

ECONOMICS OF THE TRANSPORTATION SYSTEM

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Summary

The transportation system comprises many sub-systems often characterized by the mode of transport involved, the geographical nature of its location or the types of transportation activity engaged upon. This article examines how economists view the transportation system and looks at some of the key concepts that they deploy in their analyses. The network nature of transportation systems generates a set of economic characteristics such as the focus of transportation activities on hubs, the need to develop pricing to cope with non-uniform patterns of demand, and a complex set of investment criteria.

Transportation systems have been the subject of considerable economic regulation over the years although more recently there have been reductions in the level of intervention in transport markets and changes in the nature of the regulations that remain. The approach is both to outline the ways in which economics provides a fuller understanding of transportation systems but also to highlight some places where it has proved less helpful.

1. Introduction

Transportation systems are important in any economy. While the actual quantified importance of transportation in National Income Accounts is often recorded as little more than 5% or 6% of the national product (a figure sometimes exaggerated in the media because of inappropriate inclusion of intermediate transportation activities), transport acts as a lubricant to the larger economic system. It allows nations, regions and cities to exploit their comparative advantages. This economic importance of transportation has

long been recognized. As far back as the Phoenicians the importance of maritime trade became apparent, whilst the Silk Road from the orient provided antiquity with luxuries and exotica. Much more current, the Industrial Revolution in the Western Hemisphere of the nineteenth century would inevitably have taken longer to emerge had it not been for canals, railroads and subsequently mechanized road transportation. Even more contemporaneously, the global economy has only begun to become a reality because of enhanced logistics (largely built around containerization), improved shipping and the advent of air transportation.

At the outset it is also important to appreciate that while there is a field of study often referred to as 'transportation economics', from the perspective of the economist such a division is one of practical expediency rather than a reflection of a true sub-discipline of analysis. There is nothing really unique about transportation systems from an economic perspective, the challenge is rather that transportation systems have a set of features they require the deployment of a particular portfolio of concepts and instruments from the economist's tool kit.

These features embrace such things as the derived nature of transport demand, the network character of the sector and the importance of user inputs, such as travel time, in the supply of system services. None of these features are unique to transportation but their combination does pose particular challenges to the economist. In this sense the idea of transportation economics has a 'peculiar' meaning in the strict sense of the term. This is the way it is perceived here.

The boundaries of what is viewed as transportation are also continually changing. Economists have traditionally focused on the movement of physical items, animate and inanimate, but the 'information revolution' revolution has brought to the fore the movement of less tangible things. Transportation economics has been slow to react to this, other than looking at how enhanced information systems impact on their more traditional interests.

Indeed, this is the way we progress here but it does miss important questions of how information is 'transported' and what are the most economic mechanisms for ensuring that this is done efficiently. Transportation economists have been equally slow to embrace the movement of some forms of energy, most notably electricity. Because of the traditional view, also reflected until recently in most institutional arrangements, that electricity supply is a highly vertically integrated activity, energy economists have tended to analyze the transportation of electricity.

In terms of economic development, at the local, national and international level the role of transportation systems has been the subject of continual dispute. One school of thought sees transportation as driver of economic development by opening up new markets and allowing comparative advantages to be fully exploited.

The contrasting position is that transportation systems, while sometimes acting as facilitators, are not leaders in the development process but tend themselves to be improved as the result of higher incomes that are made available. This is a major debate

and one that is large avoided here. The focus is more on the economic nature of transportation systems and on methods how they may be provided efficiently.

2. Transportation Economics

It is helpful to initially understand what economics is all about. Economics was defined over a century ago by Alfred Marshal as ‘a study of mankind in the ordinary business of life; it examines that part of individual and social action which is most closely connected with the attainment and with the use of the material requisites of wellbeing’. Whereas engineers are concerned with building and design, economists are concerned with ‘need’ and the allocation of scarce resources. Economists assess the merits of one allocation of scarce resources over another.

Assessing the merits of alternatives structures poses a number of problems. The sheer diversity of options and of individual preferences led Adam Smith and, indeed, most economists since to look at institutional structures to provide desirable allocations. The market mechanism, with its ability to facilitate transactions between individuals and small groups has been favored in most contexts. The ability of any central body or agency to marshal all relevant information and then process it to arrive at a better outcome than the market has generally been found to be lacking. Centrally planned economies in Eastern Europe and elsewhere fell in part because of their inability to do this, and regulated and publicly owned companies in otherwise more market driven systems often succumb to demonstrable inefficiencies.

Nevertheless there are cases where the market does seriously fail and where some form of non-market interventions may be seen as justified. The traditional case is where the market results in situations that produce what society sees as unfair outcomes. The distribution outcomes are considered unjust. In these cases government interventions may redistribute goods and services in ways that the market would not. Economists often have a voice in the most efficient way of doing this.

