AN ANALYTICAL ECONOMIC FRAMWORK FOR VIEWING THE IMPACT OF TRANSPORTATION INVESTMENT ON DEVELOPMENT

BY

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Introduction :

The need for transportation arises in any economy that is distributed over space. Hence transportation in an essential and unavoidable cost of overcoming the frictional effects of distance. According to Mohring and Harwitz(1) transport costs pervade every economy and are paid in some degree by every user of the system, and by every consumer of every industry that uses the system. While investments in transportation unquestionably produce changes in the fuctioning of the econmy and more broadly, of society as a whole, there is yet to be a consensus among scholars as to the specific or relative role of this sector to economic growth or development. In this paper an attemp is made to provide an economic framework for viewing the impact of transportation investment on development.

Impact of transportation Investment on Development :

A widespread view on the impact of transportation on development is that transportation improvement by lowering costs, reduces the resource requirement necessary per unit of transportation. These released resource can thus be used to expand the output of transportation and/or of other productive sectors of the economy. This situation has been put more succinctly by Brown and Harral thus :

When the price paid for transport reflects the product which the resources dedicated to transport could produce in alternative

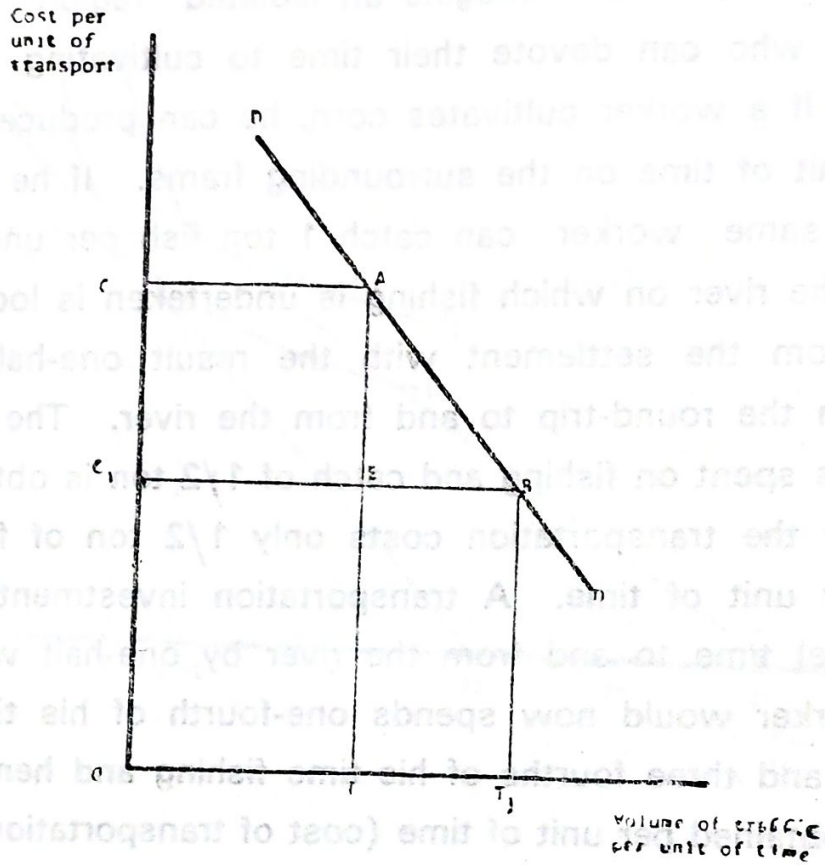
employments, a technological improvement reduces the cost of transport releases some resources and permits an increase in productio in other sectors(2).

Figure 1 . 1 shows hypothetical demand curve for transportation (DD) in an economy. The verticall axis measures the cost per unit of transport by a given mode of transport. The horizontal axis measures the value of traffic on this mode per unit of time. Initially, the cost per unit of transport is OC while the total cost of transport is OCAT. Assume an investment which imporve transportation on this mode thereby reducing the cost per unit of transport from OC to OC1. Given the same volume of traffic (OT - or the «normal») the total cost of transport, after the investment has been made, is OC1ET. Thus, total cost-saving for this volume is CAEC1. This cost -saving represents resources which are now freed and are available for investment in other productive sectors of the economy.

It can be seen from figure 1 - 1 that reduced unit cost of transport had a secondary effect. Because transport is now relatively cheaper this initiates a substitution as well as a generation effect. Transportation will be substituted from some other productive factors (substitution effectgiving rise to «diverted traffic») while reduced costs attracts additional traffic that hitherto could not afford the high costs at OC (generation effect-resulting in «generated traffic»). Both effects help to increase the volume of traffic from T to T1. Hence the total cost-saving of the investment at T1 volume of trafic is CABC1 (i.e., CAEC1 plus ABE). These savings represent resources now available for investment in other sectors of the economy.

