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Collusive Investments in Technological Compatibility

Lessons from U.S. Railroads in the Late 19th Century

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In the early morning hours of Monday, May 31, 1886, railroads across the American South simultaneously stopped running their trains, and over the following 36 hours teams of workers manually narrowed 13,000 miles of railroad track from a 5′0″ to 4′9″ gauge (track width) to be compatible with the standard being used throughout most of the rest of the country. Today, the gauge change is celebrated as a remarkable feat of engineering and coordination and is referenced in research and popular press as an example of standardization. However, whenever the story is told, a typically forgotten detail is that these railroads were also running a cartel.

Collusion has been illegal in the United States since the Sherman Antitrust Act of 1890 out of concern for consumer welfare and market efficiency—and railroads were one of its original targets. But often overlooked is the possibility that, in some settings, collusion may also contribute to the creation of unexpected new sources of value, such as standardization. This value creation might even in principle change predictions for the effects of market power on total surplus. I bring these issues into focus by examining the gauge change, which instantly integrated the South into the national transportation network, making it possible for goods and passengers to move effortlessly into and out of the region without costs and delays to interchange.

Using historical data from the Southern railroad and steamship cartel, I first chronicle the gauge change and show that it triggered a redistribution of freight traffic into the South from steamships to railroads but did not affect total shipments on sampled routes through 1890. Over the same period, records show that the cartel maintained its prices, implying that railroads did not pass through any of the cost savings achieved by the conversion. Guided by this evidence, I then develop a simplified model of the market for North-South freight shipment and show that the cartel may have both facilitated the conversion to standard gauge, by providing a venue for coordination and a means of recouping the investment, and concurrently softened its effects on prices and total shipments by limiting pass-through of carriers' resultant cost savings. Complementing the evidence from cartel data, evidence from railroads' stock returns around the time of the event indicates that investors perceived large financial returns to standardization. The effects of the gauge change were thus large yet potentially defined by the industry's collusive conduct.

The earliest U.S. railroads were constructed as local and regional enterprises to serve local needs. At the time, opinion over the optimal gauge varied, and without the vision of a national network, distinct gauges were adopted around the country. As the national network began to emerge, these incompatibilities became increasingly costly, and railroads gradually converged on a common gauge via conversion and new construction such that by the 1880s nearly all U.S. railroads

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were on a 4′8.5″ standard gauge—except for those in the South. Data from *Poor's Manual of Railroads* confirm that whereas other regions had 95 percent or more of their track in standard gauge, 75 percent of track in the South was on an incompatible 5′0″ "Southern" gauge (even more if excluding Virginia and North Carolina), and accounts indicate that the available adapter technologies were a substantial and costly second-best option to a fully integrated network. In early 1886, members of the Southern Railway & Steamship Association (SRSA) cartel, which together comprised a majority of mileage in the South, agreed to convert all track to a standard-compatible 4′9″ gauge en masse over the two days of May 31 and June 1, 1886, with traffic halting on May 30 and resuming by the evening of June 1, effortlessly traversing the former breaks in gauge. The conversion was carefully planned, seamlessly executed, and well-documented by contemporaries.

The cartel's primary purpose was to support noncompetitive pricing by Southern carriers through the creation and administration of a traffic pool. To implement the pooling arrangement, the SRSA compiled monthly records of freight traffic borne by individual carriers to and from Southern cities where two or more members operated, which were later reported to cartel members for key routes. I use these data to estimate the effects of the gauge change on merchandise shipments from the North into the South. I compare within-route traffic borne by rail and steamship before and after the gauge change, allowing the effects to vary with route length: because breaks in gauge imposed a fixed cost of interchange on through shipments, the unit costs on each route vary with distance. Steamships are a natural comparison group for all-rail traffic, as seaborne freight circumvented the breaks in gauge and was therefore operationally unaffected by the conversion to a standard-compatible gauge.

The cartel records yield a balanced panel of 52 routes with inbound merchandise shipments data pre- and post-standardization. Within this sample, I find that the gauge change caused a sharp increase in all-rail traffic relative to steamship traffic, with the effect strongest on shorter routes and dissipating after roughly 700–750 miles. When split across the two all-rail pathways into the South, I find relatively larger increases for the less trafficked routing.

Market share models return similar results, indicating a redistribution of traffic from steamships to railroads, with effects dissipating at similar distances. However, I find no differential growth in total shipments on shorter and longer routes through 1890: the effects are limited to substitution across modes. One possible explanation is that adjustment on the aggregate margin took several years, and the period I examine is too short for these effects to appear in the data; another is that the choice of mode was more sensitive to breaks in gauge than shipment overall. However, the presence of the cartel is a distinctive feature of the setting, and its potential importance is accentuated by evidence that cartel prices did not decline following the gauge change.

To evaluate the cartel's role in facilitating the gauge change and whether collusive pricing might have constrained total shipments, I develop a simplified model of the market for freight transport on a North-South route. I first use it to show how the existence of the cartel may have facilitated standardization by providing incentives for undertaking the costly investment and a venue for coordinating the regional shift to a different common-gauge equilibrium, and then I demonstrate how collusion could have shaped the effects on prices, quantities, and market shares. Although traffic will shift from steamships to all rail in any market structure, collusion reduces the pass-through of railroads' cost savings to prices and in turn the growth in total shipments, relative to a counterfactual in which railroads and steamships set prices competitively—and if cartel price adjustments are even moderately costly (e.g., due to internal renegotiation costs), prices and total shipments may not change at all. As it were, stock returns to U.S. railroads at the time of the conversion indicate that investors believed it would generate a windfall for Southern railroads, particularly those where the gauge breaks were once located.

This episode is an example of an unconventional dividend from collusion: the standardization of Southern railway gauge. The enabling role of the cartel made it possible for firms to internalize the externalities of their technology choices and provide an opportunity to coordinate on decentralized changes, such as the conversion of 13,000 miles of railroad track and the recovery of the fixed cost of conversion.

NOTE:

This research brief is based on Daniel P. Gross, "Collusive Investments in Technological Compatibility: Lessons from U.S. Railroads in the Late 19th Century," Management Science, forthcoming, http://www.nber.org/papers/w26261.