflated by GDP deflators in foreign currency per U.S. dollar normalized to be 100 in 1980.

20. Due to a lack of state industry export data in earlier years, we are forced to use weights based on the 1987 census.

inequality data itself. Since we only observe states in 3 years, our exchange rate measures may not capture the effects of the dollar movements in the first half of the 1980s.

### 7.6.3 Industry Composition

To capture changes in the composition of output at the state level, we include a measure of durable manufacturing employment for the state. Specifically we calculate the ratio of durable manufacturing employment to total employment in the three census samples (*Durable*). The pictures of the wage inequality changes in figure 7.6 suggest that manufacturing-intensive states saw disproportionate rises in wage inequality. We expect that changes in durable employment would be negatively correlated with inequality changes.

Another measure of product demand is the level of government procurement in the state. The measure is constructed from the government procurement data of Hooker and Knetter (1997) and is given by the log level of government procurement expenditures per capita (*Procure*). Since the government contracts captured in the data tend to be for large skill-intensive products, the expected relationship with inequality is positive.

### 7.6.4 Immigration

To evaluate the potential role for foreign immigration in depressing low-skilled workers' wages and thus increasing inequality, we include the ratio of recent immigrants to the population (*Immigrant*). Immigrants are those workers who immigrated to the state within the last 5 years of the prior decade.[21] The expected relationship of immigration and inequality is positive if the pool of immigrant labor is generally less-skilled than the existing stock of native workers.[22]

### 7.6.5 Labor Market Institutions

Recent work by DiNardo, Fortin, and Lemieux (1996) and Fortin and Lemieux (1997) has revived interest in labor market institutions as sources of inequality increases. Lee (1999), using state-level data, argues that all the increase in raw inequality can be attributed to changes in state minimum wages. In particular, the decline in unionization rates and the fall in the real minimum wage are offered as important explanations for the rise in wage dispersion. We construct measures of unionization rates (*Union*) for each state for the 3 years.[23] The data on unionization rates come from

21. For example, for the 1980–90 changes in inequality, the immigration measure is calculated as fraction of the state population who immigrated to the state in 1985–90.

22. Immigrants may have lower apparent skills in the data due to language problems or discrimination even if their actual skill levels are higher than the native population's.

23. Barry Hirsch generously provided files with the unionization data. For early years, some states appear only in groups. We assigned the group unionization rate to the state for those years. Since both sets of data start in 1973, we use the 1973 values for 1970.

Kokkelenberg and Sockell (1985) and Hirsch and Macpherson (1993). The minimum wage data come from Neumark and Wascher (1992). We use the log of the real state minimum wage as our measure (*Minwage*).

### 7.6.6 Income Levels

To capture the possibility that heterogeneity in state inequality measures is being driven by variations in state income levels, we construct a measure of state economic activity. For each state we calculate the difference between the median income and the national median income (*Cycle*). In our estimation framework, including state fixed effects, we expect that higher state incomes would be correlated with peaks in the state business cycle and associated with lower levels of inequality.

## 7.7 Explaining State Inequality Changes

Ideally any explanation for the large rise in inequality during the 1980s would be capable of explaining smaller increases in other periods. For our estimation procedure, we choose to pool the data across decades instead of estimating decade-by-decade regressions.[24] We estimate the relationship between our explanatory variables and state residual wage inequality, as measured by the log 90-10 ratio, in levels, pooled across years with state fixed effects.[25]

Table 7.9 contains univariate regressions of state inequality on each of our explanatory variables in columns (1) through (10). Almost all the variables are significantly correlated with inequality changes and have the expected sign. The measure of durable employment share is negatively and significantly correlated with changes in inequality across states (col. [1]) and can explain almost 30 percent of the variance over the 2 decades. A 1 percent change in the fraction of the sample employed in manufacturing is associated with a 1.58 percent increase in the 90-10 ratio.

Both measures of technology deepening, log capital per worker and computer investment per worker, are positively correlated with inequality across states. The capital-intensity measure by itself accounts for over 20 percent of the variation, while for the 1980s computer-investment changes can explain over 40 percent of the total state heterogeneity.[26]

Deunionization is also strongly correlated with increasing inequality. Decline in union membership rates can account for almost 30 percent of the variation in the pooled estimation. The minimum wage measure does the best of all the state-level measures. It is strongly negatively correlated with increases in inequality and accounts for 45 percent of total variation.

