JOSEPH BERECHMAN

THE INFRA-STRUCTURE WE RIDE ON

DECISION MAKING IN TRANSPORTATION INVESTMENT

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In memory of my parents

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About the Author

Joseph Berechman earned his BA degree in Economics from The Hebrew University in Jerusalem, and his MBA and PhD from the University of Pennsylvania in Philadelphia. He is an emeritus professor from Tel Aviv University. Presently, he is a Marvin Kristein Chair professor of economics at the City College, The City University of New York. Professor Berechman is the author of numerous articles and six books. His main areas of academic interest are transportation economics and policy.

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CHAPTER 1

Introduction

1.1 Rationale

Transportation infrastructure projects, of all types, fall within the domain of public investments that reflect public sector priorities and objectives, non-pecuniary and financial constraints, and decision-making processes. Since infrastructure investments typically affect large populations, extend over large territories and carry substantial opportunity costs, many western democracies have instituted formal procedures for quantitatively appraising their multiple outcomes as aides in choosing optimal projects. These procedures, their underlying rationale, analytical structure and empirical applications are subjects of graduate classes in various fields of academic studies, including economics, public policy, civil engineering, city planning and environmental studies. Governments, at all levels, have engaged numerous professionals and resources in the technical analysis of specific infrastructure projects. These undertakings encompass highly skilled activities ranging from the coding of networks—highways and rail—to estimating travel time and the ensuing cost savings, to assessing the monetary returns on the investment and its alternatives.

Against this background one would expect that the selection and implementation of projects, especially capital-intensive mega-projects, would be rational and optimal relative to their costs and benefits, broadly defined. And yet, numerous studies have revealed that this portrayal of infrastructure project evaluation and choice is largely inaccurate. A significant

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proportion of implemented mega-projects have been found to be inferior *ex ante*, with many not delivering the returns they were promised to offer *ex post*. In fact, many projects were not subjected to any type of evaluation, formal or otherwise, and were selected for implementation either on shaky and suspicious grounds or due to funding that, once secured, effectively precluded conducting formal scrutiny of impacts and validation of the project's transportation-economic value. Given the dire state of funding for new transportation infrastructure and the below-standard maintenance of many systems in place, one cannot but wonder how to explain this phenomenon, where huge investments are made in unworthy projects. To be clear, by *unworthy* I mean projects with unacceptable *ex-ante* net welfare contributions indicated by, say, insignificant benefits-to-costs ratios, or *ex post* by substantial cost overruns, way off target implementation periods and excessive under-utilization.

The common explanation given to this phenomenon is that politics, however defined, rather than transportation-economic values and criteria, represents the decisive factor in project selection (Altshuler and Luberoff 2003). But is this truly a credible account of how projects are selected? Do other factors enter the choice process? If so, what are they and what are their relative weights? Most crucially, how can the project selection and decision-making be characterized? These questions constitute the rationale for writing—and reading—this book.

The spending of massive financial resources on transportation infrastructure, particularly low-performing mega-projects, represents a public sector puzzle[1]: Why are public funds being wasted? Put differently, why are projects built when their opportunity costs, namely, the returns on alternative projects subsequently not built, are often significant? That is, the wasting of funds implies the generation of insufficient benefits given the costs, meaning that society foregoes returns that could have been realized had the money been invested wisely. Such foregone benefits may include congestion mitigation, improved accessibility and reliability, reduced road fatalities and lower air pollution levels. In social welfare terms, the expenditure of resources whose value exceeds that of the received benefits implies net welfare losses. From the public's perspective, the problem is further confounded when we consider the role of our elected officials as guardians of public funds; hence the importance of studying the process leading to the choice of unworthy projects. Indeed, who will guard the guardians?

1.2 Objectives and Scope

A project's engineering and planning aspects are, obviously, extremely important for its construction and successful utilization. High-yielding projects can turn out to be failures if marred with faulty planning and design, as well as sloppy management. In this book, however, I am mainly concerned with the non-technical factors that underlie the decision-making surrounding project choice and implementation. Chief among these factors are the project's non-engineering transportation-economic attributes, such as the value of improved accessibility, together with its institutional, financial and social impact factors.

In concurrence with a common assumption in the field of political economy, I assume that politicians are incentivized by these factors in light of their goals of garnering voters' support and reducing opposition through policies and resource allocation decisions. The direct objective of this book is, therefore, to analyze the major factors that tend to underlie project decision-making so as to unpack the reasons why projects are so often selected despite their inability to meet acceptable project choice criteria. From my perspective, the analysis of such choices calls for the use of political economy theories and methods, which explains why I have adopted such an approach in this book.

