Urban-Rural Regional Development Diffusion And Personal Income Inequality

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The importance of urban areas in regional development has been theoretically discussed in growth pole literature by Perroux (1955), Hansen (1967) and Lasúen (1969); empirically examined by Martin (1978, 1979a, 1979b), Martin and Graham (1980), and Lewis and Prescott (1972); and practically implemented as the basis for economic development policy under the Economic Development Act of 1965. Kuznets (1955, 1963, 1973) and Williamson (1965, 1980) in a similar line of investigation have explored the relationship between income inequality and development. Kuznets first proposed, and Williamson subsequently tested, the hypothesized *inverted-U* pattern of income inequality followed by countries and regions in the course of development. In more recent work, Amos and Greenwade (1981) hypothesize an extension of the inverted-U pattern based upon U.S. state trends in spatial income inequality from 1950 to 1970. The augmented inverted-U follows a pattern of increasing, decreasing, then once again increasing income inequality, which resembles a sine curve more than a simple inverted-U.

The objective of this paper is to investigate the augmented inverted-U hypothesis, within the context of growth poles. Why relatively developed U.S. states have experienced increasing spatial income inequality is essentially unexplained. Growth pole theory, which emphasizes the importance of urban areas in regional development, offers one explanation for this phenomenon.

I. GROWTH POLE STIMULATED REGIONAL DEVELOPMENT

Perroux first discussed asymetric regional development in a growth pole context (1955), indicating that development begins at particular spatial locations, then spreads to surrounding areas over time. Three reasons offered for a growth pole pattern of development (Amos, 1981) are (1) natural resource endowment, (2) capital accumulation, and (3) intraregional linkages. Natural resource endowments, especially those with an external source of demand, enable development to appear in a region at specific locations. A "motor" industry which uses the natural resource attracts other industries, vertically and horizontally related, enabling capi-

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tal accumulation and subsequent establishment of a growth pole. The growth pole inherently has higher marginal value product of labor, wages, and consequently per capita income, due to capital accumulation. This tends to attract additional skilled, educated and more productive labor from the surrounding areas as well as outside the region. Thus, a basic inequality of real wages exist between a growth pole and the surrounding area, which can only persist over time due to a lack of intraregional linkages, such as communication and transportation systems. As intraregional linkages are improved, development spreads outward, from the growth pole to the surrounding area.

The pattern of development implied by growth pole theory is one of increasing income inequality, as the growth pole initially develops faster than the surrounding area; then decreasing income inequality, as the surrounding area catches up. While this explains Kuznets inverted-U hypothesis, growth pole theory can also explain the Amos-Greenwade augmented inverted-U hypothesis.

If the initial growth pole in a region continues to spread development to the surrounding area, the entire region will eventually achieve a relative degree of development homogeneity, with no real wage or per capita income differentials. However, if a new growth pole appears at another location, the development process would begin a new cycle of divergence, then convergence of per capita income.

Secondary growth poles could occur for the very reason primary growth poles emerge: natural resource endowments, capital accumulation and intraregional linkages. However, a secondary growth pole is different from a primary growth pole when it emerges, in that the overall development of the region is greater. Since the level of development is higher, intraregional linkages are better and more efficient, enabling the region to traverse an increasing/decreasing inequality pattern in less time.

In addition secondary growth poles could occur, not just due to natural resource endowments, but from the comparative advantage in the production of any good. In particular, if the external demand for a good produced in a region increases significantly, and the good is produced at a non-growth pole location, a secondary growth pole could be established.

While emergence of distinct, secondary growth poles, unrelated to the primary growth pole, could occur, this process is not systematic enough to explain associated phenomenon identified by Amos and Greenwade. There is no evidence to support the emergence of secondary growth poles, in the form of new urban areas, in states experiencing re-divergence. This leads examination to the structure of primary growth centers. It is not necessary for a growth pole to emerge in the form of a new, dominate urban area. It is possible for the secondary growth pole to emerge within existing urban areas, but at a location other than at the primary growth pole. Obviously, an important trend occurring between 1950 and 1970 was the suburbanization of residential, manufacturing and commercial areas (Mills, 1980, pp. 38-49). One effect of suburbanization is the reduced dominance of central cities (i.e. the primary growth pole), and increased dominance of suburban areas, (i.e. emergence of secondary growth pole).

