PRICE DIFFERENTIALS AND TRENDS IN STATE INCOME LEVELS: A RESEARCH NOTE

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Abstract–Most of the discussion of regional income convergence in recent decades has operated under the assumption, either explicit or implicit, that spatial and temporal differences in regional prices (i.e., cost of living and inflation) are negligible. Using five different measures of interstate and interregional income inequality, we examine the evolution of regional income patterns before and after adjusting for price differences. Our results suggest that the common practice of overlooking interspatial differences in cost-of-living and inflation may yield a false understanding of regional income trends and, in turn, false policy prescriptions. Specifically, the pattern of regional income convergence through the 1970s followed by divergence in the 1980s are lost if spatial and temporal differences in regional prices are considered.

I. INTRODUCTION

Over a period of five decades beginning in the early 1930s, regional differences in per capita personal income (PCPI) appeared to diminish in the United States. Garnick (1990) reports that from 1929 to 1979, PCPI increased from 64 to 90 percent of the national average for low-income regions of the U.S. (Southeast, Southwest, Plains and Rocky Mountains) and declined from 127 to 107 percent in the high- income regions (New England, Mideast, Great Lakes and Far West). This reduction was so great that by 1979, state PCPI inequality among the states was less than one-third of its 1929 level.

Earlier studies of regional economic equality by Friedenberg (1978) and Garnick and Friedenberg (1982) provide evidence supporting the hypothesis that as a nation develops economically, regional differences in income levels disappear–that is, regions converge to some national average. More recently, Barro and Sala-i-Martin (1991, 1992) also find that over the period 1880-1988 the gap between rich and poor states closed at the rate of two percent a year. If these findings reflect the true pattern of change in regional income differentials, the implications for federal and state development efforts are pronounced. Proponents of the neoclassical theory of regional economic growth maintain that the national economy is efficient in growth and development; hence there is no need for

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government intervention. In other words, due to factor mobility, inequalities in income across regions will diminish naturally as the economy develops.

In more recent analyses, Amos (1988, 1989), Coughlin and Mandelbaum (1988, 1989), Garnick (1990), Redman, Rowley, and Angle (1992), Maxwell and Hite (1992), and Renkow (1994) present evidence of a reversal of these earlier trends. In the late 1970s low-income regions began to lose some of the relative progress they had made during the previous 50 years. Save for the Southeast region, which continued to show movement toward the U.S. average, the remaining low-income regions lost an average of nearly 8 percentage points. The performance of the high-income regions, however, was slightly more mixed. New England and the Mideast states experienced tremendous growth, while the Far West states continued a downward trend. The Great Lakes states actually fell below the U.S. average. Barro and Sala-i-Martin (1992) also find that their coefficient of convergence, when estimated for sub-periods of ten years, has decreased in recent decades and even became negative (i.e., diverged) during the last subperiod estimated, 1980-1988.

The findings of these more recent studies raise questions for researchers and policymakers alike. Theories of regional economic growth and development that supported the data prior to the late 1970s no longer appear to apply. Is there a need to revise our current thinking about the process of regional economic growth and development? Numerous researchers–for example, Amos (1988, 1989), Lipshitz (1992) and Fan and Casetti (1994), have used the apparent divergence as the foundation for advancing alternative theories of regional economic growth. Further, as argued by Maxwell and Hite (1992), the findings of these studies have implications for the emphasis that federal and state governments place on regional economic policy. If regional incomes are diverging, as the more recent data suggest, is there a greater need for policy designed to redistribute incomes and economic activity?

We suggest below that much of the research demonstrating divergence over the last decade overlooks key differences in spatial and temporal price levels, an oversight that may make its conclusions and policy implications suspect. An implicit, and at times explicit, assumption in much of the available empirical literature is that differences in regional prices, or regional cost-of-living differentials, and corresponding differences in regional rates of inflation are negligible. This is troublesome for at least two reasons. First, there is an extensive theoretical and empirical literature documenting substantial differences in regional prices (Cebula 1983 and 1989; Cebula and Smith 1983; McMahon and Melton 1978; and McMahon 1991). Generalizing from the American Chamber of Commerce Research Association's quarterly Cost of Living Index, Kurre (1992) observes that it cost approximately 46 percent more to live in Kodiak, Alaska, in 1989 than the

average of 288 other U.S. communities; and Pyor, Oklahoma, had a cost of living more than 15 percent below the average.