The common approach to the economic analysis of socio-economic phenomena rests on construction of a model for the purpose of *describing* and *explaining* the selected phenomena. Once the model's underlying logic and tenets are elaborated, it can be used to *predict* the consequences of selected policy changes. For example, we can theorize and then build a formal model to explain how users make rational choices between transportation modes for their daily commute given their socio-economic characteristics and each mode's travel time and price attributes. Once the model has been formalized, we can estimate its parameters, which will then be used to predict the impact on future choices once one or more attributes have been modified (e.g., by a policy that shortens travel times by public transit).

Another use of economic modeling is to *critique* economic decisions. In this case, a theory-based model is used to ascertain the appropriateness of the decision-maker's rationale and reasoning (Gilboa et al. 2014). For example, public-finance models based on economic welfare theory suggest that a project's net welfare contribution should be the key criterion for its

implementation. A selection decision that fails to meet this criterion is thus open to criticism regarding the reasoning and motivation behind it.

The allocation of societal resources involves judgments of two fundamental types: those of efficiency and those of fairness or equity. Based on accepted economic principles, we distinguish between a *normative* and a *positive* economic analysis. Under the former, the goal is to derive rules capable of indicating the optimal allocation of resources, where optimality refers to efficiency and fairness or to their tradeoffs. An example would be the derivation of an optimal highway congestion toll that should be collected to support highway improvements and/or expansion. In contrast, positive analysis focuses on *what is*, where the goal is to ascertain how economic agents actually behave given the market prices and economic incentives observed. Estimation of the degree to which highway congestion will be reduced following a road capacity expansion project provides an instance of positive analysis, with equity and fairness criteria embedded within.

These two types of economic inquiry are reflected in a third area, namely *policy design*, defined here as the use of normative rules and positive observations to construct a plan aimed at achieving policy objectives. To illustrate, a regional congestion-mitigation plan can combine pricing rules (e.g., optimal tolls) with a new infrastructure investment (e.g., a rail line), using information on how auto users actually behave in similar situations when a new transit facility is built. We should note, however, that a policy-maker, when stating her policy choices, simultaneously reveals her value-based rules for reaching those goals. She may decide to invest in a specific subway line, thus reflecting her aims of reducing congestion (crowdedness) on other lines, but also to stimulate real-estate development in the adjacent areas.

Given these types of economic models and economic inquiry, the focus in this book is on the use of transportation-economic-based criteria to critically examine observed infrastructure investment projects. My examination takes the form of assessments regarding the properties of a sample of projects rooted in public investment policies that presumably were derived from the application of acceptable efficiency and equity rules. For example, from a normative perspective, transportation investments should meet economic efficiency criteria such as benefit-cost ratios above a designated threshold, with benefits and costs, including externalities, equitably distributed among the relevant populations, or ensure that no single socio-economic group disproportionately bears the costs. If an *ex-ante* analysis reveals this not to be the case, for example, the actual benefit-to-cost

ratio is below the acceptable level, the project is regarded as inferior or unworthy.

The data presented in this book demonstrate that many transportation mega-projects are veritably unworthy investments. The question asked here is, therefore, why such poor investment decisions were made at all. To begin answering this question, the book hypothesizes that the respective investment decisions were the product of relationships between an array of inputs and interested stakeholders. The book subsequently sets out the kinds of inputs that enter most if not all decision processes, together with the nature of their inter-relationships. These determinants include, among others, the project's history, the institutions affected, the identity of special interest groups, demand and cost projections, and sources of funding.

1.3 The Book's Structure

Following this introductory chapter, the book is divided into three main parts. Part A, entitled "The Conundrum of Mega-Project Provision", sets the scene for the subsequent analysis by reviewing, in Chap. 2, the gap between transportation investment needs and actual funding. Chapter 3 discusses the formal requirements and procedures applied by most Western countries for investment analysis and choice. Then, in light of the universality of these practices, the chapter asks why a significant number of projects are, in fact, inferior or unworthy. Chapter 4, which introduces a paradigm explaining actual investment decision-making, aims at explaining why inferior and unworthy projects are indeed selected.

Part B, "The Political Economy of Mega-Projects", critically examines those factors hypothesized to impact on decision-making and project choice. Chapter 5 examines the nature and role of benefit-cost forecasting. The project's history and its implications for problem framing and public acceptance are discussed in Chap. 6. The roles of opposition and special interest groups are examined in Chap. 7. Chapter 8 analyzes the crucial influence of funding availability in this process. Chapter 9 reviews the role of oversight institutions in project choice. The effects of equity considerations and transportation externalities on decision-making are examined in Chap. 10.

