

**Howard L. Gauthier**  
*The Ohio State University*

## **Geography, Transportation, and Regional Development**

Since World War II no single problem has commanded the attention of social scientists more than that of economic development. Efforts to understand the process of modernization and to find effective techniques for accelerating economic growth have generated an enormous literature in economics, political science, sociology, and planning. Incredibly, American geography has remained outside of this main stream of activity.

In a recent survey, Keeble (1967) found that of the more than 500 major articles which have appeared in *Economic Geography* and the *Annals of the Association of American Geographers* between 1955 and 1964 only 16 were concerned in whole or part with questions related to economic development. Moreover, the treatment of development issues showed a focus quite different from that which has been characteristic of the other social sciences. Notably lacking was an analytical approach to problem solving. Four of the articles were descriptive accounts of the relationship between the physical environment and economic development, three were classifications of areas in terms of various indices of economic development, and the largest group of six articles emphasized the unique characteristics of individual areas with only peripheral reference to questions of development.

Clearly, the record of American geography in pursuing research on developmental problems is less than impressive. This is unfortunate given the recent concern that has arisen in many related disciplines over the inadequacies of the existing theories and models of development. In the field of economics, for example, analysis has focused traditionally on the need to raise the proportion of the national product devoted to capital formation. This approach has emphasized sectorial commitments. Recently, there has been recognition of the limitations of considering the allocation of scarce resources without attention to the related issue of where given activities should be located. This question of where activities should be located is leading economists to a consideration of the regional component of economic development and to the construction of models of the spatial structure of the economy. This is an area of concern which

lies traditionally within the core of geographic research. The work of Platt and Philbrick, among others, has emphasized a concern with a spatial perspective, evident in the ways in which geographic phenomena are spatially interconnected and the interaction that occurs over geographic space.

In treating the complex process of development in a regional context there are many divisions of geography which can make direct contributions. The purpose of this paper is to consider transportation geography as one such division that is relevant to the study of the spatial structure of the economy. Specifically, this paper will review some traditional ways of viewing transportation in the development process, argue the necessity of considering transportation as a spatial system in regional development, and suggest some problems that arise in attempting to relate the spatial impact of transportation to goals of regional integration.

### **Non-spatial relationships between transportation and economic development**

If there is a relationship between capital formation and economic growth, there must be a relationship between important components of capital formation and growth. Undoubtedly transportation is an important component of capital formation. In underdeveloped countries it is generally the largest expenditure in the national budget, and in combination with other types economic infrastructure it represents a greater commitment in capital formation than that being made for social welfare. Typically, the proportion of public expenditures devoted to transportation investment ranges between 20 and 40 percent. In addition, 20 percent or more of developmental loans made by various United States and international lending agencies have been for investments in transportation, (Fromm, 1965).

That economic development requires adequate and effective transportation services is axiomatic. However, after almost 20 years of study, there exists no consensus on the role of transportation in the development process. A review of the literature suggests three possible relationships, with transportation having 1) a positive effect on the development process with the expansion in directly productive activities being a direct result of providing improved transportation facilities; 2) a permissive effect on the development process, because transportation does not independently produce directly productive activities or

subsequent increases in the level of economic growth; or 3) a negative effect occurring when as over-investment in transportation reduces potential growth in directly productive activity and consequently leads to an absolute decline in the level of income per capita.

The historic and most common view of the role of transportation in the development process is as a precondition or prerequisite. In identifying the stimulus for the take-off stage of economic growth in the United States, Rostow (1964) identifies the railroads as the critical investment sector. In accordance with this viewpoint, Hunter (1965) suggests that the economic history of Western Europe and North America has shown that the introduction of modern transportation methods has drastically lowered shipping costs. The effect has been to widen markets and to permit economies of large scale production in a wide range of activities. According to Hupter (1965) there is a causal linkage between low cost transportation and economic development; the industrial revolution was successful because of a prior revolution in transport technology. It is not surprising, in view of the historical importance assigned to transportation in the development process, that students of economic development today should look to the transportation sector as a critical component. Owen (1964), for example, suggests that a good case can be made for transportation as the key to national development on the grounds that the widening of domestic markets is essential to economic growth.