24. In table 7.11 below, we also report estimates for changes during the 1980s.

25. Pooled estimation in first differences across the decades does not yield different conclusions.

26. The computer measure is not available before 1980.

**Table 7.9** **Explaining Changes in State Residual Wage Inequality**

| | Dependent Variable [log (state 90-10 ratio)][a] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Durable | −1.583*** | | | | | | | | | |
| | (0.247) | | | | | | | | | |
| Machine | | 0.098*** | | | | | | | | |
| | | (0.019) | | | | | | | | |
| Computer | | | 0.031*** | | | | | | | |
| | | | (0.005) | | | | | | | |
| Import | | | | 0.354*** | | | | | | |
| | | | | (0.088) | | | | | | |
| Export | | | | | 0.022 | | | | | |
| | | | | | (0.104) | | | | | |
| Union | | | | | | −0.007*** | | | | |
| | | | | | | (0.001) | | | | |
| Minwage | | | | | | | −0.162*** | | | |
| | | | | | | | (0.018) | | | |
| Immigrant | | | | | | | | 2.274** | | |
| | | | | | | | | (1.153) | | |
| Procure | | | | | | | | | −0.024*** | |
| | | | | | | | | | (0.005) | |
| Cycle | | | | | | | | | | −0.222** |
| | | | | | | | | | | (0.107) |
| $R^2$ | 0.29 | 0.21 | 0.42[b] | 0.14 | 0.00 | 0.29 | 0.45 | 0.04 | 0.18 | 0.04 |
| $N$ | 149 | 149 | 99 | 149 | 149 | 149 | 149 | 149 | 149 | 149 |

*Notes:* All regressions were estimated using state fixed effects. South Dakota is missing from the population census for 1980 and Hawaii is missing in all years from the Longitudinal Research Database. Standard errors are given in parentheses.

[a]Residuals from log wage regression.

[b]The computer numbers are not available for 1970.

**Significant at the 5 percent level.

***Significant at the 1 percent level.

Increased immigration also shows up with a positive and significant coefficient, although its overall explanatory power is low. Similarly, our measure of aggregate state economic activity confirms that states moving from business-cycle troughs to peaks have declines in inequality, although the measure cannot explain much of the cross-state variation in the 2 decades.

Surprisingly, our measures of international trade do not perform well. The import exchange rate has the wrong sign, the appreciation of the dollar on an import basis leads to declines in inequality, and the export exchange rate is not significant.[27] The measure of government purchases per capita is significant, but unexpectedly negatively correlated with inequality.

These univariate results suggest that a wide range of potential explanations may play a role in the increase in inequality. Changes in minimum wage, decreases in durable-manufacturing employment, decreases in unionization, and increases in capital per worker all have substantial explanatory power. However, one drawback of the specification in table 7.9 is that we have neglected to control for time effects; that is, any unobserved aggregate trending variable could be driving movements in both our left-hand-side and right-hand-side variables. We would like to know how robust the univariates are in the presence of time trends.

Table 7.10 reports the same set of regressions with time dummies (i.e., separate time trends for each decade). The differences in the results are quite substantial. Of the previously significant regressors, only durable employment and the business-cycle measure remain statistically significant. In addition, the coefficient on the export exchange rate switches to a negative sign and becomes significant, suggesting that depreciations that stimulate exports may reduce inequality.[28] In other words, only changes in durable employment and business cycles are correlated with differential movements in inequality across states within decades. In particular, the prior significance of the state minimum wage was due almost entirely to its aggregate trend movements and not due to variation across states.

We consider a multivariate specification with all our potential explanatory variables in table 7.11. Columns (1) and (2) report pooled results for both decades without and with time dummies, respectively, while columns (3) and (4) report results just for the 1980s. In all specifications for both time periods, the share of durable-manufacturing employment and the state of the state business cycle enter significantly and with the expected sign. Declines in durable-manufacturing employment are strongly associated with inequality increases, even allowing for the presence of alternative

27. We caution that this does not mean that international trade was unimportant for inequality increases. The decade-long span of our data may hide the role of trade. Preliminary work looking at state-level foreign direct investment shows mixed results.

