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REPORT SUMMARY

A Look at Railroad Costs, Scale Economies, and Differential Pricing (Summary)

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This is a summary of "A Look at Railroad Costs, Scale Economies, and Differential Pricing" by John Bitzan and Fecri Karanki.[1] The research and analysis received funding from USDA's Agricultural Marketing Service (AMS) through cooperative agreement number 18-TMTSD-ND-0006. The opinions and conclusions expressed are those of the researchers and do not necessarily reflect the views of USDA or AMS. The full report is available online at https://www.ndsu.edu/challeyinstitute/research/publications/a_look_at_railroad_costs_scale_economies_and_differential_pricing/.

WHAT IS THE ISSUE?

Setting and regulating prices in the rail industry is challenging. Economists typically refer to "marginal cost pricing" (i.e., setting price equal to marginal cost) as a kind of benchmark for functioning markets.[2] However, in the case of railroads, marginal cost pricing would cause railroads to go out of business. Railroads have exceptionally high **fixed costs** and **common costs** that make marginal cost pricing unprofitable.[3] High fixed costs and common costs also mean railroads experience **economies of scale**—as they increase their output, their per-unit costs fall, at least up to a point. Thus, at high levels of output (and low per-unit costs), railroads can lower their average per-unit prices while remaining profitable. However, at low levels of output (and high per-unit costs), railroads must maintain higher per-unit prices overall.

To recover their high fixed costs and common costs and operate profitably, railroads engage in **differential pricing**. Differential pricing involves charging rates based on a shipper's willingness to pay, where captive shippers pay higher rates than shippers with more transportation alternatives.

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2 Economists prefer marginal cost pricing because of the efficient outcome it creates for society. This is because the value society places on another unit of the good (the price) is the same as the value society places on the resources to produce that good (the cost).

3 "Fixed costs" are those that do not vary with output, such as the cost of the right-of-way, and "common costs" are those that cannot be attributed to a particular product or service. Under marginal cost pricing, firms cannot recover fixed costs and so cannot recover total costs. Common costs prevent the assignment of a marginal price because costs are shared.

Differential pricing and economies of scale are connected. The more economies of scale exist, the more extensive differential pricing must be for railroads to remain in business. However, differential pricing without limit is controversial. When there is no limit, shippers without alternative transport options may face rates that are unreasonably high. Although shippers can petition the Surface Transportation Board (STB) and challenge the reasonableness of the rates they receive, the rate review process is costly, and shippers rarely initiate cases.

As both rail rates and railroads' revenue adequacy have increased in recent years, so, too, have calls for reforming various elements of rail regulation.[4] This study of the rail industry's cost structure is an attempt to help rail analysts and regulators accurately assess the extent of economies of scale in the industry and their implications for prices charged to shippers. The report is also a potential resource to inform current policy debates. The study presents a nontechnical explanation of cost concepts, discusses the role of cost in rail pricing, and empirically examines costs in the rail industry.[5]

WHAT DID THE STUDY FIND?

The researchers determined railroads' economies of scale have slightly decreased over time but are still large. Because economies of scale persist, railroads must continue to differentially price to recover their costs, but the extent to which they need to differentially price (that is, the extent to which railroads need to extract disproportionately more revenue from captive shippers) has declined. The researchers contend rate relief processes can be improved, to this end, but broad attempts to limit the extent of differential pricing would be detrimental to industry investment and service.

Using variable-cost and commodity volume data, the researchers estimated the **shortrun output elasticity**—the relationship between costs and output, when at least one input is fixed and cannot be adjusted.[6] Overall, a 1-percent increase in ton-miles led to a 0.74-percent increase in variable costs, suggesting the presence of significant economies of scale.[7] Farm products, chemicals, coal, and nonmetallic minerals all exhibited a similar relationship to costs—that is, a 1-percent increase in the ton-miles associated with each group led to a 0.09- to 0.10-percent increase in shortrun variable costs. The group of all "other commodities," which includes intermodal, was much higher at 0.37 percent. The researchers explained that variation in costs may be due to differences in shipment characteristics and traffic density of the routes.

For every year from 1984 to 2016, the researchers also calculated **longrun output elasticities**—the relationship between costs and output, after railroads have had time to adjust *all* their inputs to match demand.[8] Because of the ability to adjust all inputs to traffic changes, longrun output elasticities should be less than shortrun output elasticities. That is, extra output will add less to costs in the long run than it will in the short run. The researchers found railroads' longrun output elasticities have increased slightly since 1984. The calculated longrun output elasticity rose from 0.57 in 1984 to 0.61 in 2016. An output elasticity of 0.61 suggests that for every 1-percent increase in ton-miles, costs increase roughly 0.61 percent. That the 2016 value for longrun output elasticity is less than 1 implies railroads still experience economies of scale. However, the results show that railroads' economies of scale have declined slightly

4 Revenue adequacy is determined annually by the STB and essentially measures if a railroad is earning enough on its capital investments. More technically, STB considers a railroad to be revenue adequate if the railroad's rate of return on net investment is equal to or larger than the cost of capital for the railroad industry.

5 The work also contains an extensive review of the railroad cost literature (in Appendix B) and a handy glossary of terms.

6 For example, in a certain period of time, a railroad may be unable to adjust the amount or quality of its track. That period is known as the short run.

7 More technically, the researchers examined **economies of density**. Economies of density are a type of scale economy and refers to cost savings resulting from more traffic over a *fixed* network.

8 In the long run, no inputs are fixed. All inputs are variable and can be adjusted.

over time.

HOW WAS THE STUDY CONDUCTED?

The researchers began by estimating a function for railroads' shortrun variable costs. The function included variables, such as prices of labor, equipment, fuel, and capital (e.g., tunnels, bridges, etc.) and ton-miles for five major commodity categories (farm, chemicals, coal, nonmetallic minerals, and other commodities).[9] Underlying data came from annual railroad financial and operations filings to STB, known as R-1 reports. The researchers used the STB's Carload Waybill Sample to estimate the average length of haul.

Then, they used the parameters from the model above to consider longrun cost aspects. In particular, they examined railroads' **economies of density**, a type of economy of scale where the network is taken as fixed, to see how increases in output related to changes in cost.[10]

PREFERRED CITATION

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9 The commodity breakout represents an innovation over previous cost research, which considered only total ton-miles.
10 Examining how output and per-unit costs relate with changes in the network refer to a different scale economy, known as **economies of size**.