This Time is Different (?): Telecommunications Unbundling and Lessons for Railroad Regulation

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Abstract: Lack of competition in some rail markets has led to calls to force rail carriers to open their networks to competitors at regulated prices. Such rail "unbundling" is intended to reduce rates by facilitating competition when the underlying economics of the network makes facilities entry infeasible. These proposals mirror arguments made in support of telephony network element unbundling under the Telecommunications Act of 1996. We examine the unbundling experience in the telecom industry to draw lessons for similar proposals in the rail industry, and we suggest network unbundling is highly unlikely to achieve its objectives today for many of the same reasons it largely failed in the past.

1. INTRODUCTION

In 1980 the U.S. freight railroad industry was an economic and financial disaster. A variety of factors contributed to the industry's poor condition, including excess capacity, high fixed costs, counterproductive regulation, and negligible investment. The passage of the 1980 Staggers Act substantially deregulated the industry, and this deregulation is credited with bringing the railroads back from the brink. Railroads could more easily abandon unprofitable lines, consolidate and subsequently benefit from scale and network economies, invest in new innovations, and charge different prices to customers with different demand elasticities.

Although the Staggers Act was arguably one of the most successful deregulatory efforts ever, the industry consolidation it triggered led some rail markets to be served by a single carrier. Driven by complaints from so-called "captive shippers", there have been recurring proposals to force U.S. railroads to open their track to use by competitors at regulated prices. Two proposals—competitive switching and compulsory trackage rules—are aimed specifically at these captive shippers. The basic idea is to allow competitors access to another firm's infrastructure in those areas exhibiting monopoly. Such unbundling has been tried before, most notably in the U.S. telecommunications industry under the Telecommunications Act of 1996. We believe that the telecommunications experience has the potential to better inform the current debate on rail regulation.

Our motivation for looking at telecom circa 1995 for lessons applicable to rail today arises from a number of striking similarities between these two industries. Both were historically heavily regulated, are network industries with large sunk costs, face intermodal competition, and have similar dominant firm-competitive fringe market structures. Admittedly, there are a number of differences between these sectors, including the existing regulation and regulatory "goals" in place, differences in antitrust treatment, and the level of industry "dynamism." Despite these differences, we suggest that the telecommunications industry in 1995 offers informative lessons for those recommending unbundling railroads today.

We pay particular attention to the following questions: (1) Is rail unbundling likely to create legitimate competition? (2) Will compliance assessment be feasible? (3) Will railroad revenue adequacy be impacted? (4) Will rail infrastructure be affected? and (5) What role would antitrust laws play in the unbundling process? We explore each of these issues in turn, and make comparisons between the problems in railway regulation and those in telecommunications.

We argue that the historical record suggests that rail unbundling will not be effective. In particular, it is doubtful that unbundling will produce any meaningful increase in competition. Unbundled element competition proved to be fragile in telephony despite the plausible claims that network elements were underpriced by regulators. Structural circumstances in the rail industry are, if anything, worse and the record does not suggest that beneficial entry based on unbundling is likely. Further, the basic incentive incompatibility that plagued, and ultimately, doomed the telecommunications effort is present in precisely the same way as in rail. This issue raises concerns in the areas of regulatory compliance, monitoring and enforcement, and so on. Additional issues facing rail carriers, such as revenue inadequacy, complicate matters further. And, we argue, antitrust laws will be of little help due to rail's extensive and effective exemptions.

The rest of this paper is organized as follows. Section 2 provides a brief historical review of U.S. rail industry regulation. Section 3 reviews some of the common regulatory reform proposals facing the U.S. rail industry. Section 4 discusses the similarities and differences between the telecommunications industry in 1995 and the rail industry in 2015. Section 5 discusses the reasons why regulatory efforts in the telecommunications industry largely failed, while Section 6 applies the telecom experiences to rail. We conclude that network unbundling is unlikely to be a fruitful avenue for railroad policy.

2. U.S. RAILROAD REGULATION

U.S. railroad regulation began in the late 1860s with state-level efforts to regulate rising fare prices. The legality of state-level railroad regulation was confirmed in 1877 by the Supreme Court in *Munn v. Illinois*. The Interstate Commerce Act of 1887 subsequently federalized railroad industry regulation. The Hepburn Act in 1906 allowed the Interstate Commerce Commission (ICC) to set maximum rates, while the Mann-Elkins Act of 1910 further extended rate regulation. By the 1970s, dwindling passenger transportation had been transferred to a separate federal entity (Amtrak). More importantly, the freight railroad industry was in severe economic distress. Winston (2005) summarizes the industry problems, which we briefly review here. First, the regulatory regime required higher prices for higher-valued shipments. With such distorted prices, higher-value shipments shifted to other intermodal forms of competition, and in particular, trucking. Railroads were left with low value bulk commodities which did not

sufficiently cover their costs. Second, rail prices were subject to a rate of return constraint that was below the market rate of return, which prevented the industry from attracting enough capital to sufficiently maintain current infrastructure. Third, barriers to exit prevented rail carriers from shedding unprofitable rail lines. Fourth, outdated labor rules and high wages raised costs relative to other intermodal forms of competition. Finally, annual total productivity growth in rail was between one and two percent, compared to two to three percent in other freight transport industries.

The Staggers Act of 1980 substantially overhauled U.S. rail regulation. Staggers deregulated the industry by allowing markets—rather than regulators or rate bureaus—to establish prices and determine investment. In particular, freight operators could set rail rates freely for most of their shipping. An exception was made for so-called "captive shippers", or entities with no economically viable alternative to a single railroad. For captive shippers, regulatory relief was made available if the rates charged were in excess of 180 percent of variable costs (Mayo and Sappington, 2015). In such cases, the Surface Transportation Board (STB) requires "reasonable" rates. In practice, however, the cost-determination procedures are so expensive and cumbersome that successful challenges are rare. The Staggers Act also contained provisions regarding competitive switching and trackage, which we discuss in detail below.

The Staggers Act succeeded in improving the physical viability and financial health of the railroad industry. Figure 1 indicates both volume (i.e., ton-miles) and productivity (i.e., revenue ton-miles per constant dollar operating expense) increased nearly two-fold post-Staggers, as railroads could more easily abandon unprofitable lines and benefit from scale and network economies.[1] While railroad industry revenue post-Staggers took a substantial hit immediately after passage of the Staggers Act, it has increased substantially over the past decade with positive effects on industry profitability. For instance, in the 1970s industry return on equity had fallen to below three percent with several bankruptcies; by the mid-1990s, industry return on equity rose to more than eight percent (Winston 1998). While increased industry profitability was intended and welcome given the financial difficulties, the positive effect of railroad deregulation on shippers was less anticipated. Figure 1 indicates that rates (i.e., inflation-adjusted revenue per ton-mile) fell nearly 50 percent post-Staggers, as railroads competed for freight

[1] Wilson (1997) does note that the rate of productivity increases had fallen by the early 1990s after the initial post-Staggers burst.

against both intramodal and intermodal competitors. Wilson (1994) estimates that deregulation resulted in a nearly 30 percent reduction in average shipper rates by 1988, while Winston (2005) indicates that the decline in rates paid over 1990-1996 was greatest for coal despite its often captive shipper standing. In short, the Staggers Act very successfully increased industry productivity and volumes, kept rates in check, but still allowed railroads to earn profits vital to funding needed infrastructural reinvestment and maintenance.