Second, changes in regional price differentials over time vary greatly. For example, growth pressures along the East Coast, particularly the Boston-Washington corridor, have placed greater upward pressures on regional prices than in the Midwest or Great Plains states. Indeed, the Bureau of Labor Statistics' regional inflation indices suggest that prices rose 280 percent between 1969 and 1991 in the Northeast, but rose only 260 percent in the Midwest states. We suggest that much of the current empirical literature examining regional income convergence/divergence is suspect because these fundamental differences in price levels, both spatially and temporally, have not been taken into consideration.

There are a limited number of studies which attempt to address the concern we have expressed. Ram (1992), Bishop, Formby and Thistle (1994), and Eberts and Schweitzer (1994), suggest a different pattern in state income convergence-divergence trends if regional price differentials are accounted for in the analysis of income trends. Using Theil's population-weighted index of income inequality, Ram finds evidence of state income divergence after 1978 if income levels are left in unadjusted terms. In other words, his results complement the more common literature. After adjusting for regional price differentials, however, he finds little, if any, evidence of divergence. Bishop *et al.* make price differential adjustments based on a method suggested by Tremblay (1986). Their price differential adjustment method relies on the Bureau of Labor Statistics *Index of Comparative Costs Based on the Intermediate Budget* for 1976. This is unfortunate in the sense that these data have not been available since 1981. Therefore Bishop, et al., limit their analysis to the period 1969-1979, and do not address the period of the 1980s when divergence is perceived of have occurred in the US.

The work of Randall Eberts and Mark Schweitzer (1994) represents the best attempt to date to address the concerns outlined above. Eberts and Schweitzer use data similar to that used by Trembley and Bishop *et al.* in deriving initial metropolitan price differentials (i.e., the 1981 Bureau of Labor Statistics *Report on Family Budgets*). They go further, however, in using the BLS Consumer Price Index for selected metropolitan areas to expand the period examined to include the 1970s and the 1980s. Thus, Eberts' and Schweitzer's analysis includes data for periods of observed convergence and divergence. Like Ram, they generally find much weaker evidence of divergence after adjusting for price differentials.

The intent of the research project reported here is to build upon earlier work of Ram, Bishop *et al.* and Eberts and Schweitzer and test the sensitivity of the current empirical findings to adjustments in regional price and inflation differentials using data for the lower 48 U.S. states for the period 1969 to 1991.[1] Following Ram, we use data on the differences in state-level cost of living, available

from McMahon (1991).[2] But Ram limits his analysis to the period after 1977, the year in which the historical pattern of convergence reverses itself. By using inflation rates for the four census regions, available from the Bureau of Labor Statistics, we are able to expand the period of observation to include years characterized by convergence as well as divergence.[3] In addition, to minimize the potential that our results are due to measurement construction, we report results for five distinct measures of inequality.

The article is composed of three sections. First, we describe our methods of measuring regional income inequality and adjusting for differences in price levels. We then present our results for both the adjusted and unadjusted data. Our major finding is that, when the adjusted data are used, the pattern of convergence and divergence so widely described is much less clear. We close the article with a short summary and suggestions for future directions in research.

II. METHODS AND DATA

In order to examine regional income differentials over time we use five different measures of income inequality that have appeared in previous studies (Maxwell and Hite 1992; and Nissan and Carter 1993). We have elected to use several measures of regional income inequality to minimize the potential that our results are due to measurement construction. We compute each of the following measures with data both adjusted and unadjusted for differences in prices, then compare and contrast the measures graphically. After describing each of the basic measures of income inequality, we show how adjustments for price differentials are made.

Our first measure (perhaps the simplest) is the regional proportion of per capita income ($PPCI_i$), given by:

$$PPCI_i = \frac{PCI_i}{PCI_{US}}$$

where PCI_i is per capita income for the region and PCI_{US} is the per capita income for the United States. This measure was popularized by the work of Friedenberg (1978), Garnick and Friedenberg (1982), and Garnick (1990).

More recent researchers have followed Williamson (1965) in using various methods of computing coefficients of variation. Our first method of computing the coefficient of variation is a weighted income variation as used by Amos (1988):

$$V_w = \frac{\sqrt{\sum(y_i - \bar{y})^2 \frac{P_i}{P}}}{\bar{y}}$$

where y_i and $\bar{y}$ refers to regional and mean per capita income respectively, and p_i/P refers to the region's share of national population (p_i is the i^{th} state's population and P is the nation's population).