Part C, "Where It All Comes Together", summarizes the previous analysis relative to our chosen sphere, transportation infrastructure investments. Using models and methods of decision-making under risk,

Chap. 11 first reviews what we can learn about infrastructure decision-making in the public sector. The chapter then presents conclusions regarding what actually determined the observed choice of projects. It demonstrates the inevitability of choosing inferior and unworthy projects under current practices. Lastly, the chapter recommends several policy actions that, if adopted, should improve transportation infrastructure investment decision-making.

1.4 A Note on Data

Many sources of information were accessed within the framework of the book's analysis. Most important is the database constructed by Dr. Nobbe and me (Nobbe and Berechman 2014). It contains information on 60 mega-projects, worldwide, relative to 58 key project attributes. A detailed description of the database is provided in Chap. 4, Appendix.

One key shortcoming of our database, and all other data sources for that matter, is that it does not report alternatives to the projects actually selected, relative to their transportation-economic value. Thus, we do not know whether other alternatives were considered and, if so, whether the best one was chosen. Similarly, there is virtually no direct information on the actual decision process and decision criteria used to reach the respective decision. Hence, the best we can do is to treat decision-making as a black box and observe the degree to which the postulated input factors entered and influenced all the selected cases. Concurrently, we analyze the process's outputs, namely, each project's individual attributes. The core of the argument is that this approach—entailing the observation and assessment of inputs and outputs—will explain the fundamentals of transportation infrastructure investment decision-making.

Note

1. To illustrate, New York's Second Avenue Subway (Phase 1 is currently under construction) expenditures have reached $2.25 billion per mile. While this project is on the very expensive side, the costs of most infrastructure projects, especially rail, reach billions of US dollars.

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CHAPTER 2

Infrastructure Needs and Reality

2.1 Introduction

It has long been documented that from transportation-economic as well as social perspectives, a significant number of all transportation infrastructure mega-projects have been either complete failures or unworthy of initiation. Moreover, even among more or less successful projects, a large number were not subjected to comprehensive, or even partial, benefit-cost analysis. Hence, because all projects are the result of decision-making whether by individual decision-makers or by institutions, the fundamental question invited is as follows: What kind of process led to this reality? As stated in Chap. 1, the aim of this book is to investigate the major aspects of transportation investment decision-making in an attempt to respond to this question and thereby explain these phenomena.

As a preliminary to this task, we need to define the basic terms, concepts and tenets that underlie the analysis. I begin with the term *transportation mega-project*, which I define as a large-scale *new* enterprise, with capital outlays of $1 billion or more investment in capacity. Needless to say, this definition of mega-projects is arbitrary; its benefits lie in its handy distinction between large-scale infrastructure projects and other transport investments. In reality, the majority of transportation infrastructure projects involve repair, maintenance and rebuilding investments that are, by and large, of smaller scale than new capacity investments. And so, to be clear, the focus in this book is on the latter type of investment and its attributes.

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Transportation projects are also distinguished by their physical characteristics. In this book I focus primarily on surface (land) transportation facilities including roads, bridges, tunnels, light and heavy rail and subways (metro or underground), and delve into the relationships of the respective questions relative to them. For example, the literature shows that rail projects are more prone to failure than are road projects due to the tendency to massively under-estimate their cost (generally referred to as cost overruns) and over-project future passenger loads (Flyvbjerg 2007).

Another distinguishing factor is that between *passenger* and *freight transportation*. While cargo hauling is a crucial component of any national or regional transportation system, in this book I focus almost exclusively on passenger transportation. A key reason for this choice is that many rail freight projects are carried out by private sector firms, where decision-making regarding capital investments differs significantly from the public sector. Although the fact that highway projects serve both types of transportation, freight (trucks) and passenger, complicates this choice (passenger travel constitutes the bulk of highway volume), it remains warranted.

The last major concept requiring definition is *locus of decision-making*. While mega-projects are all too often wholly or partially subsidized by central and state governments, transportation infrastructure projects are, by and large, local or regional in scope. In physical terms, very few extend beyond a metropolitan area or a region even though their impacts can spill over beyond these boundaries. As a result, *local decision-making* often lies at the core of the entire process. It therefore follows that I pay special attention to local (city, region and state) decision-making components.

With some exceptions, this book examines mega-projects already implemented. For each of these, many worthy projects probably never reached the construction stage. Exploration of the reasons for their failure to get beyond the proposal stage could shed light on the vagaries of the decision process underlying these as well as other projects. However, due to the lack of appropriate information, such an analysis cannot be performed, which does not prevent their mention, whenever possible, as examples of selected decision-making dynamics.

It might be argued that the decision-making process behind each mega-project should be viewed as a black box, representing a unique instance relative to key external and internal factors. *External factors* may include transportation and design properties, project location, socio-economic