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Evaluating the public investment mix in US freight transportation infrastructure

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Abstract

This research empirically evaluates the public sector investment in the US freight transportation infrastructure. In particular, the infrastructures to support the two most comparable modes of freight transportation – highway and intermodal rail – are examined as alternatives for public fund allocation. Indicators for public sector transportation infrastructure investment mix are established based on financial analysis of both private and social costs and benefits, as well as the propensity of freight shippers to utilize such infrastructures. The research results in recommendations for the aggregate allocation of public funds in the US based on these indicators. We find that approximately a quarter of truck freight could be handled at a 25% lower cost if rail infrastructure to support it existed. Because an additional 80% reduction in social costs could be achieved through this modal conversion, the public sector is a critical participant in creating a more efficient transportation infrastructure.

Keywords: Transportation; Policy; Externalities; Freight; Intercity; Intermodal; Trucking; US; Efficiency; Public sector

1. Introduction

Freight transportation is critical to the US economy. It supports interregional and international commerce, which due to internationalization are a quickly growing component of US Gross Domestic Product. An efficient freight infrastructure investment policy reduces total landed product costs through cost-efficient transportation of distant raw materials and final goods. Further, transportation policy has direct impact on public safety, environment and road congestion delays. Thus, appropriately designed freight infrastructure can reduce the costs of living and improves the quality of life for the US population.

In the US, the road freight infrastructure is planned by federal, state and local agencies while the rail freight infrastructure is planned and owned by private rail companies. The rail infrastructure investment decision is made by private companies that are often challenged to justify investment, which reduces the overall investment in and effectiveness of the freight rail infrastructure. As a result of this dichotomy of freight

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infrastructure planning, the coordination of freight infrastructure planning is small to non-existent, leaving potential for tremendous inefficiencies in freight infrastructure investment.

The goal of this research is to identify aggregate indicators of the level of socially optimal public investment in road and rail to support intercity full truckload freight transportation in the US. From a research perspective, this study integrates research and draws on techniques from research in economics and operations research to arrive at its recommendations for planning freight transportation infrastructure investment. This work combines three parallel research streams: the transportation infrastructure investment literature, social costs of transportation literature, and shipper modal choice and demand elasticity literature. We consider numerous complicating factors which affect public fund allocation by including infrastructure ownership structure, competing mode investment alternatives, private and external social costs to modal choice, and shipper modal choice decisions. From a policy perspective, this work characterizes improved public investment in two competing freight infrastructures, highway and rail. The purpose of the present investigation is to take a holistic approach to characterizing efficient freight transportation infrastructure policy in the United States from both private party and social perspectives. We show that, because of the large external costs of freight transportation, alternatives to disjointed public policy and private sector infrastructure investments must be considered in order to achieve an improved freight mode mix in the US. Finally, we show that an improved infrastructure would be beneficial to shippers.

2. Literature review

This work estimates the total private and social costs of intercity trucking and intermodal rail freight transportation, and evaluates the feasibility of converting shippers between modes to realize the socially optimal allocation of funds to freight transportation infrastructure. There are three areas of research that we draw on to support this study: research on the quantification of private and social costs of freight transportation, research on optimal freight infrastructure investment, and freight transportation demand elasticity estimation and shipper modal choice optimization. Infrastructure investment is often based primarily on the societal benefits of building new transportation infrastructure. On the other hand, the transportation infrastructure pricing literature is focused on the pricing of existing capacity to fully reflect the social costs and overuse of a given transportation network, less on the social benefits derived from such infrastructure. Finally, optimal infrastructure investment is often viewed in terms of a single mode, where alternative modal investment might be viewed as an option. This single-mode focus is exacerbated by the two separate entities that made modal investment decisions to support freight movement in the US; public sector investment focuses on roads while private sector investment focuses on rail. Of course, these decisions must be made in light of the shipper's modal choice in order to assure any investment in capacity is well utilized; building the infrastructure will not assure its use. We help tie these three areas of research together in an application to US freight infrastructure.

2.1. Externalities of freight transportation

Infrastructure investment policy must consider the impacts of externalities of freight transportation not borne by shipper or carrier. This area of research is best typified by recent work by Forkenbrock (2001, 1999), which provide detailed estimates of the external costs (such as pollution, congestion, noise and public safety risk) of US truck and freight rail transportation. The focus of this research is the careful calculation of the total costs of each mode of transportation, including the direct costs such as fuel, labor, and equipment, and the various negative externalities associated with each mode, such as pollution, congestion, costs to taxpayers for infrastructure maintenance, and the like. We apply the externality comparison to a broader policy statement on efficient infrastructure investment.

2.2. Optimal freight infrastructure investment

Recent research on transportation infrastructure planning has been conducted by authors such as Nash (1993), Winston (1991) and Conrad (1997, 2000). Winston (1991) focuses on empirical characterizations of