Our next measure, as used by Coughlin and Mandelbaum (1988, 1989), and Rowley, Redman, and Angle (1991), is an unweighted income variation:

$$V_{uw} = \frac{\sqrt{\frac{\sum(y_i - \bar{y})^2}{N}}}{\bar{y}}$$

where y_i, and $\bar{y}$ are the same as before and N is the number of regions (states).

A fourth measure of variation, computed by Williamson (1965), is the weighted mean absolute deviation. Maxwell and Hite (1992) used this in their work on regional convergence/divergence in Australia. This measure is given by:

$$M_w = \frac{\sum | y_i - \bar{y} | \frac{P_i}{P}}{\bar{y}} * 100$$

where y_i, $\bar{y}$ and p_i/P are defined above and $|y_i - \bar{y}|$ is the absolute deviation from the mean.

Our fifth and final measure of regional income inequality is suggested by Nissan and Carter (1993):

$$J_g = \frac{1}{n_g} \sum \frac{\rho_i}{\gamma_i}$$

where n_g is the number of states in the region, and ρ_i and γ_i refer to the state *i* of region *g*'s share of national population and income, respectively. This measure accords with Theil's entropy measures of industrial concentration.[4] Generally, values around one indicate equality, those further from one greater inequality.

We adjust the nominal data for differences in regional cost of living and inflation rates in two steps. To capture differences in regional rates of inflation, we employed the Bureau of Labor Statistics Regional Consumer Price Index.[5] Using this measure partially limits the analysis because the CPI is reported for only the four Census regions: Northeast, Midwest, South and West. However, it allows us

to move beyond the work of Ram (1992) and Bishop, *et al.* (1994) to include periods characterized by both convergence and divergence. To adjust for inflation we apply the regional CPI deflator to each state within the appropriate region. While there is clearly the potential for introducing a distortion in taking this step, we assume that interregional differences in inflation are sufficiently greater than intraregional differences. No comprehensive data on interstate inflation differentials are available. This also allows us to keep the number of observations used in the calculation of the inequality measures equal to 48.

To adjust for cost of living differentials we employ the cost of living index (as Ram 1992) which was developed by McMahon and Melton (1978) and later updated by McMahon (1991). McMahon and Melton developed the state-level index by estimating a set of seemingly unrelated regression equations based on 1969 BLS data on regional prices. They estimated parameters for the effects of housing costs, per capita income, and changes in population levels on regional cost of living.[6] By using annual data for each of these variables McMahon is able to estimate state-level prices in the form of cost-of-living indices. For this study we used McMahon's updated analysis. In this latter piece he employs the same methodology as the earlier work but computes state cost of living estimates for each year for the period 1981-1990. We compute an annual average for each of the 48 states, then adjust state per capita personal income upward or downward, depending on the value of the average index.

To summarize, our adjustment takes two steps. First, we adjust income for each state over time with the BLS Regional Consumer Price Index to derive "time real" income. Second, we use the McMahon cost of living differentials to make a shift upward or downward to derive "space real" income. Data on regional population and total personal income to compute the measures outlined above are taken from the Bureau of Economic Analysis' Regional Economic Information System CD-ROM (BEA-REIS CD-ROM) for the years 1969 through 1991.

While the steps we have outlined in constructing state-level regional cost-of-living indices may seem labyrinthine, we believe this difficulty draws attention to the problem facing regional scientist interested in looking at regional U.S. economic data. Specifically, the lack of relevant price indices constructed from primary data create significant complications in conducting sound regional economic analysis. Economists are faced with either assuming regional price differentials away, as has been done in many of the recent income convergence/divergence studies, or constructing price indices that may introduce an unacceptable level of noise in the data. Even if the relevant data are available, we still face the problem of constructing an accurate index itself. While we lack region-specific indices, even the available indices at the super-regional level are fraught with problems: determining what is a relevant sample of prices; allowing

for quality improvements; and defining relevant-economic-important weights, to name a few.

III. RESULTS

Before turning to the results of the convergence/divergence analysis, it is useful to directly examine differences in the constructed regional price differential indices (Table 1). Here the base year is 1981-82 and the index is consistent over space and time. For example, in 1969, the first year of this analysis, Connecticut had the highest price index at 48.5, followed by New Jersey, Massachusetts and California. West Virginia had the lowest index value at 35.1, followed by Mississippi, South Carolina and Utah. At the extremes, prices in Connecticut were 38.2 percent higher than West Virginia. In the most recent period, Connecticut remains at the high end, while Utah, due to a slower rate of regional inflation, becomes the state with the lowest price index at 128.4.