Development and Urban-Rural Income Inequality

As the development process proceeds, with concentration of capital and subsequently income at the secondary growth pole, spatial and personal income inequality increases. At the state level this could explain the Amos-Greenwade augmented inverted-U pattern. Inherent in the growth pole development process is the spread of development from the growth pole to the surrounding area. From the initial emergence of a growth pole, whether primary or secondary, it is inherently more developed than the surrounding area. The surrounding area is continually trying to *catch up* to the level of development of the growth pole. In a period of increasing income inequality a growth pole is developing at a faster rate than the surrounding area. In a period of decreasing inequality the growth pole is developing slower than the surrounding area. However, in both cases the level of development is greater at a growth pole.

If development leads to a pattern of increasing-decreasing income inequality, then the growth pole, as well as the surrounding area, should both independently follow this pattern. However, since the growth pole develops before the surrounding area, it always should be more developed, thus beginning the inverted-U pattern first. In early stages of development the growth pole will have greater income inequality than the surrounding area. But in later stages of development, the growth pole will have less income inequality than the surrounding area. Graphically, if the growth pole and the surrounding area separately follow the inverted-U pattern each would be on a distinct inverted-U curve, with the curve depicting the surrounding area positioned to the right of the growth pole curve.

This basic relationship would also hold for the Amos-Greenwade extended inverted-U, with a slight modification. Regions in the most advance stages of development would show the inverted-U curve for growth pole once again beginning to increase, and at some point intersect from below, and pass through the inverted-U curve for the surrounding area. Thus, at some level of development income inequality at the growth pole will become, once again, greater than in the surrounding area, a phenomenon not existing since the early states of development. It is this pattern that is hypothesized to be associated with the increasing spatial variation of per capita income in the most developed states in the U.S.

One reason offered for the relative increase in growth pole income inequality over that of the surrounding area is suburbanization, discussed above. With suburbanization, the basic growth pole process has moved into portions of the surrounding area. The process involves relocating capital in the surrounding area, thus leading to greater relative development there. Left behind at the original growth pole is older, less productive capital, and thus lower relative wages and income for workers. These factors lead to high income inequality, as the suburban periphery subsequently becomes relatively more developed than the original growth pole.

Expected Relationships

Tests differentiating the inverted-U and augmented inverted-U hypothesis can be obtained by examination of income inequality in growth pole (urban) and surrounding areas (rural) subsets of a region. If the simple inverted-U hypothesis is correct urban income inequality should always be greater than rural income inequality, since the urban area is more developed than the rural area. If the augmented inverted-U is correct urban income inequality should, at some point, become greater than rural income inequality. If the latter result is identified by the data, both the augmented inverted-U, and the secondary growth pole explanation of the phenomenon, are supported.

II. EMPIRICAL RESULTS

Data used to investigate the augmented inverted-U are obtained from the *1970 Census of Population.* Gini coefficient's of income inequality are obtained for persons residing in urbanized areas (U), rural nonfarm areas (RNF) and rural farm areas (RF) for each U.S. state. Rural areas are divided into farm and nonfarm because nonfarm rural areas are probably closer in terms of ideal distance (Faden, 1977, pp. 404-410) than rural farm areas to urbanized areas. Therefore, comparison of urban and rural nonfarm is likely to pick up the expected pattern better than a simple comparison of urban and rural income inequality. The first relationship investigated is a simple ranking of gini coefficients for the three areas within each state. Williamson, and Amos and Greenwade found less developed states generally had higher spatial income variation. Thus according to the hypothesis here, those states with a consistent ranking of gini coefficients U < RNF < RF, should also have a relatively higher average spatial income variation. Those states that have a reverse ranking between

TABLE 1

Comparison of States by Urban and Rural Nonfarm Gini Coefficient Ratings

Development Indicator	RF > RNF > U	(t-value)	RF > U > RNF
V_w	.1651	(1.74)*	.1404
Per Capita Income	3,310.58	(1.29)	3,519.36
Proportion of Urbanization	62.85	(1.39)	71.23
Agricultural Labor Ratio	6.66	(1.86)*	4.14
n	24		22

*A statistically significant difference at $\alpha = 0.10$.