Brown and Herral(3) also provide us with the logic and implication of reduced transport cost resulting from transportation investment. Following their approach we shall consider the

Figure 1.1. Effect of Investment on Unit Cost of Transport

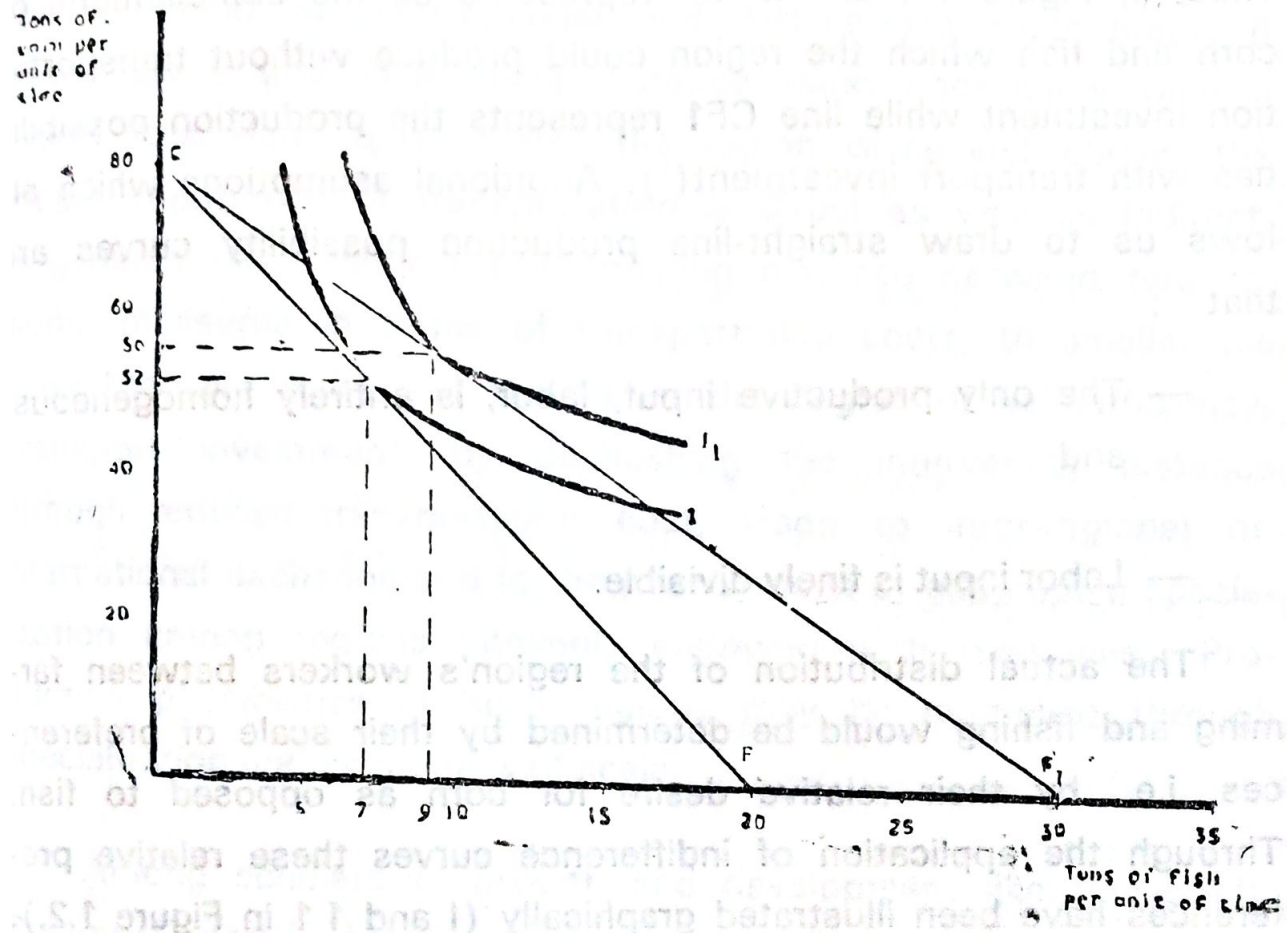


role or effct of transportation investment on the economy of hypothetical region.

We shall first of all imagine an isolated region with only 40 wrokers who can devote their time to cultivating corn or to fishing(4). If a worker cultivates corn, he can produce 2 tons of corn per unit of time on the surrounding frams. If he decides to fish, the same worker can catch 1 ton fish per unit of time. However, the river on which fishing is undertaken is located some distance from the settlement with the result one-half his time is spent on the round-trip to and from the river. The other half, therefore, is spent on fishing and catch of 1/2 ton is obtained. As a result of the transportation costs only 1/2 ton of fish can be caught per unit of time. A transportation investment which reduces travel time to and from the river by one-half would mean that a worker would now spends one-fourth of his time for the round-trip and three fourths of his time fishing and hence 3/4 ton of fish is obtained per unit of time (cost of transportation included). Under the above assumptions, the production possibilities of this economy can be presented graphically (see Figure 1.2).