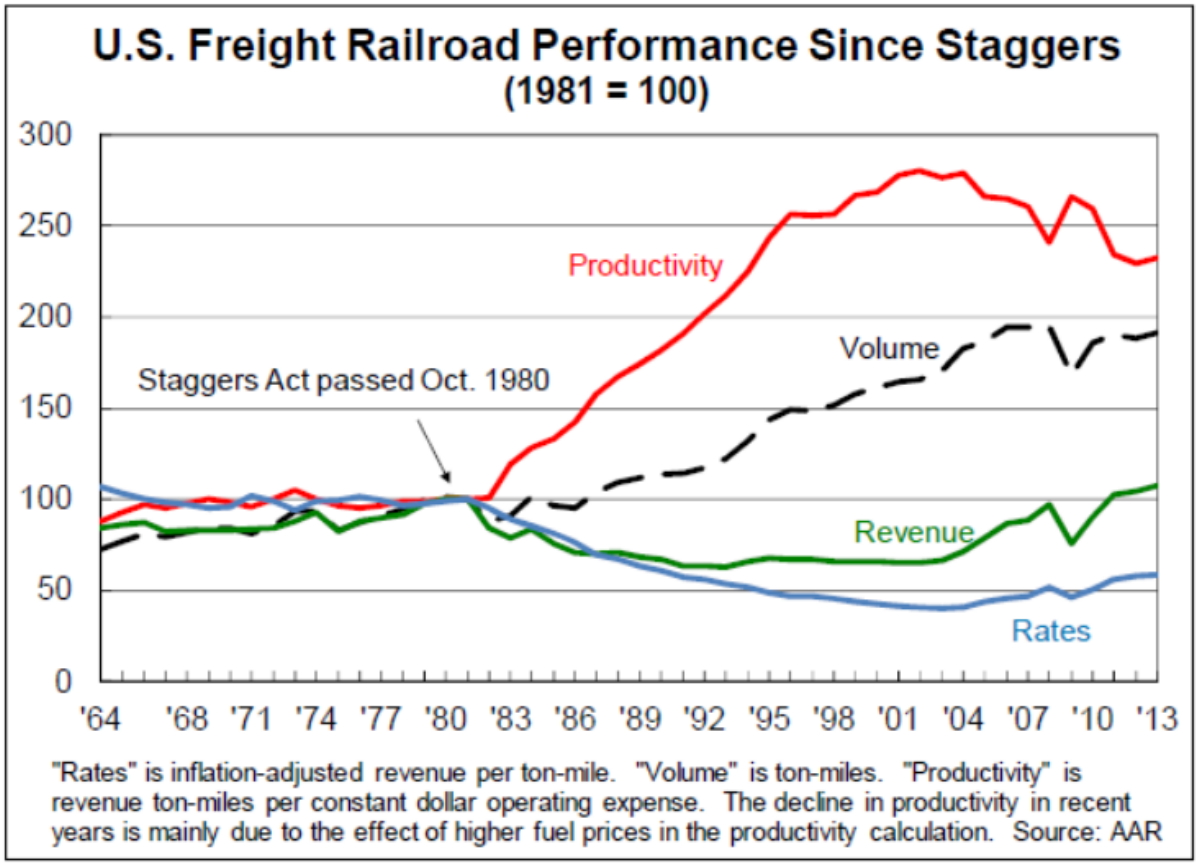

Figure 1 – U.S. Freight Railroad Performance Post-Staggers Act

The Staggers Act also allowed rail carriers to make a number of productivity improvements via investments in innovation (Winston, 2005). Some innovations were labor saving, such as the elimination of cabooses. Other innovations were service upgrades, such as automatic electronic car scanning upon terminal arrival. These latter improvements were important in allowing for increased service reliability in the face of intermodal competition, particularly with the growing use of just-in-time inventory control methods. Infrastructure was

improved, including stronger track and larger and more reliable locomotives. Through these and other logistics management improvements, rail freight successfully gained back some of the advantages lost (e.g., speed) relative to trucking.

Consolidation also increased industry productivity, as the Staggers Act allowed for and set off a wave of both horizontal (i.e., parallel) and vertical (i.e., end-to-end) mergers. The end result was a reduction in the number of Class I railroads from 41 to five (Pittman 2009)—not including two primarily Canadian railroads with some U.S. operations. The largest four remaining railroads have increased their collective market share from 53 percent in 1980 to 86 percent in 2014. While railroad industry mergers through the mid-1990s are generally thought to have had positive productivity effects, more recent mergers have less clear effects, and the prospect for future merger approvals is dim. Railroads have more recently entered into a number of "alliances" around technological cooperation, joint marketing and interchange operations as well as "parallel" alliances pairing competing carriers.

The myriad industry structural changes have not surprisingly improved railroad industry performance but have arguably resulted in reduced rail competition. For instance, a recent USDA report found large decreases in competition and increases in monopoly power in grain markets from 1992-2007 (USDA, 2013). Furthermore, a recent STB report lists five significant railroad industry changes over the past several years, including (1) rate increases (which have subsequently increased even more), (2) contract terms modifications, (3) quality of service reductions, (4) cost shifting increases, and (5) "changes in railroads' attitudes toward shippers" (Christensen Associates, 2008, p.5-23). Given these reported concerns, there has subsequently been renewed interest in increasing the amount of industry regulation.

The primary reason for the call towards greater regulation is arguably recent shipping cost increases. As noted in Figure 1, the initial years after deregulation saw price declines even in nominal terms: using a 1981 index of 100, Class I railroad freight rates have been around 50 since 1995-2013. While rates remain relatively low in comparison, they have increased since 2004. These statistics may understate the degree to which actual shipper costs have increased over recent years, however, as shippers increasingly bear more costs in addition to actual freight charges. Some of these additional costs can be attributed to input cost increases. Since 2004, rates have risen 36 percent, but an index of input costs over the same period has risen by 29 percent, helping to explain much of the price increase.

Railroads have also required shippers to directly bear more of the transport costs. Cost shifting from railroads to shippers has taken a number of forms (STB 2009), including increases in railcar ownership, maintenance standards, extra charges, and labor for unloading due to lower railroad service levels. Corsi et al. (2012) note that 87 percent of railcar investments in recent years were made by private owners, despite a relatively meager three percent return on investment.

Shipper contract terms have also been a source of contention. Some shippers allege that the move from confidential contracts to publicly posted rates has resulted in implicit collusion between railroads that no longer directly compete for business (Christiansen Associates 2009). Shippers further complain that "new contracts rarely include any performance standards or penalties for not meeting standards, so there is an increasing lack of railroad accountability" (Christiansen Associates 2009:5-12). Finally, there have been increasing railroad congestion problems, particularly in increased petroleum industry development areas such as North Dakota. Existing track usage increases have subsequently resulted in higher agricultural shipper costs (Snyder 2014). For instance, a 2014 *Wall Street Journal* report indicates that BNSF congestion delays in the Bakken shale region resulted in empty rail car deliveries to grain elevators roughly two to three weeks behind schedule and in delayed fuel shipments to coal-fired power plants (Morris, Bunge, and Miller 2014).

3. RAILROAD REGULATION REFORM PROPOSALS

This section briefly summarizes the main railroad regulatory reform proposals currently under consideration. These first two proposals—competitive switching and compulsory trackage rules—are aimed specifically at "captive" shippers, or those with no economically viable alternatives to the single railroad currently providing freight transport services. Pittman (2010a) notes that while "economic" is a Surface Transportation Board (STB) term of art, it is often not particularly ambiguous. Between 15 and 20 percent of freight traffic is estimated captive, with two-thirds of that percentage consisting of either coal or chemical shipments. The remaining proposal—so-called "quote a rate" approaches—examine efforts to reform the processes toward challenging railroad rates.

3.1 Competitive Switching

The National Industrial Transportation League (NITL) is a shipper interest group that has proposed the STB adopt mandatory competitive switching. This proposal requires railroads serving captive shippers within a certain radius (i.e., 30 miles) of a working interchange to transport freight to the competing railroad and interchange it at regulated rates. The STB declined to analyze this proposal in detail, however, concluding that "the Board still does not have the empirical evidence it needs" to evaluate either the benefits claimed by the NITL or the inefficiencies the railroads claimed the rule would create (Surface Transportation Board, 2012).

The proposed "Rail Shipper Fairness Act of 2015" currently under legislative review similarly proposes that the STB mandate competitive switching "within a 100-mile radius of an interchange between the Class I rail carrier and another carrier at which rail cars are regularly switched." Captive shippers are insistent that the possibility of competitive switching alone is necessary but not sufficient to create real competition as it "cannot be interpreted as creating competition per se." (*Progressive Railroading* 2014). Gallamore and Panzar (2004) note that while the STB can theoretically mandate reciprocal re-switching after finding it "in the public interest," the STB has never done so (although switching is sometimes required as a merger approval condition). The Staggers Act also allows this type of regulation when "such agreements are necessary to provide competitive rail service."

The most similar rail market to the U.S. is Canada, which is also characterized by duopolistic competition between major railroads supplemented by smaller regional operations (with some of these only operating via trackage rights). The two largest carriers—Canadian National and Canadian Pacific—generate over 80 percent of the revenue ton-miles in the Canadian market. Like the U.S., railroads are dominated by freight travel over relatively long geographic distances. The U.S. and Canadian railroad markets primarily maintain competition through "parallel" competition, with two (or more) vertically integrated railroads serving the origin and destination (Pittman 2005). Canada has a requirement for "interswitching", or mandated reciprocal switching, for single-served shippers at regulated rates up to a distance of 30 kilometers. A 2013 study by the U.S. Department of Agriculture, supposedly representing agricultural interests before the STB, suggested that the Canadian experience showed that competitive switching can work (USDA, 2013). Of the traffic carried by the two major carriers, 37 percent was eligible for interswitching but only four percent was interswitched. In its view,

Canadian "interswitching has neither impeded railroad efficiency nor decreased customer satisfaction" (USDA, 2013: p. 3). In view of the relatively limited use of interswitching in Canada, the USDA suggests competitive switching "should have a minor impact on the status quo" (USDA, 2013: p. 3) in the U.S. This argument could alternatively be viewed as evidence that switching rules are not necessarily useful in inducing actual competition among duopolistic railroads.

The most recent statutory review of the Canada Transportation Act was completed in 2001. It discussed and ultimately rejected proposals to expand the 30km distance (160km for traffic originating in Manitoba, Saskatchewan, or Alberta) to an interchange with mandated switching. The review panel concluded that this expansion would "worsen the market-distorting aspects of the interswitching rate regime" and viewed interswitching requirements "partly as an anomaly" (Canada Transportation Act Review Panel, p. 63); a holdover from the era of regulated rates.