28. Bernard and Jensen (1997) find that exporters contribute to increases in wage differentials between production and nonproduction workers. However, this may reflect changes in education premia as opposed to changes in residual wage inequality.

**Table 7.10** **Explaining Changes in State Residual Wage Inequality (with year dummies)**

| | Dependent Variable [log (state 90-10 ratio)][a] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Durable | −1.047*** | | | | | | | | | |
| | (0.007) | | | | | | | | | |
| Machine | | −0.033 | | | | | | | | |
| | | (0.028) | | | | | | | | |
| Computer | | | −0.001 | | | | | | | |
| | | | (0.007) | | | | | | | |
| Import | | | | −0.012 | | | | | | |
| | | | | (0.140) | | | | | | |
| Export | | | | | −0.311** | | | | | |
| | | | | | (0.145) | | | | | |
| Union | | | | | | −0.002 | | | | |
| Minwage | | | | | | | −0.142 | | | |
| | | | | | | | (0.100) | | | |
| Immigrant | | | | | | | | −1.179 | | |
| | | | | | | | | (1.03) | | |
| Procure | | | | | | | | | 0.002 | |
| | | | | | | | | | (0.012) | |
| Cycle | | | | | | | | | | −0.229*** |
| | | | | | | | | | | (0.080) |
| $R^2$ | 0.55 | 0.45 | 0.67[b] | 0.45 | 0.48 | 0.45 | 0.46 | 0.45 | 0.45 | 0.48 |
| $N$ | 149 | 149 | 99 | 149 | 149 | 149 | 149 | 149 | 149 | 149 |

*Notes:* All regressions were estimated using state fixed effects and time dummies. South Dakota is missing from the population census for 1980 and Hawaii is missing in all years from the Longitudinal Research Database. Standard errors are in parentheses.

[a]Residuals from log wage regression.

[b]The computer numbers are not available for 1970.

**Significant at the 5 percent level.

***Significant at the 1 percent level.

**Table 7.11** **Explaining Changes in State Residual Wage Inequality**

| | Dependent Variable [log (state 90-10 ratio)][a] | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Durable | −1.175*** | −1.217*** | −0.803*** | −0.698*** |
| | (0.224) | (0.228) | (0.238) | (0.243) |
| Machine | −0.001 | −0.011 | 0.014 | −0.009 |
| | (0.024) | (0.025) | (0.027) | (0.030) |
| Import | −0.011 | −0.168 | 0.259* | 0.326** |
| | (0.114) | (0.139) | (0.144) | (0.148) |
| Export | 0.039 | −0.106 | 0.011 | 0.005 |
| | (0.121) | (0.140) | (0.109) | (0.108) |
| Union | 0.000 | 0.000 | 0.001 | 0.003 |
| | (0.002) | (0.002) | (0.002) | (0.002) |
| Minwage | −0.139*** | −0.087 | −0.151*** | −0.045 |
| | (0.031) | (0.095) | (0.042) | (0.079) |
| Immigrant | −0.198 | −0.444 | −0.338 | −0.837 |
| | (0.911) | (0.932) | (1.307) | (1.322) |
| Procure | −0.002 | 0.012 | 0.010 | 0.009 |
| | (0.009) | (0.011) | (0.011) | (0.011) |
| Cycle | −0.255*** | −0.217*** | −0.267** | −0.312*** |
| | (0.075) | (0.079) | (0.100) | (0.103) |
| Time dummies | | Yes | | Yes |
| $R^2$ | 0.64 | 0.65 | 0.81 | 0.82 |
| $N$ | 149 | 149 | 99 | 99 |

*Notes:* All regressions were estimated using state fixed effects. South Dakota is missing from the population census for 1980 and Hawaii is missing in all years from the Longitudinal Research Database. Standard errors are in parentheses.

[a]Residuals from log wage regression.

*Significant at the 10 percent level.

**Significant at the 5 percent level.

***Significant at the 1 percent level.

explanatory variables. Similarly, state business-cycle expansions are associated with declines in residual inequality, and recessions are times of increasing inequality. The state minimum-wage measure is again significant only in the specifications without time trends. Of the other explanatory variables, measures of capital intensity, immigration, exchange rates, unionization, or government procurement, none is close to being significant, except for the import exchange rate measure in the 1980s, which has the wrong sign.

