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Individual freight effects, capacity utilization, and Amtrak service quality

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ABSTRACT

This paper offers a new perspective on the post-deregulation rail industry. We hypothesize that a link exists between individual freight effects and Amtrak service quality. Specifically, we investigate the relationship between freight control of the infrastructure on which Amtrak trains operate and Amtrak train delays. Our sample consists of 1117 directional station-pairs for fiscal years 2002 through 2007 on 28 Amtrak non-Northeast Corridor passenger routes. We found that freight effects have a significant impact on Amtrak train delays after controlling for other important delay determinants such as the capacity utilization rate. The impact is higher on long-distance routes. We also observed significant differences between the effects of different freight railroads. For example, Amtrak operations on infrastructure controlled by several Class I railroads experienced significantly larger delays than baseline operations, while Amtrak train delays on Burlington Northern and Santa Fe's tracks actually fell below baseline levels.

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1. Introduction

In this paper, we offer a new perspective on the post-deregulation rail industry through an exploration of the relationships between individual freight effects, capacity utilization rates, and Amtrak[4] service quality. In particular, we hypothesize that a link exists between individual freight companies' control of the infrastructure on which Amtrak operates and Amtrak train delays, a topic that has received little previous attention.[5] We investigate this hypothesis in the context of addressing the research question, "What are the causes of Amtrak train delays?" This is the first study to perform a quantitative analysis of Amtrak on-time performance. Our results indicate that freights' control of the rail infrastructure is particularly important in explaining Amtrak delays.

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[4] Amtrak, formally the National Railroad Passenger Corporation, provides all intercity passenger rail service within the United States.
[5] In 2008, the United States Department of Transportation Office of Inspector General (DOT-OIG) pointed to a probable connection between individual freights' traffic management and Amtrak's on-time performance (DOT-OIG, 2008b).

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A large-amount of research has been published on the US rail industry since its deregulation by the Staggers Rail Act of 1980. Most of these studies examine the effect of freight company mergers on shipper rates, cost savings, and other efficiency measures (Wilson, 1994; Chapin and Schmidt, 1999; Ivaldi et al., 2002). Other studies investigate rail competition more generally. For example, MacDonald (1987) found that lower shipping rates were associated with increased competition among freight railroads as well as between railroads and other transportation modes. In a more recent paper, Burton and Wilson (2006) compared prices on competitive and monopoly origin–destination pairs. Their evidence suggests that freight railroads charge higher rates on rail links without barge competition.

The railroad infrastructure Amtrak owns is comprised solely of most of the Northeast Corridor (NEC) between Boston, MA and Washington, DC, and 90 miles of track outside of Chicago. Consequently, the majority of Amtrak services run on tracks owned and dispatched by freight railroads. Each freight railroad determines dispatching priorities on its system, and Amtrak's on-time performance can be significantly affected by dispatching practices.

Freight railroads are private companies whose profits largely derive from shipping charges. Amtrak, on the other hand, is a public entity seeking to maximize public benefits. In particular, good on-time performance attracts passengers, increases Amtrak's revenues, and decreases its reliance on Federal subsidies (DOT-OIG, 2008a).[6] Because of the conflict of interest between the freight railroads and Amtrak, Congress passed a law in 1973, requiring freights to give Amtrak trains priority when dispatching.[7] However, whether the freights comply with the statute is a matter of debate (DOT-OIG, 2008b). Our results suggest that which freight railroad controls the track on which an Amtrak train travels substantially affects that train's delays.

Our empirical model controls for important delay determinants, including the capacity utilization rate, an indicator of the degree of congestion on a rail network. Dingler et al. (2009) performed a simulation-based study and showed that increases in traffic volume increase rail delays. We constructed a capacity utilization variable based on traffic volume and capacity, using an approach similar to that of Cambridge Systematics (2007), and found that increases in capacity utilization add to Amtrak train delays.

The hypothesis of a link between individual freight effects and Amtrak service quality and controlling for capacity utilization are innovations of our research. Our study is unique in other aspects as well. For example, we analyze service quality from the perspective of Amtrak, whereas Harris and Winston (1983) used Winston's (1979) estimates of shippers' value of transit time to study rail network effects on service quality. In addition, unlike Martland (2008), we employ an econometric approach. Martland compared Amtrak's average train speed with the average speed of CSXT freight trains over different track segments, and found Amtrak's average speed consistently exceeded the freight trains' average speed. From this he concluded that Amtrak trains received dispatching priority. Our analysis does not directly consider dispatching priority, but instead examines the effects of individual host railroads on Amtrak delays while controlling for other factors.

2. Background

Amtrak's historical on-time performance (OTP) on routes outside the NEC has been a matter of concern for some time. From fiscal years (FY) 2002 through 2007, Amtrak's annual OTP on the NEC ranged between 74% and 88% while outside the NEC it consistently fell below 55% on long-distance routes.[8] During the same time period, annual OTP on Amtrak's non-NEC short-distance routes varied between 65% and 76%. These figures indicate a notable difference in Amtrak's NEC and non-NEC operations, particularly for long-distance services.

The dynamics of Amtrak train delays may differ between long- and short-distance routes for several reasons. Outside of the NEC, short-distance routes are served by shorter, lighter trains that can travel at higher speeds than those on long-distance routes. Further, some short-distance routes receive service several times a day, and substantial portions of them wind through densely-populated areas. By comparison, most stretches of long-distance routes run through lightly populated rural areas, and no long-distance route has service more than once a day.

Much of the literature on train delays focuses on delay-time estimates and capacity analyses for freight or passenger trains, using either simulation-based or optimization-based methodologies[9] (Higgins and Kozan, 1998; Huisman and Boucherie, 2001; Vromans et al., 2006; Harrod, 2008; Murali et al., 2010). Both types of research involve making a number of assumptions about dispatching rules and rail network structures (Gorman, 2009), that statistically-based research does not require.

Olsson and Haugland (2004) used statistical methods to analyze the effects of selected factors on train punctuality in Norway. More recently, Gorman (2009) conducted an empirical study focused on congestion-related freight rail delays. Gorman predicted total train run time using train and track characteristics, and a list of congestion-related factors such as meets and passes. Instead of including congestion-related factors to predict congestion delay, we generated a capacity utilization measure to assess the effect of congestion on train delays.

[6] Recent Transportation Part A literature has looked into the effect of delays on demand for other modes of transportation (Tu et al., 2012; Rojo, 2012; Zou et al., 2012).

[7] 39 U.S.C. §24308(c).

[8] Long-distance routes are those which exceed 550 miles. All other routes are considered short-distance.

[9] Some studies examine the issue of scheduling and delay propagation: Cacchiani and Toth (2012) and Cacchiani et al. (2010a,b). We focus primarily on the initial causes of delay.