3.2 Compulsory Trackage

An alternative method to encourage competition is compulsory and regulated trackage right agreements (Pittman 2010a). These proposals require railroads to permit competitors to operate over their track to access captive shippers under regulated access charges. This type of regulation has been proposed in recent Congresses in order to protect captive shippers. For example, the 2007 "Railroad Competition and Service Improvement Act" would allow the STB to order terminal trackage rights beyond previously specified limits after a finding that there was "inadequate rail competition."

In principle, both captive shipper-related proposals could be implemented by antitrust authorities if they were so authorized via "refusal to deal" provisions (Pittman 2010a). In practice, however, such antitrust actions are relatively uncommon.

3.3 Rate Regulation Reforms

Although the Staggers Act permits captive shippers to challenge rates, the process is expensive and time consuming, and challenges are therefore relatively rare. In particular, the procedure requires estimating a "stand alone cost" (SAC) model, which approaches $5MM in shipper development costs (Pittman 2010b). Even the newer "simplified-SAC" created in 2006 and used in smaller rate disputes is estimated to cost shippers up to $1MM. These estimates, moreover, do

not include the costs to the STB or to the defendant railroad. The Surface Transportation Board Reauthorization Act of 2015 proposes that the STB maintain "simplified and expedited methods for determining the reasonableness of challenged rates in those cases in which a full stand-alone cost determination is too costly, given the value of the case" (S. 808, 2015). The cumbersome SAC process could alternatively be scrapped entirely. Pittman (2010b) suggests returning the focus to rates rather than estimated cost models of dubious market relevance, such as by capping the price-to-variable cost ratio.

Another regulatory reform proposal requires railroads to allow intramodal competitors to provide rate quotes and transport over bottlenecks. This "quote-a-rate" idea was included in, for example, the proposed 2008 Railroad Competition and Service Improvement Act. Railroads currently need only offer a discounted rate over a bottleneck if the shipper has signed a shipment contract along the remainder of the route. According to the CEO of the American Chemistry Council, "competing railroads have rarely signed such contracts" (Hess 2013: p. 25).

Although the proposed regulatory reforms vary, it is useful to consider their basic assumptions before turning to their prospects for success. One assumption is that the various regulatory pricing models proposed will not only provide access, but also still offer a viable business opportunity to railroads. Past regulatory regimes have failed when cross-subsidization schemes fell apart, such as when increased intermodal competition poached high value freight from railroads. Another assumption is that the Class I railroads will actually compete rather than maintain a duopolistic relationship. For example, it makes little sense to require "quote a rate" rules if the rail carriers will not compete on price. Similarly, compulsory trackage agreements do not solve the problem of railroads' perceived unwillingness to actually compete. Given railroad economies of scale and density and new line development costs, there are limited prospects for additional freight rail entry. As we discuss below, the potential for entry is an important point of departure from telecommunications where various unbundling proposals were meant as a first step towards *de novo* entry and eventual facilities-based competition.

4. RAILROADS AND TELECOMMUNICATIONS

Our motivation for looking at the telecommunications industry circa 1995 for lessons applicable to the railroad industry today arises from a number of striking similarities between these two industry sectors. Some of the similarities are admittedly more apparent than real, yet there is

sufficient resemblance to fuel this effort. The first subsection examines some of these similarities. There are several important differences between the public policy questions involved, however, and several of these critically shape our later conclusions. The second subsection briefly reviews these differences. Based on these similarities and differences, we offer a framework for the policy analysis to follow.

4.1 Similarities

Both telecom and rail have historically been heavily regulated industries, with substantial public intervention, direct price and production oversight, and all of the trappings of public interest. Telecommunications and railroads have both traditionally been closely associated with economic development.[2] Customer connection to the network has also been a consistent policy refrain in both sectors, as evidenced by Universal Service programs in telephony and numerous ICC policies in rail over several decades.[3] Public safety is also implicated in both sectors: in telecommunications, ubiquitous 911 services and the requirements of providing such service significantly affected the course of nature of unbundling and deregulation; in railroads, safety and terrorism concerns have driven the Positive Train Control program.[4]

Both telecom and rail are "network" industries, with railroads often termed the "first network industry." Railroad pricing problems, arising from joint and common costs and large economies of density and scale, were the inspiration for numerous micro-analytic concepts useful for the study of network pricing.[5] The issues of bottleneck facilities, network interconnection, demand for point-to-point connections, and so on were first manifested in the rail industry. In telecommunications, non-competing carrier interconnection was ubiquitous and mandatory.[6] And among the many provisions of the Telecommunications Act of 1996 were interconnection requirements between competing carriers. The structure of the U.S. rail network

[2] Indeed, the economic development role of the railroads was *the* focus of the earliest research in that area. See Gallamore and Meyer (2014) for an extensive review. In the telecommunications context, telephone subscription penetration was often used as an index of economic development, and the ITU has published statistics on a national basis for decades.

[3] Likewise, the ICC routinely prohibited disconnection (track abandonment) for political reasons.

[4] This program is controversial, over budget, and behind schedule as of this writing (June, 2015).

[5] Ekelund and Hebert (2012) review the earliest efforts in this direction.

[6] The obligation to interconnect was enshrined in the Telecommunications Act of 1934.

similarly requires a high degree of interconnection, trackage rights, and reciprocal switching. The great majority of rail shipments require the services of two or more carriers, as no single carrier has a coast-to-coast freight transport network.[7]

Railroads allow intramodal competitors access to own track and terminal infrastructure, often utilizing in-kind reciprocity agreements: carrier A allows line section access to carrier B in return for similar line section access within carrier B's network. In tandem with the numerous voluntary agreements between railroads, a form of reciprocal compensation—similar to the "bill and keep" system in telecommunications—is used to allocate costs between carriers for asymmetric traffic flows. The emergence of such arrangements is unsurprising, as they represent rational responses to the inevitable characteristics of interconnected networks.

In both industry sectors, the nature of production and the level of sunk costs attendant on entry have produced conditions far removed from those envisioned in textbook competition analyses. Railroad and telecommunications networks have been the subjects of extensive econometric cost analyses over many years. The notion of natural monopoly in both rail and telephony certainly undergirded much of the regulatory and academic analyses of both industries for decades.[8]

Railroad cost analysis has played a prominent role in the development of cost estimation and productivity measurement in general. Beginning prior to Griliches (1972), it was recognized that the definition of "scale economies" for a network organization was necessarily somewhat nuanced. Later work by Keeler (1974), Caves, Christensen and Swanson (1981), Braeutigam, Daughety and Turnquist (1982), and Savage (1997) has clarified matters somewhat: large savings arise from more intense use of an existing network, but less spectacular gains arise from larger networks *per se*. Bitzan (2003) argues for the presence of some degree of subadditivity, although the analysis is limited to certain variable cost categories. Any lack of strong scale effects does not indicate that firms do not gain significantly from consolidation: customers may well prefer that their shipments be handled by fewer carriers, and consolidation may facilitate economies of density. Rail analyses also suggest very different incremental costs for different

[7] The current structure of the US rail industry is characterized by very large duopoly railroads on either side of the Mississippi river, several large railroads in the heartland, and hundreds of small Class 3 companies.

[8] This is not to say that such assumptions were always (or even usually) warranted. We return to this issue below. An extensive review of railroad cost studies is given by Bitzan and Wilson (2007).

services. For example, unit train service is far less costly than way train traffic on a cost-per-ton-mile basis.[9] This phenomenon is amplified by the premium rates charged for intermodal trains, which often receive priority over others.[10]

Telecommunications costs have also been extensively analyzed, although much of the extant literature is arguably outdated due to fundamental changes in the telecom business model.[11]Analyses such as those by Evans and Heckman (1984), Shin and Ying (1992), and Bloch, Madden and Savage (2001) do not suggest that traditional wireline telecommunications was a natural monopoly before or around the time of the 1996 Telecommunications Act. Although there are similarly significant economies arising from more intensive use of an existing network, mere build-out does not significantly lower service costs per customer beyond some relatively small size area.

Cost conditions have led to very similar market structures: in both cases, there are a small number of large firms (i.e., Class 1 carriers in rail; Bell Operating Companies (BOCs) in telecom) with geographically concentrated operations and large market shares, and important though more atomistic fringes (i.e., regional and Class 3 carriers in rail; independent local and long distance companies in telecom).[12] In order to provide any services of value, fringe operations must interconnect with the larger, dominant networks. Similarly, the largest networks utilize unionized workforces with relatively high wages, while fringe operations are generally non-union.[13]

In the case of telecommunications circa 1995, the three largest long distance carriers—AT&T, MCIWorldcom and Sprint—had a collective customer account market share of nearly 92 percent, while almost all residential and small business customers had a single option for local voice message services. Mobile services were limited and costly, and thus provided only diluted

[9] Bitzan and Wilson (2007) offer some evidence for this conclusion.

[10] For example, in BNSF terminology, intermodal trains are designated "Z trains", and have priority access to track and all other facilities.

[11] For example, no one would build a conventional wireline switched network today in greenfield conditions: Verizon's efforts to avoid doing so in New Jersey in the wake of Hurricane Sandy's destruction of local networks is representative.

[12] Perhaps GTE was the largest and best known "independent" telephone company.