## 7.8 Inequality at the Top and Bottom

The preceding results focused on changes in the log 90-10 ratio of residual wages. In this section, we explore what differences, if any, result from looking at changes in the top and bottom halves of the residual wage

distribution. Table 7.12 reports specifications for the 90-50 and 50-10 inequality measures with and without time trends. All regressions are pooled over both decades, estimated in levels with state fixed effects.

The results for the 90-50 ratio are in columns (1) and (2) of table 7.12. Increases in inequality in the upper half of the residual wage distribution are significantly negatively correlated with the share of durable-manufacturing employment, although the point estimates are less than one-half those of the entire distribution. In the specification without time trends, we also find significant effects of immigration and the two exchange rates. The exchange rates have the expected sign, a strengthening dollar increases inequality through imports, but a weakening dollar increases inequality through exports. Surprisingly, the minimum-wage mea-

**Table 7.12** **Explaining Changes in State Residual Wage Inequality**

| | Dependent Variables[a] | | | |
|---|---|---|---|---|
| | log (state 90-10 ratio) | | log (state 50-10 ratio) | |
| | (1) | (2) | (3) | (4) |
| Durable | −0.370*** | −0.341*** | −0.805*** | −0.875*** |
| | (0.101) | (0.103) | (0.185) | (0.189) |
| Machine | −0.004 | −0.011 | 0.003 | 0.00 |
| | (0.011) | (0.011) | (0.020) | (0.021) |
| Import | −0.085* | −0.112* | 0.074 | −0.056 |
| | (0.051) | (0.063) | (0.094) | (0.115) |
| Export | 0.127** | 0.085 | −0.088 | −0.192 |
| | (0.055) | (0.063) | (0.099) | (0.116) |
| Union | −0.000 | −0.000 | 0.001 | −0.000 |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| Minwage | −0.112*** | −0.032 | 0.026 | −0.055 |
| | (0.014) | (0.043) | (0.026) | (0.078) |
| Immigrant | 1.261*** | 1.041** | −1.459* | −1.485* |
| | (0.412) | (0.421) | (0.754) | (0.771) |
| Procure | 0.001 | 0.004 | −0.002 | 0.008 |
| | (0.005) | (0.005) | (0.007) | (0.009) |
| Cycle | −0.017 | −0.022 | −0.238*** | −0.194*** |
| | (0.034) | (0.036) | (0.062) | (0.065) |
| Time dummies | | Yes | | Yes |
| $R^2$ | 0.79 | 0.80 | 0.39 | 0.42 |
| $N$ | 149 | 149 | 149 | 149 |

*Notes:* All regressions were estimated using state fixed effects. South Dakota is missing from the population census for 1980 and Hawaii is missing in all years from the Longitudinal Research Database. Standard errors are in parentheses.

[a]Residuals from log wage regression.

*Significant at the 10 percent level.

**Significant at the 5 percent level.

***Significant at the 1 percent level.

sure enters with the expected sign and significantly. We suspect this result is, again, due to decade trends, as most, if not all, economic theories would suggest that changes in the minimum wage should not affect this part of the wage distribution. The state of the business cycle, while significant for changes in the 90-10 differential, does not affect dispersion at the top of the distribution.

Looking at the results for the 50-10 ratio in columns (3) and (4) we find some surprising differences. Overall, our set of variables explains less of the cross-state inequality movements in this part of the distribution. Durable-manufacturing employment, as always, is negative and strongly significant with a much larger coefficient. However, increases in inequality at the bottom of the skill distribution are not significantly correlated with either the measure of technology, the exchange rate measures, or changes in state minimum wages. In addition, the coefficient on immigration has the opposite sign from what we might expect and is marginally significant. The business-cycle measure is now strongly significant with the expected sign.

Taken as a group, these results confirm the importance of durable-manufacturing employment in accounting for inequality changes through the skill distribution. They also highlight the relative importance of business cycles on wage movements in the bottom half of the distribution. The results for state minimum wages largely confirm our earlier findings and suggest that minimum-wage changes are not driving large increases in inequality.