As a point of illustration, consider the differences in personal per capita income (PPCI) between Connecticut and West Virginia. In 1969, PPCI in Connecticut was $4,816 and $25,705 in 1991, an unadjusted increase of $20,889 or 434 percent. Adjusting these figures to reflect prices in 1981 reduces the 1969 to 1991 increase to 40 percent: $9,930 and $13,932, respectively. In West Virginia, PPCI in 1969 was $2,766 and $14,695 in 1991, an unadjusted increase of $11,929 or 431 percent. After adjusting for spatial and temporal price differentials the increase over the period examined went from $7,880 to $11,347, or 44 percent. Without adjusting for price differentials, Connecticut's level of growth (434 percent) appears to be slightly out-pacing West Virginia's (431 percent). After adjusting for price differentials, Connecticut's level of growth (40 percent) is actually below West Virginia's level (44 percent), indicating convergence. In short, differences in spatial and temporal prices explain, in part, the observed and much discussed patterns of regional income convergence/divergence.

The results of our direct convergence/divergence analysis are reported in Figures 1 through 5. Consider first the unadjusted measures. In nearly every case a clear pattern develops: up till about 1978, the differences in regional income appears to be declining. Per capita income as a share of the U.S. average (Figure 1a) appears to be moving downward to the U.S. average for the Northeast and Western states, and upward for the Southern states. However, after 1978, the Northeast begins to climb away from the U.S. average, while the South appears to flatten out and run parallel to the U.S. average. The West continues its movement toward the U.S. average, while the Midwest actually falls below it.

TABLE 1
State cost of living index adjusted by CPI deflator (select years)

Region/State	1969	1980	1991
NORTHEAST			
Connecticut	48.5	106.4	184.5
Maine	40.4	88.6	153.6
Massachusetts	46.5	101.8	176.5
New Hampshire	41.7	91.4	158.5
New Jersey	46.9	102.9	178.3
New York	44.3	97.1	168.3
Pennsylvania	41.4	90.7	157.2
Rhode Island	42.5	93.2	161.7
Vermont	40.3	88.3	153.2
SOUTH			
Alabama	36.1	82.2	133.4
Arkansas	35.8	81.4	132.1
Delaware	41.7	94.9	154.0
Florida	37.1	84.4	136.9
Georgia	37.1	84.5	137.1
Kentucky	36.6	83.2	134.9
Louisiana	36.8	83.7	135.7
Maryland	41.3	94.0	152.5
Mississippi	35.7	81.1	131.7
North Carolina	38.2	86.9	141.0
Oklahoma	36.8	83.8	135.9
South Carolina	35.7	81.2	131.8
Tennessee	36.8	83.8	136.0
Texas	37.0	84.2	136.6
Virginia	41.4	94.3	153.0
West Virginia	35.1	79.8	129.5
NORTH CENTRAL			
Illinois	41.3	92.6	148.7
Indiana	38.9	87.0	139.8
Iowa	39.1	87.6	140.7
Kansas	39.3	88.0	141.3
Michigan	39.8	89.2	143.3
Minnesota	40.9	91.6	147.1
Missouri	39.5	88.5	142.2
Nebraska	38.9	87.2	140.1
North Dakota	37.7	84.4	135.5
Ohio	39.7	88.8	142.7
South Dakota	37.2	83.3	133.8
Wisconsin	39.5	88.5	142.2
WEST			
Arizona	36.9	82.7	132.8
California	45.1	100.9	162.1
Colorado	40.3	90.3	145.1
Idaho	36.1	80.8	129.8
Montana	37.1	83.2	133.7
Nevada	38.2	85.5	137.4
New Mexico	36.9	82.7	132.9
Oregon	38.5	86.2	138.5
Utah	35.7	79.9	128.4
Washington	39.3	88.0	141.4
Wyoming	37.3	83.4	134.0

Base 1981 = 100

FIGURE 1
Proportion of National Per Capita Income
(Unadjusted and Adjusted)