[13] The Communications Workers of America (CWA) represents workers at ATT, Verizon, Frontier, Sprint, etc. Railroad labor unionization is more fragmented, with nine larger unions representing various trades. Among the largest are the Sheet Metal, Air, Rail, and Transportation Workers and the Brotherhood of Locomotive Engineers.

traditional competition. Some large "enterprise" business customers had more options, and these buyers often combined purchased services with their own equipment. Much hope for competitive development was placed in cable telephony and mobile network development, rather than public system duplication.

In the case of railroads over the past five years, the current four firm concentration ratio is relatively stable at around 90 percent (Eakin et al., 2010). There remain four large Class 1 railroads, three smaller ones, and more than 500 other regional and short-line railroads which constitute the fringe. As emphasized by the STB-commissioned Christensen Associates studies and the 2006 GAO report prepared for the US Congress, however, national statistics are not very useful in gauging the state of railroad industry competition due to the point-to-point nature of product demand. For example, in the cases of Midwest agricultural markets it is the degree of competition seen in well-defined regions that affects rates. Up to 20 percent of all shipments in recent years were initiated by so-called "captive" shippers who have only a single railroading option (Pittman 2010a). Class 1 railroad competition is often characterized as a "stable duopoly," with two very large competitors in the west and two in the east. Despite this, the role of edge providers is vital, as about one in four cars either initiate or terminate on a short line railroad.

In both the telecommunications industry of 1995 and the railroad industry of today, there is evidence of market power, manifested most obviously in rate differentials that reflect either the presence (or lack) of competing carriers, significant price discrimination, or cross-subsidization. In railroads, evidence of increased rates (revenue per ton mile) for various commodities is consistent but unspectacular: the Christensen study (2009) notes, "[i]ncreasing the number of effective railroad competitors at the origin generally reduces RPTM," and later, "[w]e also suspect that in some cases, such as intermodal shipments, railroad competition may be along costly service quality dimensions not measured" (pp. 5-14).

4.2 Differences

One substantial difference between telephony in 1996 and rail today is the degree of *existing* regulation. On the eve of the Telecommunications Act, the telephone industry remained highly regulated. The earlier 1982 Modification of Final Judgment (MFJ) that divested the Bell companies from AT&T and settled long-running antitrust litigation was a landmark decision that structurally reshaped the industry. But the MFJ neither reduced the degree of direct telephone

services regulation nor interrupted the time-honored system of the state public service commissions holding contested cost-based rate proceedings. Competition did begin to emerge in long distance markets that AT&T dominated for many years just prior to the Act.[14] Yet the telecommunications industry remained heavily regulated during the passage of the Telecommunications Act. By contrast, it is widely asserted that the Staggers Act of 1980 substantially deregulated railroads, resulting in profound structural changes, large productivity improvements, substantial rate reductions, and a greatly reduced federal regulator role.[15] The ICC itself was abolished in 1995. The vast majority of railroad revenues are now collected under private contracts rather than under any tariffed rate form.[16] Although current law maintains some rate oversight, the process of filing challenges is cumbersome and largely unused.[17] Railroads can abandon track and offer various rates that reflect demand elasticity differences, leading to discriminatory tariffs that would not be acceptable under "common carrier" rules. While regulation retains a role—especially around safety issues—railroads are sufficiently deregulated such that opponents of unbundling proposals can credibly use the term "re-regulation" in their arguments.

Staggers legislation passed during a period of great anxiety in rail, exacerbated by the catastrophic Penn Central Railroad bankruptcy in 1970. The Act was primarily designed not to benefit shippers, but to provide a means for surviving railroads to become revenue adequate (Macher, Mayo & Pinkowitz 2014). Hence, discriminatory pricing, liberalized track abandonment, mergers, and other practices were freely allowed. In sharp contrast, the Telecommunications Act was seen as the culmination of an extended policy discussion regarding the future shape of the U.S. communications and electric media industries. The Act intended to open all communications markets to competition by removing regulatory impediments, and significantly, by mandating numerous interconnection and unbundling requirements on local exchange companies. To provide incentives for BOC compliance with the Act's more unpopular

[14] AT&T was regulated as a dominant carrier. The so-called non-dominance proceeding for AT&T concluded only in 1996.

[15] See Scribner (2013) for a detailed review of the effects of the Staggers Act.

[16] For example, Norfolk Southern reports 80 percent of its revenues from contracted prices in their 2014 10-K.

[17] Prater, Casavant, Jessup, Blanton, Bahizi, Nirbarger and Weingram (2010) provide a description of the appeal process. Similarly, GAO (2006) is a critic.

mandates, a promise of BOC entry into long distance telephone markets—at that time still a relatively profitable business—was made contingent on opening local markets to competition. Although the Act spoke broadly about "communications markets," the holistic outlook was perhaps one more of form than function. Policymakers at the time failed to anticipate the growth of mobile telephony, internet-based telephony, and such.

The telecommunication and railroad industries also differ in terms of antitrust treatment. In railroads, several significant antitrust liability exemptions are codified into U.S. law. First, railroad mergers are exempt from Department of Justice review (Transportation Act of 1920). Second, several other sorts of railroad agreements, including leases of track or rolling stock, trackage rights and joint ventures (49 USC Section 11323), are exempt. Third, Section 7 of the Clayton Act does not apply to railroad mergers. The current level of railroad industry concentration—much of it the results of mergers—would arguably not be permitted in other industries. Fourth, the 1948 Reed-Bulwinkle Act allows for railroad rate agreements if STB-approved. Fifth, injunctive relief is not available to private plaintiffs against railroad misconduct under Section 16 of the Clayton Act. Sixth, the Keogh Doctrine (Keogh vs. Chicago and Northwestern Railway, 1922) prohibits treble damage recovery for any STB-submitted rates. Finally, the FTC has no jurisdiction over railroad practices (Section 5, FTC Act). In contrast to rail firms, telecom companies by and large enjoy no particular antitrust immunities outside of those available to most firms in other industries. First, the Telecommunications Act of 1996 itself states that antitrust laws apply (Sec. 601(b)). Second, although Trinko (Verizon vs. Trinko, 2004) establishes immunity for a firm implementing a price approved by a regulatory authority, this immunity is not peculiar to communications firms.[18] Third, all regulated common carriers are exempt from the FCC Act (a legal fact that may produce some surprise in efforts to reclassify broadband internet service as a communication service). Against these rather generic exemptions, the robust application of Section 7 of the Clayton Act to mergers in the communications industry is the stuff of headlines. Antitrust is at least in principle alive and well in telephony and related sectors.

[18] This doctrine is actually quite old, and underlies many of the railroad exemptions: it was thought that if the ICC regulated rates, then antitrust review was unnecessary.

It seems evident that any unbundling mechanism in rail—unlike in telecom—will be "an end in itself." The 1996 Telecommunications Act envisioned the use of network elements as a portion of an entry "arc" which might begin with building a customer base through resale, eventually include more tailored services provision through the use of network elements, and finally culminate in outright new facility construction that would support innovative new services and service bundles. Network elements were an important but not ultimate component of this plan. Besides a lively expectation of *de novo* entry by CLECs, entry by established carriers such as AT&T was reliably assumed. That BOCs would rapidly and successfully enter the in-region toll market, if allowed, was unquestioned. In the railroad industry, large facility entry under current or even contemplated conditions is simply not envisioned. New track costs are very large and extremely sunk, with only incumbents able to afford such investment requirements. There are similarly no proposals for resale of existing railroad services by potential or actual entrants, as such actions would offer limited profitability and be viewed as largely pointless. Thus, unbundling in rail should be viewed solely as an attempt to reduce rates for some shippers, and not as a "stepping stone" to some more competitive future market structure.

Finally, it is worth highlighting a few additional differences between rail of today and telecom circa 1995. Largely absent from the rail yard is the state public utility commission (PUC), which played a fundamental role in telecommunications unbundling by establishing differing state-level element price lists. Their essentially co-equal status with the FCC is enshrined in the Telecommunications Act itself. In contrast, state authorities engage in very little economic regulation of railroads, instead limiting their specific administration to matters of safety and the like.

Intermodal transport services—i.e., some combination of rail, truck and barge—and intermodal competition are fundamental aspects of the railroad sector. Numerous studies, such as MacDonald (1989), show that competitive pressure, such as nearby barge access, can lower rail rates, especially in commodity markets where such substitution is reasonable. While trucking is often assumed to have an economic edge over rail in terms of shipment speed and flexibility, large and recent supply chain management practice improvements have reduced the value of trucking and raised the competitive opportunities of rail. This outcome thus suggests that intermodal competition may become even more prominent in the future. In telecommunications, the profound competitive effects of "intermodal" competition—most prominently, mobile

telephony and internet-based communications—were not well understood in the mid-1990s. Many critics, such as Ford and Spiwak (2013), have pointed to this lacuna as one of the primary reasons that the Act "failed". Regulation is admittedly a history of events overtaking intentions, and technological changes have undermined many regulatory proposals. The Telecommunications Act is a profound example of this myopia since one of the primary markets impacted (wireline telephony) is in a precipitous global decline (Macher et al. 2014). It is difficult to imagine a similar obsolescence in rail.