In recent years there has been a movement away from the acceptance of transportation as the causal factor in economic development. While recognizing its importance, there is more emphasis on its permissive role. This viewpoint argues that development is not a deterministic process and the singling out of a single component of capital formation as a causal agent is a gross oversimplification of a very complex problem. Hirschman (1958) adopts this view in considering transportation and its relationship to directly productive activities in terms of a sequence of induced decision making processes. Implied is the idea that the development process involves a complex interaction between human and material resources with investment in transportation offering the possibility for developing other resources. As Hawkins (1962) has observed, transportation improvements may release working capital which can be used more productively as fixed capital elsewhere, but before any of this takes place, there must be suitable productive opportunities in potential markets.

The permissive view of transportation has led to considerable empirical work aimed at a re-examination of American transport history. In particular, the role of the railway in the North American experience has received considerable attention. Contrary to the view that the railroads were prerequisites for economic growth, Cootner (1963) argues that railroad growth following 1830 did not precede the growth of the other sectors of the economy but rather followed them. A similar work by Fogel (1964) shows that the railroad was not indispensable to American growth and that in fact transportation capacity in the United States until the turn of the century could have been provided by existing waterways. In terms of a causal association, the railroads were built to demand and not in advance of demand.

As a result of the critical reexamination of the role of transportation in the development process a third viewpoint has emerged which argues that transportation may have a negative impact on economic growth. Essentially this viewpoint contends that the creation of transportation capacity may absorb some portion of scarce resources that should be employed elsewhere. Specifically, in terms of opportunity costs, the investment is considered less productive than some alternatives, and as a consequence, keeps the growth rate below what it would be if those resources were used more efficiently. Basically it is a case of misdirected investment.

Errors in the allocation of resources can occur in any sector of the economy. This means that errors are inevitable in the sense that some other allocation could have yielded better results, although this cannot always be foreseen. Many economists argue that this is especially likely to happen in the transportation sector for two reasons: 1) the lumpiness, longevity, and externalities associated with transportation capital create greater hazards in calculating and specifying future benefits and costs. This makes decisions to invest in transportation not easily reversible nor as readily corrected as in those sectors with assets that wear out rapidly or can be built in small increments, (Wilson et al., 1966); and 2) there is a belief that transport is a safe investment politically. Hirschman (1958) suggests that perhaps it is the absence of criteria and of sanctions that endears transportation investments so much to developers. After all, development planning is a risky business and there is naturally an attraction to undertake ventures that cannot be proven wrong before they are started and are unlikely ever to become obvious failures.

## Transportation and unbalanced economic development

The recognition of the overemphasis of transportation as a causal mechanism in development has focused attention on the general relationship between social overhead capital and direct productive activities. Obviously some social overhead capital investment is required as a prerequisite for direct productive activity, but within rather wide limits the relationship between the two is not technologically determined. As Hirschman (1958) has observed it is conceivable that the relationship can be balanced or unbalanced through time. The possibilities are illustrated in Figure 1.

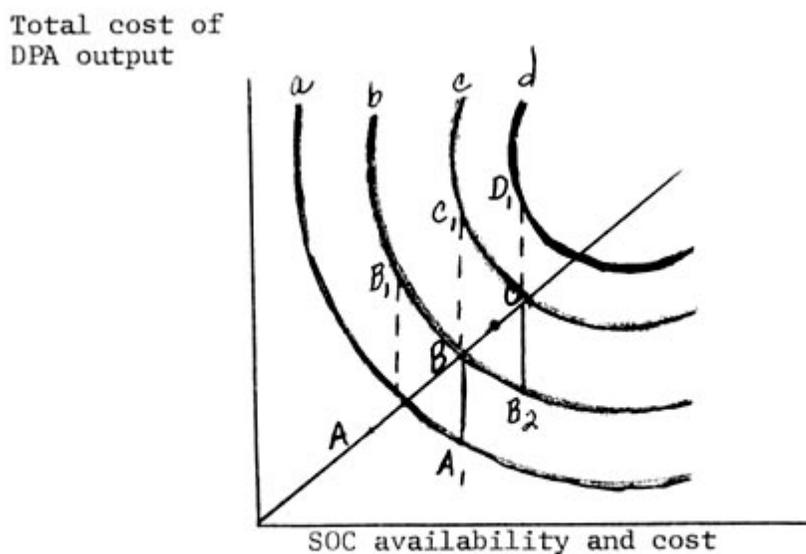


Figure 1 Balanced and unbalanced growth of DPA and SOC

Source: Hirschman. Strategy of Economic Development, page 87.