In other cases, markets may not be efficient in a pure technical sense. In these situations the allocation of resources does not produce the most efficient outcome irrespective of any distribution considerations. Put another way, there is a non-market situation that would yield a larger output for fewer inputs. Whether there should be intervention in the market in these cases is not always certain. It needs to be shown that the government action will clearly improve on the, albeit imperfect market outcome. The types of situation that give rise to these market failures include classic cases where some actors in the market (e.g., a monopolist) have excessive bargaining power. But they also embrace situation when information on service availability and the prices being charged is not ubiquitous, and when there are inputs used in production (e.g., environmental resources) that are not paid for by users. All these types of situation have at various times been ascribed to transportation.

The technical side of transportation economics is largely concerned with trying to ensure that markets work efficiently and those resources are used in the best way possible. In this sense they are usually less concerned with the distribution aspects of transportation although in practical terms that inevitably becomes part of the wider decision-making

process. The aim is to be as objective as possible in this process – i.e., to deploy ‘positive economics’. In some cases economists become involved in more normative debates. This is because they feel that they should have at least an equal say in matters concerning the distribution of costs and benefits as others, or because they have the tools to point to trade-offs between more efficient outcomes and those that, while less efficient, accord more nearly with ideas of social justice.

Moving to the more specific area of transportation economics, historically, economists have, for reasons that are not always clear, only intermittently become involved in analyzing transportation systems. One historical reason is that transportation until comparatively recently has been seen as meeting criteria well outside of those of modern economics. Roads and shipping have in the past been treated more as parts of the military and political infrastructures of countries, than as parts of their economic assets. Decisions governing which pieces of infrastructure to build and how they are to be used rested largely on non-economic criteria.

Yet strangely enough, much of modern microeconomics (that part of economics that concerns itself with the actions of individuals and firms) has many of its roots in transportation problems. The genesis is in the nineteenth French Engineering School of economics that was concerned with matters such as the pricing and decision rules for investing in transportation infrastructure, and in assessing such things as the value of travel time to users of that infrastructure. It was in these areas that economists became particularly active with the advent of rail transport. There was a need to develop more sophisticated pricing techniques for industries with what were seen as significant fixed costs and also characterized by asymmetric demand patterns (notably the difference between demand for transport in one direction differed considerably from that in the other.)

Subsequently, the importance of transportation systems to economies made them a central focus for economic policy. Concern about the potential for market failure in transportation, and the possible need for government intervention produced, a considerable body of specialized economics aimed at addressing these problems. Indeed, the emphasis of much of transportation economics during the middle of the twentieth century was on developing legal structures consistent with the best practices of economic regulation. Where there was public ownership or price controls designed to limit excess profitability, concepts such as Ramsey Pricing were developed (basically ensuring cost recovery by differential pricing according to variations in user demands). The emphasis shifted, as seen in Section 4 below, towards the latter part of the century as new ideas about regulation emerged and empirical studies began to emerge that brought into question the effectiveness of many types of regulation.

Additionally, towards the end of this period, a new strand of transportation economics emerged that focused much more on infrastructure expansions. Factors such as the growth in populations, increased urbanization, the increased specialization of production, and growth of road traffic brought forth the need for more and improved infrastructure. This mainly concerned roads but also urban transit systems, airports, and seaports. This was largely seen as a public works initiative serving public needs and immediate transportation pressures. But it was also thought of as part of a larger socio-economic

initiative. Consequently, accompanying this was the perceived need for land-use/transportation planning activities but set within a larger market based economic structure.

Economists became active in this process in two particular areas. They developed more sophisticated modeling and forecasting techniques that provided vital inputs into the decision-making processes. Although not dealt with in any detail in this paper, these models were based more on human behavior and calibrated at a much more disaggregate level – e.g., based on household behavior rather than spatial zones – than the engineering based models then in widespread use. Indeed, the work of Dan McFadden in this area led to him winning the 2000 Nobel Prize in Economics. Second, economists developed assessment tools such as cost-benefit analysis that we consider in more detail in Section 5. These were aimed at introducing more discipline and consistency into the decision-making processes, and to make its underpinnings more akin to those found within market structures.

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Biographical Sketch

Kenneth Button is Professor of Public Policy and Director of the Center for Transportation Policy, Operations and Logistics in the School of Public Policy, George Mason University since 1997. Prior to this he was Conseiller in the Advisory Unit to the Secretary General of the Organisation for Economic Cooperation and Development, Paris where he headed work on international aviation policy. He was at that time on leave from being concurrently Professor of Applied Economics and Transport at Loughborough University, UK and VSB Visiting Professor of Transport and the Environment at the Tinbergen Institute, Amsterdam. He has been the Special Advisor to the UK House of Common Transport Committee. He has held visiting post at the University of British Columbia, the University of California at Berkley, University of Porto, and the University of Bologna.