5. THE FAILURE OF TELECOM UNBUNDLING

In the case of unbundling under the Telecommunications Act of 1996, success can be defined in several ways. If the relevant measure of success is the extent to which unbundling contributed to the emergence of durable competition over the "last mile" of telecommunications networks, then most commentary is synoptic: unbundling ultimately failed to create local service competition. If unbundling is viewed as an intermediate step to facilities-based competitive entry, unbundling has had no lasting effect at least within traditional wireline telephony. Many U.S. local telecommunications markets are competitive today, but the relevant competitors came from repurposing of cable television networks, VoIP, and similar Internet applications but emphatically not from service using unbundled network elements (UNEs). Finally, if success is defined in terms of the extent of service provided over leased elements, then the process was relatively successful until around 2004 when several regulatory and legal decisions undermined the leased element business model. Unbundled elements play almost no role, however, in the telecommunications marketplace of today aside from their use in providing internet services to small business customers.

The unbundling mechanism contained in the Telecommunications Act of 1996 was perhaps one of the most complex regulatory programs of recent decades. Although a few earlier experiments can be pointed to—e.g., reselling of AT&T's long distance excess capacity to rival firms in the 1980s—it is a reasonable claim that the telecom unbundling policy was unique both in its scope and in the fundamental industrial transition for which it was supposed to facilitate. Although by the time of the Act the long distance marketplace was relatively competitive, local service markets remained seemingly static monopolies. Most regulators and economists believed

the doctrine that such local switched networks were natural monopolies, and competition of the ordinary sort was either impossible or ultimately unstable.[19]

The relatively successful experience of long distance competition provided a possible approach to the local service monopoly. Resale of AT&T long distance capacity to rivals such as MCI and Sprint did appear to lead to—or at least not preclude—later facilities investments by these competitors.[20] But what if potential entrants were allowed to enjoy scale economies inherent in the network by renting pieces of it? Incumbent network operators could be compelled to lease network elements to entrants at cost-based prices, allowing these entrants to offer services, build customer bases, and combine leased elements with their own facilities as had occurred in long distance.

The Telecommunications Act of 1996 specified its unbundling mechanism by first introducing the so-called "impairment standard" to establish precisely what network elements would be subject to mandatory unbundling (Beard, Ekelund, and Ford 2003; Ford and Spiwak 2016). The hypothetical question proposed was which network components and functions would reasonably be necessary for an entrant to provide telecommunications services? The FCC initially established a "minimal list" of required unbundled elements by state, and allowed state PUCs to specify additional elements as each saw fit. Unbundled elements included local loops, switching, transport, and so on, but also included "features, functions, and capabilities that are provided by means of such facility or equipment, including subscriber numbers, databases, signaling systems, and information sufficient for billing and collection or used in the transmission, routing, or other provisions of a telecommunications service" (Section 153). The FCC purpose was very clear: ILECS would be compelled to provide the elements an entrant would need to offer service in competition with the incumbent.

Element pricing was described in Sections 251 and 252 of the Telecommunications Act. Cost-based prices were not designed to recover embedded costs, would be established by FCC and State Commission orders, and would be "just, reasonable, and non-discriminatory." The practical implementation of this program led to the development of various proxy cost models based on the Total Element Long-Run Incremental Cost (TELRIC) concept. The logic behind

[19] See Joskow (2007) and Gasmi, Kennet, Sharkey, and Laffont (2002)

[20] In fact, some facilities created by MCI later became part of the Internet backbone (Kende 2000).

this choice was straightforward: the existing network cost is sunk, and the only relevant economic choice to consider is that of the potential entrant. In order to lead the entrant to the economically correct (i.e., least cost) decision, elements should be available at prices based on economic costs, regardless of historical embedded network costs.

An extended and complicated academic debate ensued over this pricing methodology, with several important criticisms developed. Among the most influential critique was Hausman's (1999) observation that ILECs compelled to provide elements under a TELRIC standard would simultaneously provide a real option to buyers: lease elements only during periods of profitability and return these elements during down times. The ILEC, in contrast, has no such opportunity to offload investments during periods of poor financial performance. Network sunk costs would thus be borne wholly by the ILEC.[21] Other critics have pointed to various defects in the FCC proxy cost models (Mandy and Sharkey 2003). But for our purposes, the details of these criticisms are irrelevant as all such criticisms of which we are aware claim that TELRIC prices were uniformly too low. This is significant because, if unbundling failed, then that failure was not the result of UNE prices being "too high," but rather of competition failing to emerge even though it was literally subsidized. We return to this issue below.

The unbundling process was the subject of contentious FCC hearings and orders, lawsuits, and considerable academic acrimony. Process adjustments were made continuously, with great uncertainty surrounding the ultimate legal status of the system. Despite this turbulence, by some reasonable measures the unbundling process produced (at least at the beginning) moderate success. Although attended by various delays, CLECs were serving 20MM access lines in the U.S. by 2004 using unbundled elements (which representing more than 60 percent of all competitively provided access lines).[22] There were also price declines in home telephone service, with the price index falling from 100.5 in February 2003 to 94.6 in October 2004.[23] From roughly zero percent in 1996, CLECS sold around 20 percent of total US access lines in 2004.[24] The early years under the Telecommunications Act also saw high levels of

[21] Hausman has applied this logic also to railroads. See http://economics.mit.edu/files/1034.

[22] Local Telephone Competition: Status as of June 30, 2007, Federal Communications Commission (July 2009) at Table 3.

[23] See Phoneix Center (2004) for a discussion. The price index is FRED Series CUUR0000SEED.

[24] Local Telephone Competition: Status as of June 30, 2007, Federal Communications Commission (July 2009) at Table 1.

telecom sector fixed investments, although not all of this investment should be attributed to any particular regulatory policy (Lenain and Paltridge, 2003).

Such regulatory progress, however, did not continue. The 2005 FCC Triennial Review Order abandoned the ILEC requirement to provide local loops with switching—the so-called UNE-P or UNE "platform"—and allowed ILECs to meet their statutory obligations through sale of unbundled loops sans switching—the so-called "UNE-L" or "UNE-Loop" (Beard, Ekelund, and Ford 2003). As is evident in retrospect, this decision invalidated the CLEC business model of providing services using the earlier UNE-P modality. In particular, it was no longer economically viable to provide switching through the purchase of third-party equipment. Customer migration costs to the CLEC switch were very high, and such "hot-cutting" led to endless disputes, service interruption, billing errors, and so on (Ford and Spiwak 2013). Thus began a profound decline in network element use by entrants. The extent of the failure of unbundling to support competitive local services is illustrated by the following simple market statistics: from a high of 20MM access lines using UNEs in 2004, usage fell to under 3MM in 2013.[25] While substantial competition in local services exists today, it is due entirely to wireless and Internet-based technologies and not the local switched networks.

Although tautological, it is important to emphasize that unbundling failed because service provision using unbundled elements was unprofitable. Numerous factors contributed to this result, but we view the following two as most important:

1. The unbundling system introduced by the Act sought to compel ILECs to provision their competitors when it was plainly not in their interest to do so. The Act thus adopted a form of regulation that sought to compel complex and involuntary transactions between private parties.
2. The competition envisioned by the Act—retail "last mile" competition between providers using the local switched wire network—was not viable, given alternative platform developments (e.g., cable telephony, Voip, wireless service, etc.) and local service provision economics.

These factors are worthy of further investigation. The incentive problems inherent in the Act's mandatory unbundling scheme were profound to the point of hilarity. For example, CLEC employees working in ILEC central offices would complain they were not allowed to use the

[25] Local Telephone Competition: Status as of June 30, 2007, Federal Communications Commission (July 2009) at Table 3; Local Telephone Competition: Status as of December 31, 2013, Federal Communications Commission (October 2014) at Figure 8. Today, UNEs are used almost exclusively to provide small business internet service.

buildings' rest rooms, giving new meaning to the term "essential facilities doctrine." More seriously, monitoring compliance with the hot cut process resulted in endless workshops and hearings regarding the proper statistical tests to measure ILEC cooperation.[26] The terms of the unbundling mechanism were subject to continuous litigation, appeals, and complaints, reflecting the involuntary nature of the underlying process.

In all but the simplest transactions, the number of margins which affect the involved parties' welfares, beyond simple price and quantity, is very large indeed. It is neither realistic nor feasible that all such components can be specified and monitored by regulators. When the underlying transaction is detested by one of the parties, these multiple "unmonitored" performance dimensions allow tremendous scope for activities sometimes termed "sabotage" in the economic literature.[27] Amelioration of such phenomena is not surprisingly problematic.

The Telecommunications Act itself anticipated this problem, and in response offered ILECs a quasi-bargain: Section 271 of the Act indicated that if ILEC local markets became open to competition, then ILECs would be allowed entry into in-region inter-lata toll markets. In retrospect, the weaknesses of this device are patently obvious. First, the inter-lata toll markets were somewhat competitive already, so the "bargain" asked the incumbents to yield a monopoly market for permission to enter a more competitive market. Second, the BOCs were free to enter the toll markets outside of their operating regions immediately, but little or no such entry occurred.[28] This suggests long distance was perhaps not as profitable as the Act seemed to assume. Third, the CLECs would never agree that the ILECs had adequately complied with their Section 271 obligations, and would oppose entry indefinitely. Finally, and perhaps fatally, once ILECs were allowed in-region entry, the mechanism lost all force since such entry would never practically be revoked. Incentive compatibility acts as a form of compulsory transaction tax, but unlike a transparent tax the size of the levy is not directly observable. Such "taxes" can be expected to work in the same manner as conventional levies by reducing transactions, however.