## 7.9 Conclusion

In this paper, we argue that the previous research on wage inequality in the United States has largely overlooked an important source of information, the heterogeneity of inequality movements across regions.[29] We suspect this oversight stems from an assumption that individuals participate in a single national labor market. If there is one nationwide market setting wages, then there is no reason to look at regional data to understand sources of the rise in wage inequality. If, however, regional labor markets experience idiosyncratic shocks that are only slowly transmitted to other areas, then we can potentially learn about the sources of inequality from the experiences of different regions.

We find that the assumption of a single national labor market fails in the data. Blanchard and Katz (1992) show persistent effects of state employment shocks. In addition, we find that education premia show large, persistent differences across states, suggesting that flows of workers and

29. As mentioned earlier, important exceptions are Bound and Holzer (1996), Borjas and Ramey (1994, 1995), and Topel (1993).

firms are not sufficient to eliminate wage differentials. Finally, we show that regional employment shocks have large effects on plant-level wages.[30]

The story that emerges from most of the prior literature on wage inequality in the United States is one of a remarkably consistent increase during the 1970s and 1980s across and within groups (industries, education categories, etc.). The state-level data provide a very different view. Measures of state inequality show a remarkable variety of levels and changes over time. In any given year, numerous states have levels of inequality far from the national average in both directions. More importantly, the relative positions of the states change sharply from decade to decade. Numerous states with above-average inequality in 1970 end up being relatively equal 20 years later, and some states even improve their absolute positions over the period.

This variety of outcomes at the state level provides a natural environment for reexamining the existing theories for the overall inequality rise. To evaluate existing theories of the rise in inequality, we construct state-level measures of industrial composition, skill-biased technology, international trade shocks, and labor market institutions.

Among our results, one fact is clear. The decline in the share of durable-manufacturing employment is negatively correlated with inequality increases in all our specifications, over all periods, and for every segment of the residual wage distribution. By itself, the share of durable-manufacturing employment can account for 30 to 55 percent of the state changes in wage inequality and is especially important for movements in the bottom half of the wage distribution.

The most surprising failure in our state regressions are our measures of international trade and weighted state import and export exchange rate indices, which are not significant and usually are the wrong sign. On the other hand, while immigration is not important for changes in the 90-10 ratio, increased foreign immigration is positively correlated with inequality increases in the upper half of the skill distribution, and negatively correlated in the bottom half.

The evidence collected here is a useful starting point for reconsidering possible explanations for the large increase in inequality in the 1980s, and the smaller but significant increases in the returns to skill in the 1970s. Unlike previous research on inequality increases, we find an important role for the decline of manufacturing employment. These results suggest the importance of understanding the sources of and variation in manufacturing employment declines. While international trade appears not to have played a direct role in the inequality rise, its role in changing the com-

30. We encourage further research on the integration of regional labor markets, whether it is increasing, and for which types of workers.

position of production remains to be explored. On a more positive note, the results also suggest that, to the extent that manufacturing employment has stabilized, the increases in residual wage inequality should slow as well.

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## Comment

Lee G. Branstetter

### Introduction

This interesting paper is the latest in a series of interesting papers generated by the productive collaboration of Andrew Bernard and Brad Jensen. I found this to be a provocative and well-executed piece of research, and I suspect that this paper may be one of the most important contributions that will emerge in this volume. While, in keeping with the traditional responsibilities of a discussant, I will raise some questions about the authors' approach and results in these comments, I should stress at the outset that I like this paper very much. I should also issue a disclaimer: I am neither a labor economist, nor an "expert" in the debate over the sources of increases in U.S. income inequality. Therefore, the authors and the reader should apply the appropriate discount factor to all that I am about to say.

The authors' starting point is the observation that, while the inequality of income distribution in the United States has widened substantially over the last decade, the direct causes of this increase have eluded the collective research efforts of some of the brightest minds working in economics. The estimated effects of the usual suspects—international trade, deunioniza-

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tion, and minimum wage changes—can explain only a portion of this increase. The rest is attributed to "skill-biased technological change," but this attribution has come about more through a process of elimination of alternatives than on the basis of direct evidence.