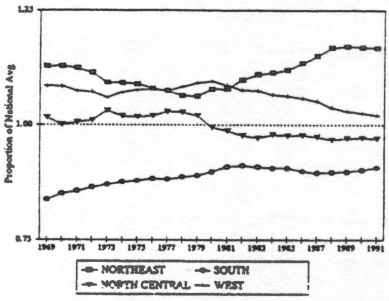

Figure 1a. Proportion of National Per Capita Income--Unadjusted

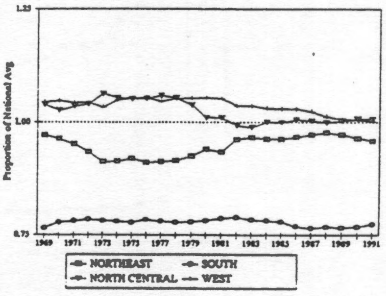

Figure 1b. Proportion of National Per Capita Income--Adjusted

FIGURE 2
Unweighted Variation of Per Capita Income Across States

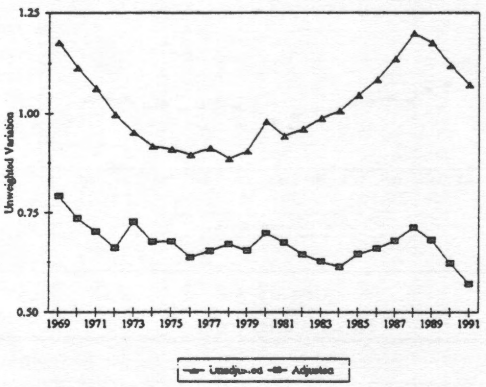

FIGURE 3
Weighted Variation of Per Capita Income Across States

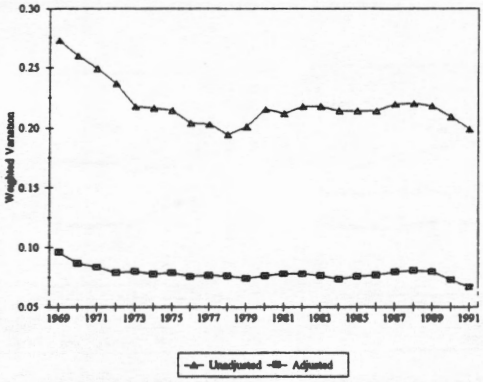

FIGURE 4
Weighted Mean Absolute Deviation of Per Capita Income

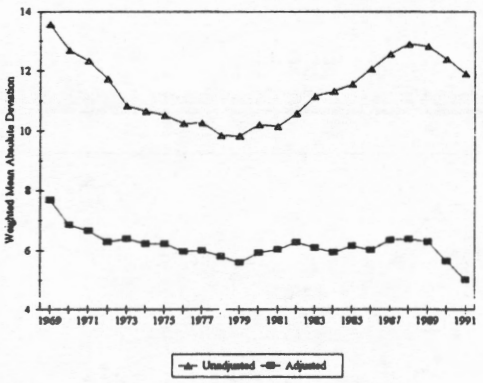

FIGURE 5
Nissan-Carter Index

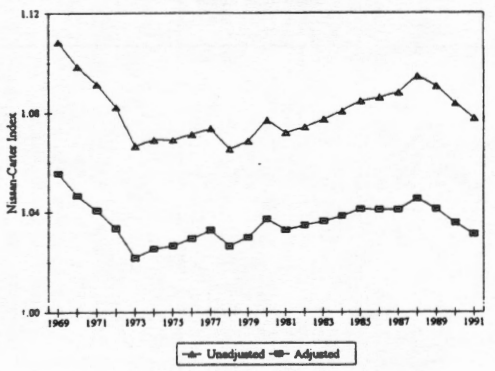

Figure 1a and the three unadjusted coefficient-of-variation measures (unweighted, weighted and weighted mean absolute deviation) depicted in Figures 2-4 all produce the U-shape pattern reported in the literature. Differences across the 48 states appear to be declining up till 1978, after which a pattern of divergence appears. The U-shaped pattern is particularly evident with the unweighted variation and weighted mean absolute deviation measures. It is interesting to note that for the last three years observed (1989-91), a pattern of convergence reappears. The entropy measure of Nissan and Carter (Figure 5) further supports the general pattern revealed by the other approaches but suggests that the reversal in the convergence trend occurred much earlier in the 1970s.