The Telecommunications Act viewed unbundled network element sales as part of an entry strategy which Hausman and Sidak (2005) called "the stepping stone hypothesis." Using

[26] See, e.g., Center and Darr (2001).

[27] The concept of "sabotage" is explored in Beard, Kaserman and Mayo (2001).

[28] Statistics of the Long Distance Telecommunications Industry, Federal Communications Commission (May 2003) at Table 7 (available at: http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/ldrpt103.pdf).

country-level evidence, the authors indicate that this conjecture has not been borne out in any unbundling regime to date. One possible reason is the potential importance of firm-customer connections and high costs of cultivating and maintaining those links. And creating a regulated wholesale network element market does not directly address these costs. Unless the nature of the elements being sold is carefully selected, the cost of providing local services through UNEs is prohibitive—as the UNE-P to UNE-L transition illustrates. History illustrates the profound fragility of local competition supported by network unbundling.

6. TELECOM UNBUNDLING LESSONS FOR RAIL

The network unbundling results under the Telecommunications Act of 1996 were decidedly mixed, making it difficult to claim that mandatory UNE sales had any enduring effects on telephony competition. It is unclear whether a different result would obtain if competitive switching or mandatory track access is introduced in the railroad industry. An important reason for the weak telephony results is surely the emergence of new platforms offering local services. While difficult to predict, there appears to be a low likelihood of a new technology supplanting freight rail services in the near future, at least for many classes of goods. It therefore seems unlikely that railroad unbundling would fail due to rail transport technological obsolescence.

There is an important policy distinction between railroad proposals and prior telephony proposals: so far as we know, no one claims that rail network access regulation will serve as a stepping stone to new facilities-based entry. There is virtually zero construction of new U.S. rail routes outside of specialized spurs, given the immense build-out costs. Rather, in the case of the rail proposals, we see "unbundling for its own sake." It appears the explicit goal of mandatory trackage rights and competitive switching is to allow certain captive shippers to obtain lower rates. Rail unbundling would not "change the competitive landscape" of the rail industry, however, as the Telecommunications Act of 1996 sought to do. Freight rail unbundling goals are therefore much more modest. The mechanism being considered, however, does bear a close resemblance to that used in the UNE program. What lessons does telecom unbundling provide to the railroad debate? We suggest the most important insights for railroad regulation concern the following:

1. The likelihood of competition facilitated by unbundling or competitive switching
2. The costs of regulatory compliance assessment

3. The issue of revenue adequacy in rail freight
4. The consequences of unbundling for rail infrastructure investments
5. The (non)role of the antitrust laws

The following sub-sections review these points in-depth.

6.2 Unbundling and Competition

During the telecom unbundling experiment, one assumption widely made by policymakers was largely borne out: if element prices are not too high, then entry would occur. Entry was indeed robust, as over 500 CLECs sold residential or small business voice message services in the years before the effort faltered around the 2005 Triennial Review.[29] Importantly, these CLECs were not all small start-ups: AT&T was by far the largest and most active. This outcome is perhaps unsurprising, as long distance carriers already had customer relationships and national presence. A reasonable next step is to sell packages combining long distance, local services, and so on.

There was no shortage of potential telephony competitors. But is the same true in rail freight services? For a host of reasons, we think that it is not. This conclusion—which is likely to undermine attempts to address captive shipper situations by unbundling mechanisms—is dependent on several related hypotheses. Because the various sorts of unbundling and competitive switching proposals differ in details and application, it is not easy to argue that all such proposals must necessarily fail for some finite set of reasons. However, it is reasonable to assume that any effective mandatory access program would need to allow for unbundling in such a way that: (1) head-to-head competition between two or more carriers was feasible; and (2) carriers who were made *able* to compete actually *would* compete. These are different requirements.

Consider first the issue of the feasibility of competition under mandatory trackage or interswitching rules. If (some portion of) a shipment remains under the monopoly control of a railroad, then that carrier should extract a great deal of the available rents arising from the entire shipment, in much the same way as the monopoly seller of a perfect complement for a good supplied competitively will make the same profits as if it controlled the entire market. If a

[29] FCC Telephone Trends, 2008.

monopoly portion of the road is essential, then the owner of that roadway would be expected to exploit it. We examine this issue in a simple setting in the Appendix.

Even when unbundling allows head-to-head price competition between railroads, competitive outcomes will result only when rail carriers have incentives to behave competitively. And there is considerable, though suggestive, evidence that this is not a sure thing. Rail history is replete with examples of "ruinous competition" and "rate wars" in which low variable costs, high fixed costs, and undifferentiated services led to rates below those necessary for solvency.[30] This history is surely on the minds of rail carriers, shippers and regulators. Competition tends to be contagious: in this case, it might prove fatal.

What, though, is the contemporary evidence on the nature of price competition between railroads? This issue has been extensively addressed, but conclusions are in no sense uniform. In particular, the literature contains analyses that suggest: (1) two firms produce Bertrand equilibrium (marginal cost pricing) results;[31] (2) rail carrier competition has Cournot-consistent effects, with the first competitor lowering prices more than the second, and so on;[32] (3) competition between rail carriers reduces rates in some but not all cases, and non-price competition may supplant observable price competition in important cases.[33] While important differences in methodologies and data make direct comparisons between these studies quite difficult, the following conclusions are fair.

The historical record, as well as the analysis of Winston et al. (2011), suggest extreme price competition can and does sometimes occur. In the case of the Powder River Basin coal fields of Wyoming and Montana in 1985, entry by the Chicago and North Western railroad via new route construction allowed its successor (Union Pacific) to directly compete with Burlington Northern. This competition resulted in very low prices—perhaps around marginal costs—for unit train shipments. In this case, extreme price competition followed new entry post-Staggers. The homogeneity of unit train coal services, combined with the presence of large customers making infrequent orders, produces structural circumstances consistent with aggressive pricing.

[30] Gallamore and Meyer (2014) provide a great deal of historical evidence regarding railroad conduct.

[31] See e.g., Winston, Dennis, and Maheshri (2011).

[32] See e.g., MacDonald (1989), Koo, Tolliver, and Bitzan (1993), and Harbor (2008).

[33] See e.g., Christensen Associates (January, 2010) prepared for the STB

On the other hand, there is anecdotal but nonetheless compelling evidence suggesting that Class 1 railroad competition is not always "robust." First, railroads engage in various and often "in-kind" voluntary trackage and reciprocal switching agreements: one railroad allows access to another in exchange for a similar concession elsewhere. Second, industry rate quote practices illustrate careful price competition avoidance efforts. For example, a GAO report on freight railroad industry health describes proposals to require railroads to quote rates on network bottleneck portions (GAO, Oct 2006). GAO analysts note that railroads often forebear from such rate quotes on track portions that intersect with competing railroads' track at its end points,[34] as doing so would allow direct price competition where only one carrier could offer service before.

The most obvious place to look for indications of potential future competition is in those markets where competition exists today. Here, a variety of effects is observed. Consider the extensive Christensen Associates analysis prepared for the STB in January 2010. Using detailed waybill records, econometric analysis was used to determine different cargo class rates under varying competitive conditions. The results are underwhelming, and led to the conclusion that "[i]ncreasing the number of effective railroad competitors at the origin generally reduces RPTM" (pp. 5-14). The term "generally" is applied because no significant results obtain for many commodity groups. Christensen Associates further note that "RPTM tends to be lower for some range [of number of competing railroads at the origination point] than for shipments originating in counties served by a single railroad. We also suspect that in some cases, such as intermodal shipments, railroad competition may be along costly service quality dimensions not measured in the CWS. Results for railroad competition at the destination are mixed." (pp. 5-14, brackets added).

The Christensen study findings are in contrast to "conventional" findings that often arise from restricted geographic analyses of western agricultural commodity markets. These markets are frequently associated with captive shippers, and thus are the source of many current rate complaints. MacDonald (1989) found a move from monopoly to duopoly reduced grain rates an average of 18 percent, while a third competing railroad produced an additional 11 percent reduction. Harbor (2008) found a 10.9 percent difference between monopoly and duopoly. These

[34] See, e.g., the discussion around Figure 24: Bottleneck Rates, p. 50.

studies and others are of course observational in nature: the "treatment effect" of competition is not identified.

The various findings are not surprising: the major railroads compete over time and space in innumerable complex ways. It is overly optimistic to expect that a single competitive norm applies to each instance where competition either already exists or could exist. Studies will ordinarily combine observations on rates from markets that exhibit significant historical differences. In short, rates might be observed in: (1) monopoly markets where entry is economically impractical; (2) monopoly markets where entry is practical, but has not occurred; (3) duopoly markets which survive as a remnant of the pre-Staggers rail network; (4) duopoly markets created by post-Staggers entry in a previous monopoly market; (5) duopoly (or more populated) markets resulting from previously less concentrated markets undergoing contraction. Most observational studies combine the data from these distinct markets together, differentiating only with respect to the observed number of firms.

