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Problems in Measuring Economic Progress

By Mindaugas Petrulis

In regional income comparisons, relative and absolute measures sometimes produce apparently contradictory results. These can be reconciled if a proper time perspective is utilized. An income gap between regions, relative or absolute, indicates the situation at a particular time, while growth rates and changes in proportions point to long-run implications. As long as a regional growth rate exceeds the national rate, the absolute regional income gap may increase or decrease in the short run, but in the long run the ratio of per capita incomes must approach unity and the income gap must approach zero.

Key words: Regional income comparisons, measuring economic progress, relative income convergence, absolute income convergence, Appalachia growth rates.

Has the recent pattern of regional growth in the United States led to a convergence of regional incomes? Different conceptual measures applied to available statistical data lead to conflicting conclusions. Using the Appalachian Region as an example, one measure, such as the per capita income of Appalachian residents relative to the national average, points to an improvement for Appalachia—a convergence of per capita incomes with the national average. A second measure, the yearly percentage gain in per capita income, suggests Appalachia is growing faster than the Nation as a whole. But a third measure, the dollar gap between Appalachian and non-Appalachian incomes, suggests the opposite—a divergence in regional per capita incomes between regions. Yet each conceptual measure draws on the same basic data of aggregate income and population totals.

This paper describes several common approaches to measuring economic change, indicates the logical basis for each approach, and discusses the best uses for each. The various approaches are classified for discussion into the following categories: (1) Economic aggregates, such as population and personal income; (2) measures of central tendency—these are ratios of aggregates such as per capita income, or ratios of ratios such as relative per capita income; (3) growth rates of aggregates and ratios; and (4) the gap between economic aggregates or ratios.

Economic Aggregates

The simplest measures of economic activity are total levels of basic variables such as population, employment, or income. These measures indicate, for example, that in 1966 Appalachia had more people than New England, the Plains, the Southwest, the Rocky Mountain States, or the Far West. On the other hand, the Plains, with a smaller population than Appalachia (15.9 million compared with 18.3 million), managed to produce a larger income ($45.6 billion compared with $42.0 billion for Appalachia.[1] Such raw aggregates describe general economic conditions, indicate regional contributions, and serve as data for various policy considerations. More importantly, they are used in computing other measures, such as growth rates and income gaps, which may be more useful in explaining economic progress or delineating economic problems.

Measures of Central Tendency

As a second approach to interpreting economic progress one can use various measures of central tendency such as per capita income, average family income, or median family income. By comparing one aggregate with another, these statistics provide insights as to the relative efficiency of regional production and indicate the success in achieving various economic goals.

If the criterion for progress is "the bigger the per capita income, the better," then it seems both the United States and Appalachia are doing quite well. The national per capita income rose from $2,161 in 1959 to $2,961 in 1966, while Appalachia increased its per capita income from $1,661 to $2,291.

On the other hand, the ratio of these two ratios indicates that Appalachia's per capita income in 1966 was still only 77.4 percent of the national average. This is usually interpreted as a reason for economic aid to Appalachia, since one of our national goals is the elimination of regional income inequalities. When it is noted that this proportion has increased from 76.9 percent in 1959, it appears that programs to aid Appalachia may be working, although slowly, and

[1] Data were obtained from U.S. Department of Commerce, Bureau of the Census, *Survey of Current Business*, August 1967, and *Journal of the Appalachian Regional Commission*, Vol. 2, No. 6, March 1969.

AGRICULTURAL ECONOMICS RESEARCH

VOL. 23, NO. 2, APRIL 1971

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Appalachia residents are somehow catching up to the level of living in the rest of the economy. As will be seen under subsequent discussions of growth rates and income gaps, this conclusion may not be reflected by other measures of progress.

Growth Rates

A third approach considers the rate of growth of gross regional (area) income or per capita income. These measures represent what may be called the volume effects of economic growth—the faster the gain, the better.[2] Under this criterion, the United States and the areas within it seem to be doing well. The country just about doubled its per capita income between 1950 and 1966, while every State in the so-called "depressed" Southeast *more than* doubled its per capita income. In 1959-66, per capita income increased 37 percent for the Nation and 38 percent in Appalachia. This amounts to a 4.6 percent national annual growth rate and a 4.7 percent annual rate for Appalachia. These growth rates suggest that Appalachia is growing faster than the Nation and thus should tend to converge with the national average in per capita incomes.