The total cost of DPA output is measured on the vertical axis, while the availability and cost of social overhead capital is indicated on the horizontal axis. The curves a through d represent successively higher amounts of DPA output. From the viewpoint of the economy as a whole, the goal is to obtain increasing outputs of DPA at minimum cost in terms of the resources devoted to both DPA and SOC.

Theoretically this should result in the most economical utilization of a nation's resources, but as Hirschman (1958) observes, one of the paradoxes of development is that underdeveloped countries cannot afford to be economical. It is extremely difficult to allocate resources so SOC and DPA are expanded at the

same time. Thus, underdeveloped countries must pursue a process of unbalanced growth through time, with preference being given to a sequence of developments that maximizes an induced decision making process.

Two principal sequences are suggested: one in which development is related to an excess capacity of SOC (represented in Figure I by the line connecting points  $AA_1$ ,  $BB_2$ , C); and another where development is presented by a shortage of SOC (indicated by the line  $AB_1$ ,  $BC_1$ , C).

If a country follows the first strategy, it begins by expanding its social overhead capital to permit direct productive activity to become less costly, and thus, provide an incentive for increased investment in DPA. On the other hand, if the second strategy is pursued, the expansion of DPA is undertaken first and DPA production costs rise substantially. In response, producers will realize considerable economies through the construction of improved SOC facilities.

Either sequence generates incentives and pressures for an expansion of DPA production. This expansion is in response either to an opportunity for increased profits or an increase in public expenditure in SOC facilities to reduce obstructions to economic growth resulting from increasing transportation costs. The effectiveness of the induced decision making process will depend on profit motivation and on the response to public pressure of the authorities responsible for investment in SOC.

### **Transportation as a spatial system in the development process**

The argument that economic growth should be viewed sectorally as an unbalanced process raises the companion problem that it should be viewed as an unbalanced process in geographic space. Perroux in his well-known article on growth poles (1964) argues that a fundamental fact of sectorial development is that growth does not appear everywhere nor simultaneously. Rather it appears at points or development poles with variable intensities and spreads along diverse channels with varying terminal effects for the economy. Hirschman (1958) argues that for an economy to attain higher income levels it must develop several regional centers of economic strength. The presence of "growth poles" in the process of economic development means that interregional inequality of growth is an inevitable concomitant and condition of growth itself.

In analyzing economic growth as an unbalanced process both sectorally and spatially, many of the traditional models dealing with spatial variation in levels of development are irrelevant. Most of our interregional growth models are based on concepts drawn from international trade theory. As a consequence they are dependent on static equilibrium and assume that, given the relatively free mobility of the factors of production, factor movements tend to bring about an equalization of income among regions. As Slater (1968) has noted, such equalization models are of little use in illuminating the development of spatial variation in the real world, since regional inequality is not only remarkably persistent but apparently increasing in many countries.

Intuitively appealing in treating regional inequalities is the notion of "growth poles." As conceived by Perroux (1964), these growth poles develop in an economic space which is defined without reference to geographic space. The distinction between the economic space in which growth poles are defined and the geographic space in which they happen to have a location is a basic and important one which has been neglected too often by those using the concepts of growth poles. The growth pole concepts a priori do not offer any explanation of the location of a propulsive industry in geographic space nor of the consequences of a pole having a location in a given geographic space.

Much of the French economic literature during the 1950's developed extensions of the growth pole notion without reference to geographic space. Most of those studies attempted to examine inter-industry linkages, to rank industries by their degree in independence, and to show that some sectors have a very high combined linkage impact, both forward and backward, and presumably exert a polarizing influence on the spatial economy.