Evidence from the Canadian experience with mandatory "interswitching" is also relevant. The Canadian rail industry shares many characteristics with that of the U.S.: almost all railway revenues come from freight (rather than passenger) traffic, and great distances with captive western shippers are the norm. The 1987 National Transportation Act introduced major rail reforms, including competitive access at regulated rates and compulsory switching for captive shippers. As noted by David Ouellet (2000), however, these provisions were seldom and only voluntarily used, and were ineffective in encouraging competition.[35] He suggests that, given the duopoly structure of most rail markets in Canada, the carriers have no reason to compete for the business of captive shippers. Interswitching is imposed on carriers with track within 30 kilometers of either origin or destination points.

A relevant lesson for the formation of realistic competitive expectations from unbundling railroads is as follows. When contemplating unbundling to support competition, conscious entry is assumed to be undertaken which thus changes a monopoly market to a duopolistic one (in most cases). This outcome requires evidence of the competitive consequences of voluntary entry into a monopolized market be found. The historical record and the Powder River Basin experiment suggest intense price competition is possible. Foreseeing this, would the rational

[35] Remarks from Ouellet's presentation were provided by Russell Pittman.

entrant enter? The "Bertrand paradox" is suggestive: entry does not occur, regardless of observed current high rates, when the post-entry expectation is one of incremental cost pricing.[36] This analysis highlights the other central difficulty with the assumption that unbundling will produce competitive entry and low prices. In the case of telecommunications, the list of potential entrants included all the large IXCs, such as AT&T, MCI, and so on. In the case of the railroads, it seems likely that the sole potential entrant will be the "other" Class 1 railroad.

On balance, it appears that the unbundling mechanism will be less successful in the railroad context than it was in telecommunications, due to the reasonable fear of intense post-entry price competition, extensive and in-place voluntary trackage and switching agreements, and the simple expedient of mutual forbearance. Regulatory policy might make competition feasible but will not make firms wish to compete.

6.3 Regulatory Compliance Assessment Costs

The Telecommunications Act of 1996 required the FCC—in cooperation with state PUCs—to institute an unbundling mechanism with certain characteristics: element prices should not be fixed to recover historical investments; prices must be non-discriminatory; and so on. The implementation of this requirement was by no means straightforward. Since the ILECs did not wish to sell network access to rivals intent on relieving them of their most profitable customers, unbundling necessitated a monitoring, evaluation, and sanction system for statuary obligation compliance failures. Thus were born the so-called "performance assessment plans" of both state and federal regulators. Hundreds of commission hearings, workshops, and paper dockets were held in the early- through mid-2000s regarding unbundling compliance rules, particularly with respect to the "hot cut" process. Poor performance could trigger fines. The extraordinary complexity of determining ILEC compliance with its legal unbundling and interconnection obligations was a consequence of two primary forces. First, networks are inherently complex, and their management is difficult. Failure of one component can by definition cascade into failures elsewhere, often with serious consequences. Second, the Bell companies emphatically did not want to sell network elements to entrants and rivals, and they had absolutely no incentive to do so outside of those incentives created directly by regulation. Yet, as a juridical process,

[36] For a discussion of the Bertrand Paradox, see Tirole (1988), Section 5.1 .

regulation cannot act arbitrarily and standards of proof for non-performance are required. The complexity of the activities at issue made performance assessments difficult, costly, and stochastic. And as a result, complaints were constant, customers were sometimes left without service, and costs were high.

In important respects, unbundling compliance rules in the railroad context appears to mirror the situation that prevailed in telephony. The network nature of the railroad business—and the necessity of careful train scheduling and switching—suggests that activities (e.g., track provisioning) must be closely coordinated and scheduling changes must be effectively communicated in real time. If anything, circumstances are less favorable in rail due to the potential for catastrophic accidents in the event of coordination failures. Unbundling means two or more independent operators will utilize the same track; any network management difficulties are presumably magnified.

Railroad unbundling may similarly represent an involuntary transaction, and thus a regulatory apparatus must exist to force potentially unwilling parties to comply. Railroad unbundling is also a difficult problem because the STB enforcement action record—exemplified by a currently dysfunctional rate complaint process— is not encouraging. STB performance is so poor that some analysts, such as Grimm and Winston (2011), have argued for its dissolution and its "replacement" via abolition of the antitrust exemptions in place. The telephony experience highlighted the inherent difficulties with involuntary transactions between competitors. It is not enough to legally require compliance: there must be follow-through of sufficient force to make noncompliance unattractive. In the case of local telephony, coordination failures could result in no dial tone. In the case of railroads, the consequences are inherently much more serious.

6.4 Revenue Adequacy

Revenue adequacy is a stated goal of the Staggers Act, and gives permission for discriminatory pricing based on demand characteristics. Unbundling is presumably always intended to be nondiscriminatory, however, which suggests it will occur only in those places where it is profitable. As in telecommunications, railroads will be asked to provide access to those network portions that are most attractive to an entrant. It is quite unlikely that these network elements will constitute a random sample of their businesses. If unbundling works as intended and imagined, then entrants will undermine markets where profits and/or prices are high, but show little interest

in markets with lower rates. Since unbundling will presumably be cost-based and nondiscriminatory, successful unbundling is expected to reduce railroad profits overall by eliminating pockets of higher-margin services.

Unlike the case of ILECs—i.e., financially strong firms ultimately destined to dominate the industry—railroad revenue adequacy is not only a constant concern but also (and at best) a recent achievement. While definitional differences abound, the STB is required by statute to determine revenue adequacy annually for Class 1 railroads. The 2013 STB Docket indicates five Class 1 carriers were determined revenue adequate while two other Class 1 carriers were determined revenue inadequate.[37]

Unbundling proposals thus raise several important questions. If unbundling lowers rates (and therefore profits), what does that imply for railroad revenue adequacy? Is it expected that other rates would be raised in compensation? If so, which rates could be raised? If no offsetting adjustments were to occur, how will adequate investment capital be obtained for network modernization and ongoing maintenance? Looked at this way, the current and largely unregulated rate architecture can be viewed as reflecting a particular "solution" to the Ramsey-like problem of a profit constraint. Customers with inelastic demands do not welcome elasticity-based discrimination. While there are many price systems that can satisfy a minimum profit constraint, they vary widely in their social welfare consequences. Changing the current system to something else raises the possibility that welfare will likely be reduced.

6.5 Network Infrastructural Investment

As the discussion above suggests, revenue adequacy is not primarily a problem of adequate investor returns. Those investments are sunk and—for good or ill—will earn what they will. Given the extremely capital-intensive and long-lived nature of rail networks, however, freight carriers must attract adequate capital investment going forward. Potential investors must be persuaded that rail investment returns will adequately compensate them for the risks and illiquidity involved. Any evaluation of the desirability of an unbundling mechanism would need to include some analysis of this issue at a minimum.

[37] STB docket No. EP552 on 09/02/2014 was referenced. BNSF, Grand Trunk, Norfolk Southern, Soo Line, and Union Pacific were deemed revenue adequate. CSX and Kansas City Southern were deemed revenue inadequate. These determinations were made against an industry cost of capital of 11.32 percent.

Although less obvious, rail infrastructure investment is not solely concerned with rail carrier investments. Railroad and shipper joint ventures—manifested through the construction of special spur lines, terminal and intermodal facilities, and so on—illustrate the important potential role of shippers in this calculus. One particular example is the creation of small Class 3 railroads using otherwise noneconomic spur track. Shipper and public authority coalitions have elected to assume track ownership and operate track in shipper interests, who are often important employers.[38] This arrangement is feasible because Class 3 railroads have much lower labor costs than the heavily-unionized Class 1 railroads. In many cases, track transfers are facilitated by Class 1 railroad loans, with a partial reduction in seller risk being afforded by a paper barrier agreement. Paper barrier abolition would presumably reduce the incentives of Class I railroads to finance marginal spur lines, suggesting this track might be abandoned. As in the case of telecommunications, investments include not only those by the regulated or dominant carriers, but also those by entrants and customers. In the case of railroads, significant rolling stock is owned by shippers—particularly chemical firms.[39] It is difficult to anticipate whether and how such practices will evolve in the future, but it does seem likely that mandatory unbundling will affect network infrastructural investment.

6.6 The (Non)Role of Antitrust

The complexity and poor track record of most direct economic regulation has led some researchers to suggest that administrative regulation be scrapped in favor of judicial regulation, particularly through antitrust laws. This idea has been proposed for railroads, with congressional bills introduced to either abolish or greatly modify the antitrust exemptions rail carriers currently enjoy.

The telephony experience may again provide some guidance regarding the effectiveness of such a course of action. Railroads enjoy various antitrust exemptions, including broad DoJ review exemptions in the areas of mergers, rate agreements (i.e., price fixing), rate bureau establishments, and so on. Railroads are not free to do whatever they please, however, as their

[38] A representative example is the Alabama State Port Authority's railroad, which in 2015 operates ten locomotives on 75 miles of track in the immediate vicinity of the docks (ASPA).