Without transport investment, if all the workers in the region devote all their time to cultivating corn, 80 tons of corn will be obtained per unit of time. If all the time of the workers is devoted to fishing 20 tons of fish will be obtained per unit of time. With transport investment there is no change in the maximum number of tons of corn obtainable if all the workers devote all their time cultivating corn. However, investment which reduces the round-trip time to and from the river shifts the maximum tons of fish caught, if all the workers devote their time fishing, from 20 to 30 tons. Since no economies of scale are assumed, i.e., costs are constant in both corn cultivation and fishing, irrespective of the output, the combinations of corn and fish which the region can

Figure 1.2. Production Possibilities of a Region With and Without Transport Investment



produce are given by a straight line which connects the two points. Thus, in Figure 1 . 2, line CF represents all the combiantions of corn and fish which the region could produce without transportation investment while line CF1 represents the production possibilities with transport investment(5). Additional asumptions which allows us to draw straight-line production possibility curves are that :

— The only productive input, labor, is entirely homogeneous, and

— Labor input is finely divisible.

The actual distribution of the region's workers between farming and fishing would be determined by their scale of preferences, i.e., by their relative desire for corn as opposed to fish. Through the application of indifference curves these relative preferences have been illustrated graphically (I and 1 1 in Figure 1.2.). The region's productive resources are distributed between farming and fishing at that point where the highest indifference curve is tangential to the production possibility curve. Hence, without transport investment the region produces 52 tonns of corn per unit of time with 26 workers devoted to farming, the remaining 14 workers are engaged in fishinng and producing 7 tons of fish per unit of time. With transport investment the production of both corn and fish increases as 28 workers are now engaged in farming producing 56 tons of corn per unit of time while 12 workers engage in fishing and producing 9 tons of fish per unit of time. The increase in the region's production resulting from transport investment is 4tons of corn and 2 tons of fish per unit of time. This represents an increase in the welfare of the region as more tons of corn and fish are added to the regionn's consumption basket. Development, as traditionally defined to include increases in income or output per capita, is thus enhanced by investment in transportation.

The role and significance of transportation on development can be found in inter-regional and international trade theory, 6 where space and intervening distance must necessarily play a critical role Here, quite unlike the region discussed above, the critical importance of transportation is direct as well as indirect. In general, the greater the intervening distance between two regions, measured in terms of transportation costs, th smaller the trade between them and the higher the degree of selfsufficiency. Transport investment, by diminishing the intervening distance through reduced transportation cost, leads to inter-regional or international exchange and to the phenomenon of geographic specialization among regions unevenly endowed with resources. Production possibilities of such regions may be multiplied through specialization and economies of scale.

Among scholars of growth and development like Savage(7), Rostow(8) and Stabler(9), it is generally believed that regions in the process of development have to pass through a series of stages and that some preconditions have to be met before progressing to each subsequent stage. For each subsequent transition between stages, the role of transportation is critical : A subsistence economy cannot change to a trading economy without improvement in its transportation facilities. Transition to industrialization requires adequate transportation input to link both consumption and production centers.

It should be noted that while the above theory of development holds in some regions, others do not start their development cycle with a subsistance economy. This was observed by D.C. North(10) in his study of some states in the U.S. He found that states like Oregon initially started not from a subsistence economy but from the exploitation of particular commodities-in the case of Oregon, the economy was founded on the basis of lumber export. Nearly all the basic subsistence necessities were imported in such econo-

mies. However, the underlying factors here include knowledge of and the ability to exploit those resources for which such region enjoys a comparative cost advantage and, of course, transport facilities are essential to serve both export and import sectors. Hence for this latter theory the role of transportation is also crucial.

In larger regions like the United States it is also crucial development to occur without interregional or international trade(11) Here, external trade forms only a small part of the national income. However, development depends and is focused on internal trade and hence adequate transportation facilities are essential to encourage flows of goods and services.