Focusing on inter-industry linkages and ignoring questions of the spatial incidence of growth is one of the great shortcomings of the original growth pole idea. As Darwent (1968) has observed, "Since all economic units must have a location, and since in regional economic development the question of 'where?' looms large, then despite the fact that poles are independent of geographic space their existence within it poses complex problems unexplained by growth pole theory." To meet this inadequacy the original growth pole concepts have been broadened to include geographic space. In contrast to Perroux's (1964) non-geographical orientation is Bouderville's (1961) emphasis on the regional character of economic space. He maintains that from a development viewpoint

there are three types of geographic space: homogeneous, polarized, and programmed or planning place.

Homogeneous geographic space is equivalent to the uniform region and is characterized by a maximum internal homogeneity and a maximum external heterogeneity for whatever phenomena is being measured. Polarized space is very similar to Robert Platt's concept of the functional region; the emphasis being on the linkages that exist between points distributed in geographic space and the intensity of interaction associated with those linkages. As such, polarized space is compatible with the central place structure of a hierarchy of cities of ascending size and function. The propulsive industries that create economic growth poles have a geographic location in growth centers which are the larger, more functionally complex centers in the urban hierarchy.

Finally, a region can be defined from the point of view of specific planning goals. A planning or programming region is geographic space organized for the realization of the objectives of a planning or political authority. The concept of a planning region has taken on special significance in France, where the system of national and regional economic planning calls for the definition of regions and advice on the spatial as well as sectorial distribution of investments.

A vital question in programming the spatial incidence of economic growth is the regional impact of transportation investment. What degree of interdependence exists between the development of a transportation system and a geographic pattern of urban economic growth?

One way consider capital investments that lead to additions or changes in the transportation network is as shocks that are felt throughout the entire system. One possible consequence of those shocks is an alteration in the spatial structure of the network. The change in network structure has an impact on economic development by changing the pattern of internal accessibility for urban centers on the network. Changes in the accessibility for a set of urban centers threatens to disrupt the existing patterns of spatial competition within the region. This in turn may have a decided impact on relative rates of urban growth (Gauthier, 1968).

Just as transportation investment may have positive or negative sectorial consequences, it also may have positive or negative spatial consequences. Certain centers are advantaged by their increase in accessibility while others are

disadvantaged. A changing pattern of accessibility means a change in the spatial structure of the economy and in the spatial incidence of growth. This in turn, has ramifications for programming space in that a changing pattern of accessibility poses the problem of determining whether or not the changes in the spatial structure of the economy are those desired. Are they consistent with the objectives of a given regional plan for development?

It may be that the heavy investment many underdeveloped countries are making in transportation is creating a polarized space that is inconsistent with the spatial objectives of their regional development programs. For example, in developing its program of regional development, the planning agency of the state government of São Paulo, Brazil, has sought to reduce regional differences in economic well-being by influencing the spatial incidence of economic growth at designated regional centers. These centers are to serve as secondary targets for the factor movements of labor and capital that have been attracted traditionally to the major metropolitan areas, such as São Paulo and Rio de Janeiro. The important feature of this program, in terms of net investment, has been the improvement of transportation facilities between the proposed regional centers and the major metropolitan areas. The principal goal is to increase commercial flows between the centers by reducing average transportation costs. Theoretically, the improvements should help to create conditions that increase the attractiveness of the regional centers as foci for capital investment, given the permissive role of transportation in the process of economic development. It may be this is an unwarranted expectation (Gauthier, 1968). There is no reason to assume that the improvement in accessibility to the regional centers will necessarily accelerate their rate of growth more than that of the metropolitan regions. Indeed, just the reverse may be the case. The reduction in the transport cost barrier may increase the agglomerative advantages of the metropolitan areas. As a consequence externalities will make locations in São Paulo and Rio even more attractive to propulsive industries. If this occurs, then, the changes in polarized space are inconsistent with the planning objectives of the state government.