Next consider the adjusted measures presented in Figures 1b-5. Turning first to the regional proportion of the U.S. average (Figure 1b), the relatively neat pattern based on the unadjusted data (Figure 1a) seems to disappear. The Northeast, traditionally the wealthiest region in most analyses, actually lies below the U.S. average for the period examined. But rather than following a pattern of convergence, then divergence, the Northeast actually appears to follow a pattern of divergence, then convergence, the opposite of the pattern found with the unadjusted analysis. The South appears to follow no pattern, save for a slight dip downward in the mid-1980s. The Western states parallel the U.S. for much of the 1970s and early 1980s, then converge toward the national mean. The pattern for the Western states seems to be the same for both the unadjusted and adjusted analysis. The pattern for the North Central follows that of the Western states.

The three coefficient of variation measures reported in Figures 2, 3 and 4 relate a similar story. While there is some evidence of regional income convergence in the period from 1969 to 1978, there is no systematic evidence of regional income divergence in the 1980s. For the unadjusted data there is a clear movement away from equality in the 1980s. However, no clear pattern emerges with the price-adjusted data. There appears to be an overall pattern of convergence in the adjusted data, but the trend is quite diminished in comparison with the unadjusted data, and appears to reveal a certain degree of randomness.

For the Nissan-Carter entropy measure, however, the pattern of convergence and divergence remains after adjusting for prices. Three observations seem warranted here. First, the computation of this particular entropy measures requires the division of two small numbers. It may be the case that our simple price adjustment mechanism is insufficient. Second, the scaling of the measure decreased significantly after the adjustment, indicating much smaller levels of inequality. Finally, it is possible that there did indeed occur some level of divergence after 1978 and that spatial differences in prices does not explain all of the observed pattern in the unadjusted analysis.

An independent observation on levels of inequality across the states can be gained by examining the relative levels of the respective measures across the entire time period. In the case of every measure used, the overall level of inequality is much lower after adjusting for price differentials. For example, with the unweighted variation measures (Figure 2), the adjusted measure is about .8, while the unadjusted measure is about 1.2. This result suggests that a noteworthy proportion of the differences in income levels across the states can be explained, in part, by price differentials.

IV. SUMMARY

Considerable attention has been devoted to the apparent reversal in regional income convergence. Concern has been expressed on two fronts. First, our theories of regional growth and development neither predict nor account for the observed patterns. Second, and perhaps more important, are the policy implications. A trend toward greater equality lends itself more readily to arguments for a laissez-faire approach by government.

A sizeable proportion of the literature, both empirical and conceptual, has neglected a very important aspect of regional economics: differences in prices over both space and time. The cost of living on the East Coast is much different from that of the Heartland. Differences in levels of economic growth also contribute to different rates of inflation across regions. Our central question is: Are differences in regional prices (i.e., spatial or cost of living and temporal or inflation rates) explaining, in part, the patterns so widely discussed in the literature? After making simple adjustments we reach the conclusion that the "neat" pattern of convergence/divergence is questionable. The pattern of divergence during the 1980s does not appear to be supported with the adjusted data. In only one of the five measures explored does the pattern of divergence remain after adjustments are made. We also note that the absolute level of regional income inequality can be explained in part by differentials in regional price differentials.

Our findings, however, are provisional and limited by the availability of good regional price data. We suspect that this is the primary reason why this aspect of the topic has been overlooked. Rather than ignoring the lack of quality data, we suggest that we as regional scientists need to develop a research program to address the shortcomings of our data.

ENDNOTES

1. Alaska and Hawaii are removed due to the extremely high cost of living in those two states. In essence, they represent outliers in the data set.

2. Briefly, McMahon also uses the BLS estimates of regional price differentials based on the family budget data to construct a simple statistical relationship between demand proxies and cost-of-living. Once the statistical relationship is established, more widely available data, such as a region's population, can be used to predict an index describing a region's cost of living. This is the same method suggested independently by Cebula (1983, 1989).

3. This approach is parallel to Eberts and Schweitzer's (1994). Our analysis differs in that we use state-level data as oppose to selected metropolitan indices. Our analysis also differs from Eberts and Schweitzer in two additional ways. First, we use per capita income, as opposed to wages; thus we capture non-wage sources of income. Second, we test the sensitivity of the results using several separate measures of inequality.

4. This measure is also similar to the one employed by Ram (1992).

5. See BLS *Monthly Labor Review* and *CPI Detailed Report*, January issues. Also see Table 761 in the *Statistical Abstract of the United States: 1993*, Bureau of the Census.

6. Using these price data, we may be introducing a simultaneity problem. If prices are a function of income, as McMahon argues, can we use the income-derived price index as a mean to adjust income? We may have a bit of a chicken-and-egg problem. Unfortunately, there are currently no alternative methods to make spatial price adjustments.

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