Adopting a different approach, Johnson(12) has explicitly underscored the significance of transportation in development. While he argues for the need for a new look at the whole problem of economic development, he believes that development in the Third World will require a spatial reconstruction of the «economic landscape». This spatial reconstruction involves the creation and/or development of adequate market centers or what he calls «central-place infrastructure.»(13) These market centers would form nucleus where market products can readily be sold and where shops filled with consumer and producer goods can exert their strong demonstration effects. Thus, the incentive to produce more for the market and the inducement to invest in better tools, fertilizers or better livestock in order to generate a larger marketable surplus can be stimulated and maintained. In terms of our discussion, Johnson's observation are relevant as they involve distrbution of activities over space in which transportation investment is critical of the exchange and the distribution of goods and services between the market centers and their respective hinterland are to materialize. Under the Johnson model returns from transportation investment would include :

— Higher prices obtained by producers ;

— Increased output and revenues of producers ;

— Lower prices for imported commodities ; and

— Higher sales volume of consumer goods, increading net profits of market-center merchants.

A careful examination of Johnson's model reveals an aspect of development sometimes overlooked in the literature of growth and development. This relates to other investment options and attitudes. Here, accessibility which results from investment in transportation affects in an indirect way the attitudes of the society in terms of production and consumption. This is the demonstration-effect which accessibility to market centers exerts on their interland. G. W. Nilson in his discussion of the effects of different kinds of investment notes that :

> Investments in transportation have a wider geographical dimension than almost any other. Therefore, they affect a far greater number of people and in a more intimate fashion than does a factory or other facility requiring a specific location. Furthermore, access to the latter types of investment is limited mainly to employees, although their products may be widely distributed. But even wide distribution of products will not affect attitudes nor give rise to much additional economic opportunity unless the product is a producer's good, in which case it will be acquired mainly by people already «developed» in an entrepreneurial or business sense.(14)

The point to be stressed here is the distinction drawn between investments which mainly affect productivity and those that mainly affect attitudes. Transportation investment combines both and

hence its role in development becomes significant, if it is realized that for stimulating and maintaining growth attitudes must change and efficiency of productive resources must increase.

Another example of a remote and an indirect role of transport investment on development is provided by the United Nations Economic and Social Council. In its study of transportation,(15) in relation to development, it observed that not only did better and cheaper transport increase the output of agricultural products, it was responsible for introducing and raising new crops in some of the regions. Besides, better and cheaper transport made available some perishable foodstuffs which improved the diet of the people. It also observed that improved transportation facilities tended to encourage competition, with the result that the producers are offered more favorable prices by the wholesale buyers(16). The total effect being an increase in the output and income of the people of the region.

It would appear that the discussion thus far has largely been centered around development and trade theories. At this point, it would be pertinent to note that a somewhat different but relevant perspecitve of the role of transportation in development is to be found in location theory. Following the poineering works of Thunen(17) and Christaller(18) location theorists have been concerned with the location and/or distribution of economic activities in space. Transportation costs have been critical in the location of economic activities in space(19). Walter Isard summarizes this role as follows :

> Historically we find that reduced transport rates have tended : (1) to transform a scattered ubiquitous pattern of production into an increasing concentrated one, and (2) to effect progressive differentiation and selection between sites with superior and inferior resources and trade routes(20).

A point to be noted in the above statement is that investment in transportation has been an important agent in promoting urbanization and its inherent economies of agglomeration necessary for increased output per capita. As accessibility is higher among urban centers, new economic opportunities which attract people to these centers are crested. Increased output requires more labor and with higher incomes, more migrants are attracted into those areas thus stimulating growth by creating demands for goods and services. Writing from the same point of view, FROMM has noted that improved transport development helps retard pathological urbanization by increasing productivity and income of the rural agricultural sector(21). This is true to the extent that mobility and accessibility offered through transport investment help to attain «preffered» regional distribution of population, industry, and income.

Summary and Conclusion :

We can summarize the discussion so far by saying that whatever agriculture, industry, power, capital and human resources are available, the development of any region or some of its resources largely depend on mobility and accessibility offered through its transportation facilities.

It should be noted, however, that transportation alone is not the key to development. The number of variables necessary for growth and development of a region include not only transportation investment but also entrepreneurial and technical abilities, education, the kind and amount of political, social and economic resources. Development at any kind requires a «cluster of investments.» According to Mead(22), transportation must be part of this cluster if development must be sustained. This is why Wilson has argued that the role of transportation in promoting development, «is obviously dependent on the existence of prior dynamism»(23).

Some skeptics like Cootner(24) and Fogel(25) have questioned the potential of transportation in promoting development. These scholars have attempted to show that transportation is a consequence rather than the cause of development. The discussion so far suggests that the question to be answered is not whether transportation is important or more important than other investments (as these skeptics have done) but rather under what conditions can investments in this sector accomplish the roles outlined above, in short, if «prior dynomism» already exists. For this reason, transportation should not be regarded as a separate sector of the economy but, in the words of Owen, «a web of communication that joins other sectors together. The effect of transportation investment are not immediate. Some time-lag is required before a change in development occurs and much will depend, as already stated, on the latent and potential dynamism of the economic system.

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