Can economic analysis at the regional level help us disentangle the causes of changes in the income distribution at the national level? The promise of this idea is that there is considerable variation across states, not only in levels of inequality and their potential determinants, but also in the rates of change of these variables over time, which could be exploited to improve identification. Of course, there are also costs to this approach. One cost comes from the data: The authors have only three cross sections of census data to work with, whereas, for instance, Katz and Murphy (1992) had annual data from the 1960s through the 1980s, which allowed them to look closely at the dynamics of labor market adjustment. Here data availability precludes such an analysis of dynamics. More substantively, U.S. states are really not like miniature countries, nor is the United States like a state within a larger supranational economy.[1] For this and other reasons, extracting lessons for national policy from the experience of individual states may prove problematic.[2]

Nevertheless, a number of researchers have sought to understand changes in the wage distribution by looking at regional economic developments, including Topel (1986, 1994), Bound and Holzer (1996), Borjas and Ramey (1995), and others. These papers have tended to measure inequality by examining the returns to education. Bernard and Jensen make a valuable contribution to this line of research by focusing on state-level changes in residual wage inequality. This approach certainly has promise. After all, international economists and growth specialists have learned much through empirical work at the state and local levels. Such geographic disaggregation may prove to be even more useful in economic analysis of increasing income inequality.

## Are States the Appropriate Unit of Analysis?

Given the potential advantages of geographically disaggregating the national economy, the first challenge we come up against is how to define

1. Products and capital move much more freely across state borders than across many national borders, and the associated forces of factor-price convergence are likely to be orders of magnitude stronger within than across countries. Even labor, relatively immobile though it is, is much more mobile within the United States than it is across national borders. Finally, as Paul Krugman (1996) and others have pointed out, for all of the talk of globalization, the U.S. economy remains in many ways a closed system, since the vast majority of goods and services consumed within its borders are also produced there. This is much less true of individual states, even less true if the level of analysis is the MSA.

2. Bernard and Jensen argue that "any theory of the rise in income inequality in the United States as a whole should also be capable of explaining the wide variety of outcomes across individual states." I think this might be asking a bit too much from any theory we are likely to be able to construct, although I agree with their basic message.

regional economies. Are states the appropriate units? To their credit, the authors have obviously thought about this issue, and readily admit the problems of using state data. I think this issue is important enough to merit some additional comment here.

The obvious advantage of states is that much data is available at the state level because states are important political units within the U.S. federal governmental structure. However, there can be considerable diversity within as well as between states. I am not just talking about the obvious differences between urban and rural labor markets (are labor market conditions more similar between San Francisco and the Central Valley than they are between San Francisco and Boston?). In their study of college wage premia at the metropolitan statistical area (MSA) level, Borjas and Ramey (1995) document nontrivial differences across different urban areas within the same state! Moreover, the political boundaries between states often do not correspond very well to the contours of regional economies. Casual empiricism suggests that California contains at least two regional economies, northern California and southern California, with different patterns of specialization in production and possibly different business cycles. At the other extreme, casual empiricism can also identify groups of states that are obviously highly integrated, such as the Tri-State region surrounding metropolitan New York.

Different papers in this literature have taken different approaches to this problem. Robert Topel has looked at agglomerations of states (regions), while Bound and Holzer (1996) and Borjas and Ramey (1995) have looked at MSAs. The fact that these papers have come to different conclusions about the sources of changes in regional income inequality suggests the answers one gets may be somewhat dependent on the level of aggregation at which one conducts empirical analysis. All that being said, I must say that states strike me as a completely logical place to begin.

**Do State-Level Labor Markets Exist?**

Taking the state as the appropriate unit of analysis, the authors note that looking at state-level data only makes sense if the level of integration across states is limited, at least in the short to medium term. The authors offer three pieces of evidence concerning this claim. First, the authors cite the well-known study by Blanchard and Katz (1992). This study indicates that the migration of workers across state boundaries mediates shocks to employment over horizons of 6–10 years. It seems to indicate that state-level labor markets only exist in the medium run, rather than the long run.