All regions seem to have had increases in personal income. But such comparisons of growth rates tend to cover up both the levels of change and regional variations. For example, changes in per capita income can result from diverse movements in both total income and population. In the United States as a whole, in all the major regions such as the Mideast or the Southeast, in Appalachia, and in all the States except West Virginia, per capita income has been growing because total income is outstripping population increases. In West Virginia and the Appalachian portion of Pennsylvania, an actual population decline (between 1950 and 1966) coupled with a modest increase in total income also produced a rise in per capita income. Within Appalachia, the Georgia section, for example, experienced higher growth rates than Alabama in both population and per capita income (between 1959 and 1966)—an 11 percent gain in population and a 49 percent gain in per capita income compared with 8 percent and 38 percent, respectively, for the Alabama section. In spite of the different growth rates, both areas experienced very similar increases in per capita income ($596 in Alabama and $613 in Georgia), and the Alabama area with a smaller population growth rate gained 177,714 people while the smaller but faster growing Georgia area gained only 82,676 or half as many.

Nonetheless, growth rates in per capita income do point to an overall improvement in Appalachia; however, these rates may be too low if Appalachia is expected to catch up to the Nation in a reasonable period of time. Let's look at another measure—the income gap.

[2]Assuming the gain is not due just to inflationary pressures.

The Income Gap

In absolute terms, recent trends indicate that per capita income in Appalachia is falling further and further behind the national average. In 1959, Appalachian per capita income lagged the national average by $500; by 1966, the gap increased to $670. Within Appalachia, the 1959 income gap ranged from $1,237 in Kentucky to $46 in Maryland; and, by 1966, among the 13 State areas comprising Appalachia, 11 were worse off—the increases in income gaps ranged from $348 in Kentucky to $99 in Tennessee. In the remaining two areas, the South Carolina section narrowed its gap by $110 (to $476) while Maryland, the only area with a substantial increase in per capita income ($1,021), managed to exceed the national average by $173.

These results conflict with what was concluded when only proportions and growth rates were examined. This is quite possible since a period of convergence in regional per capita incomes relative to the national average may at the same time be one of increasing absolute income differentials. For example, if a sizable income gap exists between the region (numerator) and the Nation (denominator), and the region's growth rate is not substantially larger than the Nation's, the ratio may indicate that the region is catching up with the Nation; but in absolute terms the opposite may be true, as was the case in Appalachia. There the ratio of per capita incomes to the national average increased from 76.9 percent in 1959 to 77.4 percent in 1966—implying an improvement; but the income gap also increased from $500 to $670, implying a deterioration. Such results are possible since the value of the ratio of per capita incomes is determined only by regional growth differentials, while the absolute gap is determined by a mixture of regional growth rate differentials and initial absolute differentials. Let's consider some specific examples of how different growth rates affect per capita income ratios and income gaps.

If the ratio of per capita incomes had remained constant at 76.86 percent (line 1, table 1), Appalachia's growth rate must, by definition, equal the national rate (4.6 percent per year, compounded) and the income gap would have grown at the same rate to $685 by 1966.

If Appalachia's growth rate had been slightly below the national rate (4.5 percent compared with 4.6 percent nationally), the ratio of per capita incomes would have dropped below 76.9 percent and the gap in incomes would have increased to $701 by 1966 (line 2, table 1). In this event Appalachia would appear to be getting worse relative to the Nation by all four measures.