U and RNF gini coefficients (i.e., RNF < U < RF) are hypothesized to be most developed, and thus have relatively lower average spatial income variation. Other various indicators of development: per capita income, proportion of urbanized population, and the ratio of agricultural labor to total labor, should all correspond to the appropriate ranking of U, RNF, and RF gini coefficients. Again states with U < RNF < RF gini coefficients should be generally less developed than states with RNF < U < RF gini coedficients. Table 1 presents these results.

The results indicate states with a reverse in urban and rural nonfarm income inequality rankings are more developed. While the mean values between groups are of the correct ranking, only two show a statistical difference between them. The U < RNF < RF group of states are by all indicators less developed (i.e., higher spatial income variation, proportion of urbanization, and agricultural labor ratio, and lower per capita income) than the other group of states. However, only spatial income variation and the agricultural labor ratio show a statistical difference between the two groups of states, and then only at a 0.10 significance level.

While results in Table 1 offer only minimal support for the hypothesis, they offer no overt contradiction either. This fact may in part be due to the nature of the phenomenon itself. Table 1 is trying to identify the upturn of the urban augmented inverted-U, which is passing through the rural nonfarm inverted-U curve. In that the urban curve lies below the rural nonfarm curve, it must be increasing prior to the intersection. However, the data used includes only the segments of the urban curve that lies above the rural nonfarm curve, and not the entire upturned segment. Thus,

TABLE 2

The Relationship Between Urbanization and Urban-Rural Nonfarm Gini Coefficients

BEA Region	Average Proportion of Urbanized Population[a]	Average (RNF-U) Gini Coefficient Differences[a]
New England	67.75	.0015
Mideast	80.65	−.0086
Great Lakes	72.58	−.0044
Plains	58.60	.0223
Southeast	54.77	.0016
Southwest	74.28	.0273
Rocky Mountains	65.38	−.0004
Far West	77.88	.0024

[a]Source of data: 1970 Census of Population.

some states may be on the increasing segment of the urban curve yet still be included in the group that have gini coefficients ranked, U < RNF < RF.

A second test is more indicative of the diffusion of development away from the growth pole, and a subsequent upturn of spatial income variation. The states were regrouped into Bureau of Economic Analysis (BEA) regions: New England, Mideast, Southwest, Great Lakes, Plains, Southwest, Rocky Mountain, and Far West. For each group average state proportion of urbanized population and the average difference between RNF and U gini coefficients (RNF-U) are calculated. The proportion of urbanized population is once again used as an indicator of development. The expected relationship between (RNF-U) and urbanized population is also one of an inverted-U. In early stages of development the relationship between gini coefficients should be U > RNF according to the hypothesized offset inverted-U curves. This would involve (RNF-U) < 0. However, this difference should increase (i.e., become less negative) as development proceeds. In later stages of development (RNF-U) becomes more positive, peaking at some stage of development and subsequently decreasing, until it eventually begins negative once again. It is the second time (RNF-U) becomes negative that is the focus of this paper, as this implies an upturn of the inverted-U pattern.

Average (RNF-U) and proportion of urbanization values are presented in Table 2 for the eight BEA state regions. At first glance the data shows no apparent pattern. However, Figure 1 presents two curves reflecting one possible grouping of the estimates. One curve connects points for the Southeast, Plains, New England, Great Lakes, and Mideast regions. The second curve connects points for the Rocky Mountain, Southwest, and Far