In treating the problem of increasing polarity or primacy in the spatial incidence of growth, the work of Friedmann (1966) is intuitively appealing. Friedmann considers regional organization in terms of a center-periphery model. He observes that a planner might expect that capital and labor would initially combine at a small number of growth poles having high marginal productivity,

but would gradually diffuse from them to other centers as the original development opportunities at the center are exhausted, diminishing marginal returns set in, and the demand for raw materials and intermediate products indicates potentially profitable investments on the periphery. Under these conditions, one can reasonably expect that capital will tend to flow from low productivity regions to the incipient growth poles of the economy and labor from low to high-wage areas until, by a process of successive marginal adjustments, a spatial equilibrium is established. In short, there should be a gradual convergence in the rates of return to the different factors of production employed at each location. The principal difficulty with this strategy is that historical evidence does not support it. As Hirschmann (1958) has argued, disequilibrium is built into transitional economies from the start, and the indisputable fact is that regional convergence will not automatically occur in the course of a nation's development.

Friedmann (1963) suggest that the failure of convergence to occur is related to a number of factors, including 1) a failure of diminishing returns to set in at the center, 2) a failure to perceive investment opportunities in the periphery, 3) a growing export demand for goods produced in the center, 4) the growing coincidence of the center with the national market, 5) the location of quaternary services in the center, and 6) the inability of the periphery to make adjustments appropriate to the social-economic change occurring at the center.

The allocation of investments in geographic space involves questions of growth verses welfare, imbalance verses balance, concentration verses dispersion. In many respects these three dichotomies are similar to each other in raising the old issue of whether to emphasize growth at the expense of welfare by concentrating investments in large agglomerations which will produce multiplier effects rather than searching for equity or balance. The choice in sectorial terms between balance and imbalance is expressed spatially in either dispersion or concentration.

Friedmann argues that the goals of a society in a transitional phase of its economy must be related to the removal of the periphery by substituting for it a single, interdependent system of urban regions and the extension of a national system of factor and commodity markets. The goals for spatial organization and the methods of implementation require that they be related to the regional system as a whole and be consistent with dominant regional aspirations. Regrettably Friedmann does not provide us with an operational model for

obtaining those goals. However, it is apparent that he views economic growth as occurring in a matrix of location points which are the building blocks around which economic space is constructed, and which evolve in the direction of ever greater spatial integration. In effect he generalizes his location points as cities and towns which serve as basic decision points in the growth process. Because of their valuable urbanization and localization economies, they are attractive as centers of growth. In this respect his viewpoint is consistent with the emergence of a hierarchical system of cities. He implies that economic development is related to the emergence of a hierarchy of cities of the Losch type with the rate of growth being some function of size, modified by imperfect labor mobility.

Obviously there are many areas in which the growth pole and growth center notions fall short of our expectations for a theory of the spatial incidence of economic growth. As Darwent (1968) has observed, the most serious omissions concern the absence of explicit statements about the relationship between polarization and empirically observed regularities, and the inadequate treatment of the question of external economies. To this we might add an inadequate treatment of the role of transportation development in the organization of the space economy. There are many important questions which need to be answered. For example, Berry (1964) stresses the relationship between the development of a central system and a state of entropy in a socio-economic system, achieved in the steady state of a stochastic process. This seems compatible with Friedmann's idea that the spatial objective of economic development is the progressive replacement of a center-periphery structure with a single system of cities extending throughout the economic space under consideration. However, it may be that transportation investment strengthens the center-periphery structure of the economy rather than generating a movement towards the spatial integration envisioned by Friedmann and Berry.

Is the tendency towards spatial polarity or primacy a normal aspect of the early stages of regional development? If so, is it corrected in the process of development by the evolution of a spatial system characterized by an integrated central place hierarchy? What is the mechanism by which the evolutionary process begins and becomes self-sustaining? Does the development of linkages between propulsive industries encourage the development of a central place system which will integrate the space economy? Is there an optimal central place structure at any given level of development in the regional economy? To what extent is such a structure related to investments in regional infrastructure,

particularly transportation?

At the present time all these questions are begged by the concepts we have of regional differences in economic growth and the methods for implementing a spatial incidence of growth. Certainly they are fundamental questions we must answer if we are to understand the structure of the space economy and the process by which it develops. Clearly they represent problems which lie within geography's traditional concern with regional organization and regional development. One can only hope we will begin to probe such problems in order to make a contribution toward understanding the spatial dimensions of economic development.

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