If the Appalachia growth rate slightly exceeds the national rate (as was the case between 1959 and 1966, line 3, table 1), the ratio of per capita incomes must increase; but the income gap in the short run will also increase, although at a decreasing rate. To start closing the absolute income gap in the short run would require a much larger rate of gain than shown in line 3 of table

Table 1.—Per capita incomes, growth rates, and proportions derived from specified assumptions, Appalachia and United States, 1959, 1966, and projected 1980[1]

Assumptions	Annual compound growth rates			Income per capita[2]						Income gap between Appalachia and United States			Ratio of per capita incomes (Appalachia: United States)		
	Income per capita		Gap	Appalachia			United States								
	Appa-lachia	U.S.		1959	1966	1980	1959	1966	1980	1959	1966	1980	1959	1966	1980
	Pct.	*Pct.*	*Pct.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Pct.*	*Pct.*	*Pct.*
Ratio of per capita incomes between Appalachia and United States remains constant	*4.6*	*4.6*	*4.6*	1,661	2,276	4,271	2,161	2,961	5,557	500	685	1,286	*76.86*	*76.86*	*76.86*
Ratio of per capita incomes between Appalachia and United States is decreasing	*4.5*	*4.6*	*4.9*	1,661	2,260	4,186	2,161	2,961	5,557	500	701	1,371	76.86	76.33	75.33
Ratio of per capita incomes between Appalachia and United States is increasing[3]	*4.7*	*4.6*	*4.3*	1,661	2,291	4,358	2,161	2,961	5,557	500	670	1,199	76.86	77.37	78.42
Eliminate the gap between Appalachian and U.S. per capita incomes by 1980	*6.5*	*4.6*	---	---	2,291	5,557	---	2,961	5,557	---	670	0	---	77.37	100.00
Maintain gap between Appalachian and U.S. per capita incomes in 1980 at 1966 level	*5.6*	*4.6*	---	---	2,291	4,887	---	2,961	5,557	---	*670*	*670*	---	77.37	87.94

[1] Numbers in italics are assumed to be constant; those not in italics are implied by the assumed structure and constants in each row.

[2] Source: *Journal of the Appalachian Regional Commission*, Vol. 2, No. 6, March 1969.

[3] This was the actual situation in 1959 and 1966.

or much smaller initial absolute income differentials. Nevertheless, as long as the Appalachia growth rate exceeds the national rate, eventually the ratio of per capita incomes must converge to unity and the income gap must go to zero, although it may take quite a while.

This demonstrates another aspect of gap analysis—the importance of the time perspective. An income gap indicates the situation at a particular point in time. If growth rates are neglected, the projection of an income gap amounts to a linear extrapolation. In the Appalachia case a linear extrapolation (solid lines in figure 1) would indicate that the per capita income gap would never close. On the other hand, if the 1959-66 per capita income growth rates prevailed and everything else, such as migration, productivity, institutions, etc., remained constant, a compound interest projection (dotted lines in figure 1) indicates that the income gap is increasing at a decreasing rate in the short run but eventually will be eliminated although it would take about 250 years.

If Appalachia's growth rate could be raised to 6.5 percent, the national rate remaining constant at 4.6 percent, per capita income parity could be achieved by 1980 (line 4, table 1). If this were not possible, a rate of 5.6 percent would keep the income gap in 1980 at the 1966 level (line 5, table 1).

We have seen that a growth rate slightly above the national average may allow the gap to widen in the short run while a larger growth rate can close the gap quickly. In between, there exists a growth rate which will achieve a target gap in a finite time period. Thus, if we are concerned with the near future, say up to 1980, a 5.6 percent growth rate for Appalachia is mandatory for the income gap to remain at the 1966 level while a higher rate is needed for any reduction in the gap.

Conclusion

Looking at the four measures, it is obvious that no one measure tells the whole story—some provide more insight, others less. Even if one looks at all these measures, he will get only a rough approximation of such concepts as real income since these measures do not reflect the demographic, economic, and sociological characteristics of the region. However, if one has to make regional income comparisons it is definitely not enough to look only at relative measures, or only at