[39] This is a current source of argument between the railroads and chemical shippers. The railroads wish to establish a national standard chemical tank car specification, which the chemical firms do not support due to costs.

actions are subject to STB review and oversight. For example, the Reed-Bulwinkle Act (1948) allows railroads to reach rate agreements subject to STB approval. Such agreements would otherwise be *per se* violations of the Sherman Act. Railroad mergers are similarly exempt from Clayton Act review, subject to STB approval. Since the STB has allowed several mergers that have resulted in a concentrated industry structure, STB oversight is often presumed weak and the exemptions generally considered profound in effect.

In contrast, telecom companies have no antitrust immunity outside of that available to any firm subject to regulation as in Trinko. Telecom mergers are severely scrutinized by the DoJ antitrust division, and several have been prohibited. But aside from active and important merger oversight, it does not appear that antitrust litigation is a primary factor in the evolution of the industry. Sidak (2003) notes that the DoJ initiated no important antitrust cases in telecommunications between the MFJ and 2003, and this argument could be extended to the present time. Issues that are sometimes raised in the antitrust context include handset lock-in by large wireless carriers, blocking of Skype and similar services, and so on, but these sorts of practices are primarily the subjects of Sherman Act Section 2 type claims. Even if a case of this sort were won, it would not fundamentally change industry competition. As mentioned earlier, refusals to deal—a type of behavior that could be used to describe some common complaints amongst railroad customers—are a difficult and largely unpersuasive antitrust offense.[40] The recent weak role of antitrust law in shaping telecommunications business practices outside of mergers does not suggest that the loss of immunities by the railroads would fundamentally change industry practices or appearance.

What, though, of mergers? Prohibition of telecom mergers is common and important, so perhaps the same might be expected in the railroad case. Post-Staggers carrier consolidation has already produced a highly concentrated industry, and the STB has indicated its unwillingness to allow any remaining mergers (Pittman 2009). The prospect of active DoJ oversight of significant mergers therefore seems to offer no substantive change from the current regime. It also suggests that repealing the railroads' antitrust exemptions—while perhaps a potent political act—will have limited practical consequence.

[40] Pittman (2009) makes this point forcefully, citing Monsanto Co. v. Spray-Rite Co. (1988).

7. CONCLUSION

This paper uses the experience of the U.S. telecommunications deregulation in 1995 to predict the likely consequences of current railroad regulatory proposals which fall under the category of "unbundling"—in particular, competitive switching and compulsory trackage. We are skeptical that the railroad proposals would be any more successful than the largely failed attempt made in telecommunications. On balance, it appears improbable that most current regulatory proposals hoping to inject competition into railroads will succeed. All regulation can ordinarily do is make competition feasible. Assuring that competition actually occurs requires the presence of a set of circumstances that regulations of the sort proposed simply cannot produce. Firms will not make large sunk investments with the expectation that post-entry prices will fall to marginal costs, and entry via unbundled network elements resembles *de novo* facilities entry more than legacy duopoly competition. As the telecom experience shows, regulations which seek to force involuntary transactions between competitors are difficult to monitor, and the complexity of sharing rail networks is not a favorable factor. Even if the goals of an unbundling regime are met, the resulting loss of rail carrier profits is itself problematic: revenue adequacy cannot be assumed, and the historical record is discouraging in this regard. Moreover, there is limited evidence that the STB will be able to streamline and rationalize the dispute process sufficiently to make the system work. The FCC found this to be largely impossible. Finally, it seems unlikely that the revocation of railroads' antitrust status will be a panacea. Antitrust litigation plays little role now in telecommunications outside of merger reviews, and the STB seems unlikely to allow any of the remaining large carriers to combine.

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Appendix

We consider two cases involving rail network unbundling. In both, a shipper (*S*) wishes to move goods from an origin (*O*) to a destination (*D*). Point *D* need not be the final goods destination, but may itself be some intermediate point for further switching, intermodal service, and so on. Service is provided by freight railroads *x* and/or *y*, who interchange at point *I*.

In Schema 1, freight transport from *O* to *D* requires the services of two railroads. The shipper could utilize either railroad *x* or *y* as the "primary" carrier, as long as the other railroad either agrees or is compelled to participate. In the first scenario, the shipper hires *x*, who then uses *y*'s track for a fee (via trackage, terminal agreements) established by regulation. In the second scenario, the shipper can use *y* as a primary carrier, and *x* can be compelled to transport goods along the first route leg via reciprocal switching rules.

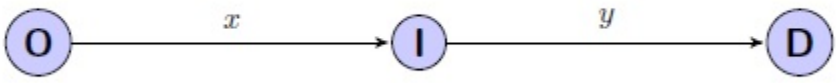

Figure 1: Two different railroads hold a monopoly over segments of the shipment.

In Schema 2, a bottleneck controlled by railroad *x*—whose route is divided into segments x_1 and x_2—is observed. Freight transport from *O* to *D* could occur solely on railroad *x* track, or a combination of x_1 track and *y* track. If *x* will only quote a rate for the entire *O* to *D* route, however, then *y* is unable to participate without coordination with *x*. The bottleneck portion of *x*'s track could similarly be controlled by a Class 3 railroad, which is required by contract to switch only with x_2. This is the case of the "paper barrier."

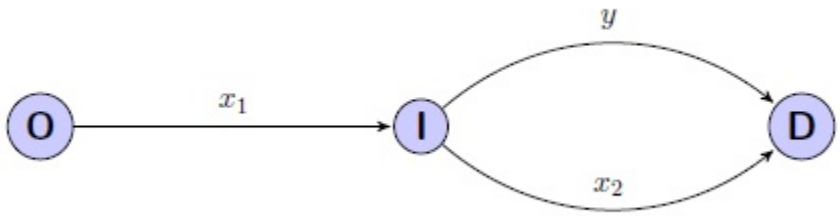

Figure 2: Railroads compete over part of the shipment but one holds a monopoly over part.

It is important to recognize that no rail network unbundling proposal addresses the "no rail service shipper" issue. Problems of this nature are also generally ignored by the STB.[41] Our discussion is limited to cases of a "captive" shipper facing single carrier service.

First, current regulation allows for railroads to enter into all of the practices described above. Carriers can and often do practice reciprocal switching, agree to trackage pacts, share terminal facilities, and so on. Paper barriers are established in some but not all cases by private contract. The thrust of most regulatory proposals is to make the specified practices mandatory, rather than voluntary. It is this element of compulsion that many railroads oppose.

Second, it is important to analyze precisely how these regulations are thought to create competition, and presumably lower shipper rates. We begin with Schema 1. To simplify, suppose the maximum shipper willingness-to-pay is *M*. Suppose further that shipment costs are c_x for segment *x*, and c_y for segment *y*. Let $c = c_x + c_y < M$. Let R_x and R_y be the respective rates quoted by *x* and *y*. Finally, let r_x and r_y be regulated trackage access fees for *x* and *y*, respectively. First consider the case of *x* and *y* collusion, regardless of unbundling rules. In this case, $R_x + R_y = M$, and the rail carriers earn the maximal profit for which they must contrive some means for sharing. Alternately consider competitive behavior under unbundling. Three possible simple

[41] Pittman (2010a) provides a discussion.

unbundling schemes are considered. First, x could be required to provide its track to y for a regulated price r_x. Second, y could have an unbundling obligation at the regulated rate r_y. Third, both carriers could face unbundling obligations. It is solely under this last case that unbundling rules might produce an outcome different from collusion. Only symmetric unbundling allows price competition to exist between railroads. If railroads behave competitively prices should reflect that. Under Bertrand price competition, if carrier x wins the contract, it charges $R_x = c_y + r_x$, (i.e., the minimum incremental costs of railroad y). The Bertrand equilibrium rate is specified generally as $R^* = \min(c_y + r_x, c_x + r_y)$, which is a cost-based, independent of willingness-to-pay, and not equal to incremental shipment cost unless the regulated unbundling rates are equal to corresponding costs.

Schema 2 represents the same basic idea in a somewhat altered guise. Here, a bottleneck or paper barrier prevents railroad y from offering O to D service. The sole means to create competition between x and y is to force unbundling of segment x_1 and make available to y at a regulated price that permits it to compete. The only two sequences that complete the shipment are (x_1, x_2) and (x_1, y). These pairings must belong to carriers who will compete for the shipment to obtain a competitive result. This condition, in turn, requires that x unbundle segment x_1.

This analysis is simple but makes the most important point obvious: unbundling will "work" if and only if: (1) price competition between carriers is made feasible; and (2) the firms behave competitively. Both conditions are necessary but neither alone is sufficient. In the case of condition (1), consider what would transpire in Schema 1 if the unbundling rule only required that segment x be unbundled at a regulated rate of r_x. In this case, railroad x cannot offer O to D service but can offer O to I service with y. If both x and y priced independently, the equilibrium shipment cost is M, and the effect of railroad x unbundling would direct a portion of shipment revenue M (r_x) to railroad y. The unbundling of x alone does not allow competition. Even though the two railroad firms behave competitively, the rate outcome is equivalent to collusion. A similar scenario applies to Schema 2.