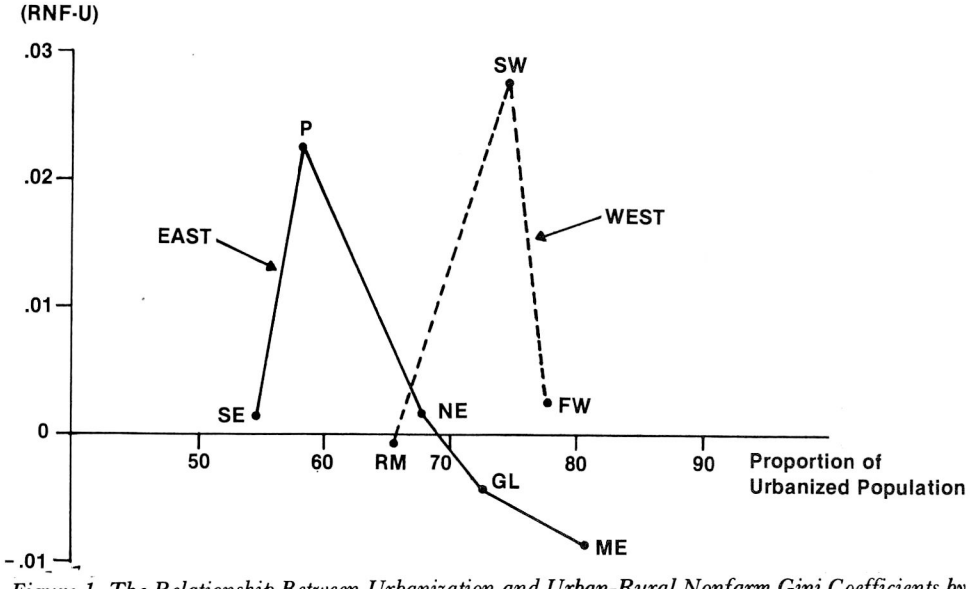

Figure 1. The Relationship Between Urbanization and Urban-Rural Nonfarm Gini Coefficients by BEA Regions

West regions. The most evident difference between regions along the curves is the east-west division. The east group of states goes as far as the western borders of North Dakota to Kansas, over to Missouri and Louisiana, including all states to the east. The west group includes Texas, Oklahoma, and all states west.

There is one reason that makes this east-west division sensible, when the proportion of urbanization is used as an indicator of development. The eastern half of the U.S., is generally more densely populated than the west. The west subsequently has relatively more land, encouraging the outward growth of city political boundaries, and thus the proportion of people included in urbanized areas. A comparison of two equally developed states, one in the east, the other in the west, might very well show a relatively larger proportion of urbanized population in the west than the east.

Given this, the two curves in Figure 1 make intuitive sense. The east curve has a pattern of positive and increasing, then decreasing and subsequent negative values for (RNF-U) as the regions increase in the average proportion of urbanized population. This pattern is consistent with expectations. The west curve follows a similar type of pattern also consistent with expectations. As the proportion of urbanized population increases from the Rocky Mountain region to the Far West region, the average (RNF-U) value increases then decreases.

Combining the two curves in a way that would compensate for the "west" effect would place the regions in general order of development, from high to low, as: Rocky Mountain, Southeast, Southwest, Plains, Far West, New England, Great Lakes, and Mideast. This ranking, though tentative, does not seem unreasonable.

This second analysis, employing Figure 1, like the first, offers some support, but no contradition of the extended inverted-U hypothesis. A third test offers more substantial support. Once again the difference between rural-nonfarm and urban gini coefficients (RNF-U) is used. This time in relation to the change in spatial income variation from 1960 to 1970.

It is expected, from the extended inverted-U hypothesis, that states experiencing a decrease in spatial income variation has a relationship between rural nonfarm and urban gini coefficients where (RNF-U) < 0. This is the *normal* case, consistent with Kuznets original inverted-U hypothesis. However, states experiencing an increase in spatial income variation should have a (RNF-U) < 0 coefficient relationship. In essence, if (RNF-U) is regressed on the change in spatial income variation, the slope should be negative. Figure 2 presents a plot of the points and the resulting regression line. The regression equation is:

$$(\text{RNF-U}) = -0.00137 - \underset{(1.972)}{0.11058}\ \Delta V_w\ 60\text{-}70\ R^2 = 0.08 \qquad (1)$$

where: (RNF-U) = the difference between rural nonfarm and urban gini coefficients, and $\Delta V_w 60\text{-}70$ = the change in spatial income variation from 1960 to 1970.