GAP ANALYSIS - LINEAR AND COMPOUND INTEREST

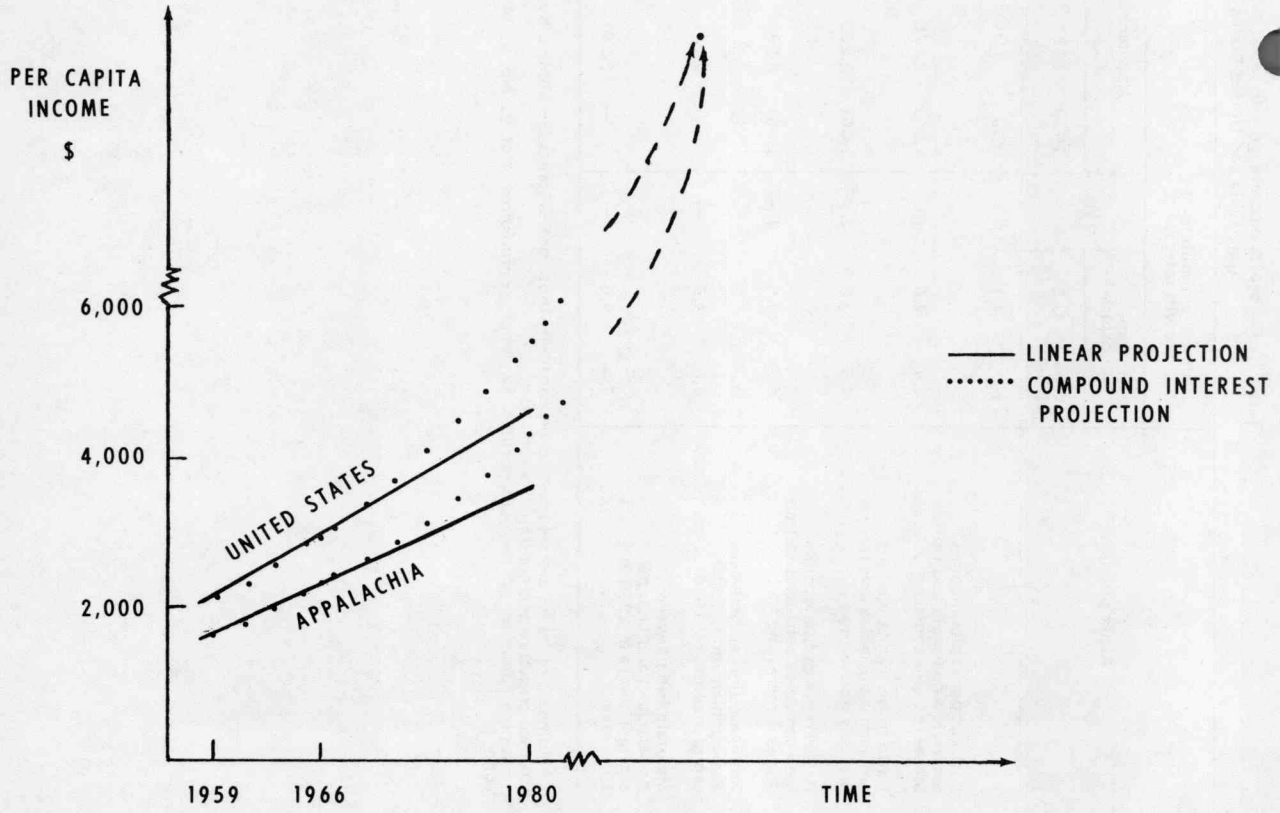

Figure 1

absolute measures. The two sets are just different sides of the same coin. Apparent contradictions in results can be reconciled if a proper time perspective is utilized. To reiterate, an income gap, relative or absolute, indicates the situation at a particular point in time while growth rates and changes in proportions point to long-run implications. With respect to the long run, any State whose per capita income continues to grow faster than the national average must eventually close the gap, both relatively and absolutely. As long as a given growth rate exceeds the national average, the ratio of per capita incomes *must* converge to unity and the gap *must* approach zero, although it may take a while if the growth rates are not substantially different or the initial income levels are quite disparate. In some cases, it may take even longer to close the gap when the absolute gap is decreasing than when the gap is increasing (in the short run). This again will depend upon the particular growth rates and the respective income levels. Thus, when income comparisons are to be made, one needs to take into account not just ratios of incomes but also income gaps and the inherent growth rates.