To provide additional support for limited integration across states, the authors show that returns to education differ substantially across states. This is a striking piece of evidence. However, some care needs to be taken in interpreting these numbers. What the coefficients on education actually measure in these regressions are the statistical relationships between

schooling and income for a cross section of residents of a particular state at a particular time. The wages of highly educated current residents are measured relative to the less-educated current residents of that state. Of course, many current residents were educated outside the state of current residence.[3] Furthermore, this measure will probably be higher in states with more unequal income distributions.

What these coefficients do not measure are the alternative real wages that could be earned by a given individual with a given level of education and quality, who is contemplating a move to a different state. Imagine an MIT Ph.D. choosing among California, Michigan, and Texas—her decision will be influenced by where her wages are the highest, not where high school dropouts have the lowest relative wages. Another way of thinking about this question is to ask what we might expect a "perfectly integrated" labor market to equalize. The answer is fairly complicated—the after-tax, "cost-of-living" adjusted real wage for individuals with identical education/skill levels (which is not necessarily well captured by "years of schooling"), adjusting for noneconomic amenities (California sunshine or the indignity of being represented by certain politicians in Washington) that are likely to differentially impact utility for different education groups, up to the fixed cost of migrating across states. In other words, it is not clear that even perfectly integrated national labor markets would equalize the education premia that the authors measure. Nevertheless, I do believe that the differences in these measured premia are so large that they are very difficult to reconcile with any notion of a well-integrated national labor market, even in the medium to long run.

For skeptics not convinced by these first two pieces of evidence, the authors undertake some original empirical analysis using the ASM data in defense of their proposition of limited interstate integration of labor markets. They compute the relevant impact of industry and state employment shocks on average wages at the plant level, finding that plant-level wages tend to respond more quickly and to a greater extent to state employment shocks (employment changes outside the two-digit industry of the plant) than to industry shocks (nationwide employment in the same two-digit industry outside the state). I would have thought that plants adjust employment rather than wages, especially in the short term.[4] I also

3. These coefficients are also possibly affected by different levels of educational quality across states, as the authors suggest, but they do not measure these levels of quality. In order to do that, one would need information on where a person was educated as well as where they currently lived. David Card and Alan Krueger (1992) present evidence on the returns to education in different states—their evidence suggests that, at least historically, important quality differentials have existed.

4. Given the way plant-level wages are computed, these measured wage changes could reflect changes in the composition of employees rather than a change in the marginal wage paid to a "representative worker."

harbor some reservations about these results due to the fact that many industries are geographically concentrated. Krugman (1996) has suggested that this concentration is evidence of agglomeration externalities. Regardless of the reason, the fact of geographic concentration of industries seems fairly well established. I am therefore a bit surprised that the data seem to have so little trouble differentiating between state employment shocks and industry employment shocks. (It seems that a major downturn in the aerospace industry should have some impact on the state of Washington, just as the oil price declines of the mid-1980s induced a regional slump in Texas and Oklahoma.) Nevertheless, I do not dispute the results—yet more evidence that there is but limited integration of local labor markets in the short to medium run.

**Residual Inequality at the State Level and Its Causes**

Having offered evidence on limited labor-market integration, the authors then construct measures of "residual inequality" (changes in the log wage ratio of the 90th percentile and the 10th percentile of the wage distribution, controlling for the effects of education and demographic factors) at the state level. These measures have changed over time in dramatically different ways in different states. In fact, for me, the most striking feature of the paper was the contrast between the declining residual inequality in some southern states (−7 percent for Virginia) versus exploding inequality in some northern states in the old manufacturing belt (21.9 percent for Michigan and 20.8 percent for New York) and the West. A whole research agenda could be built around exploring and explaining these differences, which to my knowledge are documented for the first time in this paper. I hope that the authors will proceed full speed ahead in this direction, and I look forward to reading their future papers on this topic.

I have one concern about these numbers, however. Residual income inequality is only one component of the total increase in wage inequality observed in the United States over the last 2 decades. We need to keep this in mind in our subsequent discussion of the authors' results.[5] On a related note, I would like to point out that, as the authors freely admit, they are not weighting by population in any sense. Their striking results may be driven by big changes in small (less populous) states. Not that this is not interesting, but the implications for the U.S. economy as a whole will be different in this case. On the other hand, the authors present evidence in section 7.5.2 that suggests the extreme states are collectively large enough to have had some impact on overall national trends.