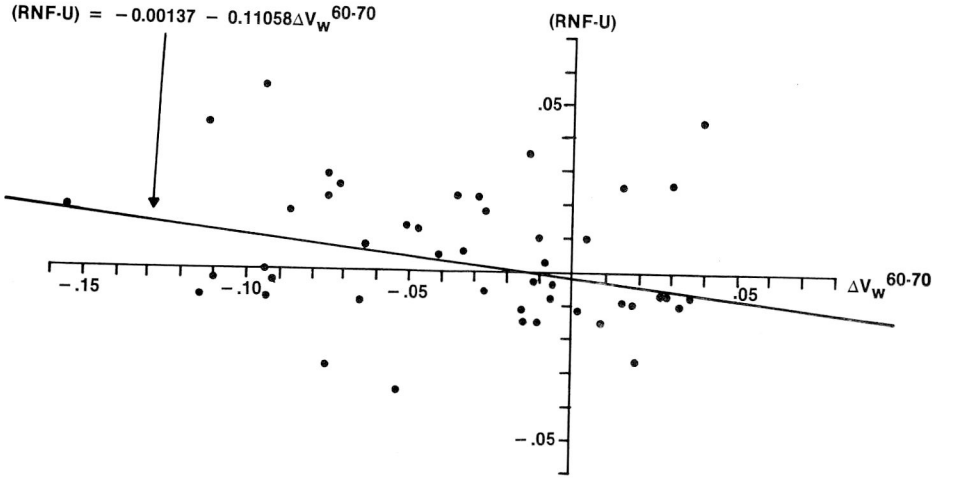

Figure 2. The Relationship Between Urban-Rural Gini Coefficients and the Change in Spatial Income Inequality from 1950 to 1970

The slope is negative and significant at the $\alpha = 0.10$ level, supporting expectations. However, equation (1) supplies even more information. The intercept term is negative, i.e., when there is no change in spatial income variation, the (RNF-U) value is less than zero. This indicates urban income inequality is greater than rural-nonfarm inequality before there is an increase in spatial income inequality. This presents evidence that the urban-rural income inequality differential, and the increase in urban inequality is a cause or contributing factor to increases in spatial income inequality.

III. POLICY IMPLICATIONS

The augmented inverted-U hypothesis indicates growth center strategies of regional development should be reevaluated. Growth center development strategies, as evaluated by Martin (1978, 1979a, 1979b), and Martin and Graham (1980), call for economic stimulation, and heavy investment, at primary growth centers. As indicated by the results of this study, the emergence of secondary growth poles is apparently assuming the role originally played by primary growth poles. Therefore, regional development might be promoted, much more effectively, by directing stimulation towards secondary growth poles. This is consistent with conclusions reached by Lewis and Prescott (1972). The results do not imply that primary growth pole stimulation would be ineffective. Evaluations of growth center strategies, by Martin and Martin and Graham indicate they are relatively effective. However, it is indicated here that secondary growth pole stimulation might be even more effective in promoting development.

IV. CONCLUSION

The objective of this paper has been to provide further analysis of income inequality and regional development. In particular, the augmented inverted-U curve first hypothesized by Amos and Greenwade has been the subject of investigation. Increasing spatial income variation in the more developed U.S. states from 1950 to 1970, is contrary to previous expectations. This paper has sought one possible explanation of this phenomenon.

The explanation offered here is based on the spread of development from growth poles to the surrounding area. It has been argued that in the process of growth pole development secondary growth poles emerge in the area surrounding the initial growth pole, or in essence suburbanization.

The results of the three tests performed are supportive of this hypothesis. By all indications, increases in spatial income variation in U.S. states are due to the outward spread of development. This process is apparently as natural as Kuznets inverted-U. Therefore, if regions, or countries, follow Kuznets inverted-U, they will undoubtedly continue the extended inverted-U pattern, and eventually experience increasing income inequality. Of course, there are a number of factors specific to U.S. development from 1950 to 1970 that may be significant determinants of the patterns identified by Amos and Greenwade, and the results presented here. Most obvious is the relative decreasing energy prices which contributed to suburbanization. With higher energy prices since the early 1970's the historical trend could be reversed. In addition, states, regions, or other countries at lesser stages of development than those states experiencing the upturn in spatial income variation, may not undergo this process due to higher energy prices.

In addition to support offered by this study for the augmented inverted-U, support of growth pole theory is also evident. Since the spread of development, and secondary growth pole explanation of the augmented inverted-U were derived from growth pole theory, support of the explanation is also support of the theory.

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