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A global perspective on railway inefficiency and the rise of state ownership, 1880–1912

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ABSTRACT

The rise of state ownership was one of the most significant policy changes in the railway sector in the early 20th century. This paper estimates the cost inefficiency of railway sectors across countries using stochastic frontier models and examines whether the rise of state ownership affected inefficiency. The results show that the trends in inefficiency differed substantially across countries from the 1880s to 1912. They also show that inefficiency increased with greater nationalizations and decreased with greater state railway construction. A counterfactual analysis suggests that the rise of state ownership contributed to lower inefficiency in most countries, but the effects within countries varied depended on whether state ownership increased through nationalizations or new construction.

1. Introduction

Economic historians often analyze railways through their contribution to social savings. Contemporaries in the early 20th century also discussed the developmental effects of railways, but with equal interest they analyzed the performance of railways as a sector. In 1910 railway revenues equaled around 6% of GDP in countries like Britain and Germany.[2] Railway tracks, locomotives, and stations also constituted a relatively large share of the total capital stock. According to estimates in the 1880s, railways accounted for around 9% of total wealth in countries like Britain and Germany (Mulhall, 1892, p. 589). Given the large size of the railway sector and its potential spillover effects on other sectors in the economy, any excess in operating costs could have substantial implications.

Railway operating expenses differed greatly across countries from the 1880s to 1913 in part because the scale of outputs (i.e. ton miles and passenger miles), the density of services, and the price of inputs were all substantially different. However, even after accounting for these factors, there remain differences in operating expenses both across countries and within countries. Inefficiency is one reason why expenses differed. In general, inefficiency arises when firms or organizations do not minimize costs with respect to a given output level, input price vector, and available technology. In the railway context inefficiency would be associated with the failure to adopt more energy-efficient locomotives, poor network design, or the lack of coordination across railway lines. Inefficiency would also be associated with the misallocation of inputs, such as the failure to reduce the use of labor when wages increased relative to fuel or capital prices. Environmental factors like geography are another explanation for residual differences in expenses. Variation in elevation or rainfall could contribute to

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[2] The GDP figures are taken from Mitchell (1992). The sources for revenue will be discussed in Section 2.

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differences in expenses because railways traversed the landscape of a country. Distinguishing between inefficiency and environmental factors is important because there was scope for lowering inefficiency through the actions of policy makers, railway managers, and workers.

This paper addresses two questions. How did railway inefficiency differ across countries from the 1880s to 1912? How did the rise of state ownership influence railway inefficiency across countries and over time? The rise of state ownership marked one of the major policy shifts in the railway sector from the 1870s to 1913. Private ownership and operation was predominant in most countries in 1870. Afterward there was an evolution toward greater state ownership and operation through greater construction of state-owned railways and nationalizations of privately-owned railways. By 1910 approximately 10% of the world's railway miles had been nationalized and 22% were constructed by the state.

Private ownership is generally believed to be more efficient than state ownership because it encourages competition and arguably provides stronger incentives for investment and innovation.[3] However, it is not obvious that private ownership contributed to efficiency in the railway context c.1900. Contemporaries hotly debated the benefits and costs.[4] Some echoed modern complaints about government ownership arguing that state railways lacked commercial discipline. Others took a different view and stressed that private railway companies were often guaranteed interest or dividends and thus had less incentive to cut costs. It was also noted that private companies had difficulties coordinating services and the adoption of technologies.

Inefficiency is estimated in this paper using stochastic frontier models and cross-country data on railway performance. The cross-country data are drawn from a number of sources like *the Statistical Abstract for the Principal and Other Foreign Countries*, published by the British Board of Trade. It includes total expenses, railway miles, passenger miles, ton miles, and construction costs for railways in 18 of the largest economies. Additional sources were used to combine the railway data with information on fuel prices and wages in these same economies. The stochastic frontier methodology involves the estimation of a cost function with the addition of a random term measuring inefficiency.[5] Following other studies, the specification of the cost function includes variables for scale, density, input prices, and country fixed effects.

The results show that the average level of inefficiency was 0.058, implying the average country could have reduced its annual costs by 5.8% if it eliminated all inefficiency. More significantly the estimates suggest that the trends in inefficiency differed substantially across countries. The US, Belgium, France, and The Netherlands had the most efficient railway sectors by the 1900s, while Canada and Italy had the least efficient. In the 1890s the ranking of inefficiencies was quite different. Italy, Sweden, Austria, and Switzerland had the most efficient railway sectors, while the US and The Netherlands had the least efficient.

The effects of state ownership are analyzed using regressions of inefficiency on variables for the degree of nationalizations and state railway construction. The results show that inefficiency increased with nationalizations and decreased with greater state (as opposed to private) railway construction. These findings imply that the effects of state ownership differed depending on whether nationalizations or new state construction were more common. The results also provide estimates on the effects of greater state ownership in the most important railway countries by 1910. A counterfactual analysis shows that average inefficiency would have been 12% lower had there been no nationalizations in any country before 1910. On the other hand inefficiency would have been 39% higher if no countries had more than 25% of their networks constructed by the state. These results suggest that the railway sector would have been more inefficient overall had there been less state ownership.

This paper contributes to the historical literature on railway efficiency and productivity. It builds on the studies by Crafts et al. (2007, 2008), Leunig (2006), Arnold and McCartney (2005), and Herranz-Locan (2006), which estimate freight charges, fares, travel speeds, rates of return, productivity, and inefficiency for British and Spanish railways before 1912. It also builds on the work of Foreman-Peck (1987) and Bogart (2009) who analyze construction costs, nationalizations, and network development in a cross-country setting.[6]

The paper also offers a new perspective on the role of policy choices in the global economy from 1870 to 1913. In this period there was greater government intervention through increased spending on social services and infrastructure.[7] Railways provide an important case to evaluate the effects of greater government intervention. The results reject the claim that private companies were always better than the state in managing railways. If that were the case, greater nationalizations *and* greater state railway construction should have contributed to inefficiency. Instead the results suggest that by the 1890s and 1900s greater private railway construction contributed to worse management of railways. A likely reason is that interest or dividend guarantees dulled the incentives for private railways to cut costs.

The estimates also suggest that state railway bureaucracies were becoming increasingly sophisticated. As one example, the Government of India organized railway conferences promoting better coordination and management of the rail network (Bell, 1894). It also created the State Railway Provident fund which contributed one-half of one percent of state railway earnings to its employees in proportion to their salary and position. It appears some governments addressed the incentive problems highlighted by their critics at the turn of the century and today.

[3] See Shleifer (1998) for summary of recent views on the efficacy of private ownership.

[4] For a sample of works see Edwards (1907), Cunningham (1906), Raper (1912), and Dunn (1913).

[5] For an introduction to stochastic frontier models see Kumbhaker and Lovell (2000).

[6] The paper also relates to the contemporary literature on efficiency estimation. A number of studies have analyzed efficiency at the network or country-level and examined its relationship with ownership or regulatory policies. Some examples include Parisio (1999), Christopoulos et al. (2001), and Cantos and Maudos (2001).

[7] See Lindert (2004) and Millward (2004) for studies of social spending and infrastructure.