The variable that stands out as explaining the changes in residual wage

5. Virginia may have undergone a decline in the level of residual income inequality, but according to the authors' figure 7.3, its advanced degree premium—an alternative measure of inequality—has been persistently high relative to other states.

inequality across states is the (change in) percentage of the state labor force employed in durable-goods manufacturing. Somewhat surprisingly, measures of migration and international exposure seem to matter little, but this measure of changes in the industry composition of employment has very large and very robust effects on local income inequality. The potential implications of this finding are hard to overstate. Careful research at the national level has consistently failed to find any strong relationship between changes in income inequality and changes in the pattern of labor demand across industries.[6] In this paper, at the state level, the authors are able to identify such a linkage in their data. The authors suggest that this is evidence that changes in demand for labor across industries really do have a powerful impact on inequality. They tell a story of manufacturing relocation from the Midwest to the South that is consistent with the data.

**An Alternative Explanation?**

Does durable-goods manufacturing really move the wage distribution? Perhaps so. I must admit to have been so brainwashed by the accumulated evidence against industry composition being important that I am not easily persuaded. Let me suggest an alternative story, which is actually not my own—rather, it is a restatement of Bound and Holzer's (1996) story based on their analysis of regional labor markets at the SMSA level and the work of Topel (1986). It focuses on labor supply considerations, which are, I think, somewhat in the background in this paper. I should say that I myself do not put too much stock in this alternative scenario, but it is at least worth thinking about.

Let us suppose that Blanchard and Katz (1992) are right—interstate migration does act to smooth shocks. However, the propensity to migrate is quite different for educated/skilled workers than for uneducated/unskilled workers; it is higher for the more-educated and better-skilled workers. This has implications for the wage distribution following a shock to the local economy, whether we measure this by the college wage premium (picking up the returns to educational attainment) or residual wage inequality (picking up, at least in part, the returns to skill, broadly defined). Wage adjustment will fall more heavily on the less-mobile workers. So, less-skilled workers in the southern boomtowns have their wages bid up, less-skilled workers in the North have their wages pushed down. Obviously, expectations about the duration of the shock affect the migration response. But it is not too hard to tell a story of Midwest versus South in which asymmetric responses to different overall demand shocks, rather

6. This failure is one important reason why the economics profession has been skeptical about the popular linkage between the rise of manufactured goods imports and the declining economic fortunes of the less educated and less skilled.

than changes in industry composition, tell the story. And the convergence of the southern regional economy toward national levels of income and capital per worker, if nothing else, could drive these kinds of changes. How do I explain the big effects of durable goods? I would have to argue that it is picking up other factors. Durable goods is such a broad aggregate of economic activity that the argument is not impossible to make, but it is not easy either. Furthermore, this alternative explanation may not be consistent with the facts. The authors have told me that a more inclusive measure of immigration from other states proved insignificant in earlier regressions, which would certainly go against this story. Bound and Holzer (1996) have found substantial effects from migration on the college wage premium, using data at the MSA level, but this does not insure that migration would have similar effects on residual inequality at the state level.

### Implications for the Increase in Inequality at the National Level

I would like to end this review with the same question I posed in the introduction: Can an examination of changes in income inequality at the regional level help us understand changes in the income distribution at the national level? Here the authors' findings are extremely provocative but, perhaps, not quite conclusive. Nevertheless, as the authors of this paper have measured it, a very large portion of the increase in residual inequality can evidently be explained by changes in industrial structure, and that, in itself, could turn much of what has been written about increasing income inequality on its head.

In fact, the basic message and ultimate impact of this paper may go well beyond the relatively narrow question I posed in my introduction. The balance of the evidence presented in this paper strongly suggests that regional labor markets are much less strongly integrated at the national level than most of the economics profession had previously assumed, despite high levels of interstate migration and more less or less perfectly free trade of goods and services across state lines. At the very least, these findings need to be further explored and explained. Their implications may inform not only our understanding of changes in income inequality, but also our understanding of the roles of distance and political borders in intranational as well as international trade, and the limits this may place on the level of intranational economic integration and, even, the definition of national economic policy. I look forward to the next paper by these authors on this topic.

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