Staff Paper Series

Constrained Market Pricing and Revenue Adequacy: Regulatory Implications for Shippers and Class I U.S. Freight Railroads

Gerard J. McCullough

**Department of
APPLIED
ECONOMICS**

**College of Food, Agricultural
and Natural Resource Sciences**

UNIVERSITY OF MINNESOTA

Author Contact: Gerard J. McCullough, gmccullo@umn.edu, 612-624-2210

USDA Contact: Adam Sparger, Adam.Sparger@ams.usda.gov, 202-720-0194 and
                    Bruce Blanton, Bruce.Blanton@ams.usda.gov, 202-690-0435

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Extended Abstract

On April 1, 2014, the U.S. Surface Transportation Board (STB) announced an *ex parte* proceeding (EP722) to evaluate the relationship between revenue adequacy and the procedures it uses to judge the reasonableness of railroad freight rates. The announcement raised the possibility that the Board would revise or supplement the Constrained Market Pricing (CMP) approach to rate regulation that had been adopted following the Staggers Rail Act of 1980.

When it adopted CMP in 1985, the STB's predecessor agency, the Interstate Commerce Commission (ICC), described it as a "practical solution" to the problem of identifying Ramsey prices for the railroad industry. Ramsey pricing is a theoretical ideal that economists have proposed for regulating a monopoly with high fixed costs when government subsidies are not available. Under current CMP jurisprudence, a complaining rail shipper cannot be required to pay more than the estimated *stand-alone cost* (SAC) of the service it receives. The SAC procedure is the process that the ICC and STB have used to identify the approximate Ramsey price.

The ICC warned at the time that it proposed its new regulatory approach that CMP is based on "sophisticated economic theories which require careful interpretation and application." The aim of this paper is to provide an accessible analysis of these theories. The paper reviews the history of freight railroad regulation in the U.S. since 1980 and analyzes the development of constrained market pricing and revenue adequacy. It identifies four questions that the STB—along with affected policymakers and rail market participants–should address in evaluating the relationship between CMP and revenue adequacy.

First, does the STB's revenue adequacy measure define a lower bound (floor) or upper bound (ceiling) for the revenues of Class I freight railroads?

Second, are the revenue adequacy constraint and the stand-alone cost constraint described in the Guidelines mutually exclusive procedural alternatives or can they be applied jointly in STB rate reasonableness proceedings?

Third, do the simplified procedures that the STB has adopted since the Guidelines provide reasonable alternatives to full SAC proceedings in cases where a defendant railroad is not revenue adequate?

Fourth, should SAC-based rate regulation be abandoned in cases where a defendant railroad is revenue adequate and replaced by a revenue adequacy-based procedure?

Appendix A provides empirical estimates of the direct economic effects of a hypothetical revenue-adequacy based rate regulatory regime. Appendix B summarizes arguments made by carriers' and shippers' experts and others in filings in EP722.

1. Introduction

Rostow (1960) has argued that railroads played a decisive role in the economic "takeoff" which transformed the United States from an agriculture-based society to an industrial nation. That may be the case, but railroads have played an important role before and after the takeoff in the functioning of agricultural markets. Railroads still account for about one third of total grain movements in the U.S., and in some markets, where distances are significant, the share is much higher. Prater, Sparger, Bahizi and O'Neil (2014) estimate that railroads transport about 95 percent of Montana grains and oilseeds and 86 percent of North Dakota grains and oilseeds.

Despite their interdependence, agricultural producers and railroads have sometimes been at odds on rail policy issues. The U.S. Department of Transportation's *Prospectus for Change in the Freight Railroad Industry* notes that the expanding railroad markets of the 19th century were characterized by rate wars, rebates, and discriminatory pricing, and that this left "almost everyone dissatisfied."[1] Pressure to regulate the behavior of railroads came from many sides including the National Grange of the Order of Patrons of Husbandry, the grassroots agricultural organization. The Grange helped assure passage in 1887 of the Interstate Commerce Act that placed railroads under the administrative control of the Interstate Commerce Commission (ICC).

Stover (1997) claims it was the convergence of strict ICC regulatory procedures developed during the Progressive Era and the emergence of new modes of transportation during that period that led to the railroad industry's financial decline after World War I.

> The new toughness in railroad regulation came at the very time when new, competitive transport facilities were appearing. In the early postwar years the old monopolistic position held so long by the railroads was lost as new modes of transport by highway and air appeared. New growth in water and pipeline transport also contributed to the major traffic losses suffered by the rail carriers.[2]

This loss of traffic accelerated after WWII and continued into the 1970s when several major railroads in the Northeastern and Midwestern U.S. were forced into bankruptcy. By 1978, significant portions of the U.S. rail network were deteriorating as railroad firms were unable to generate funds necessary to maintain roadway and replace equipment. Most at risk were Conrail, the government-supported entity created in 1976 to serve the Northeast, and the Rock Island and Milwaukee, two of the original Granger railroads that served agricultural shippers in the Midwest.

The response to the crisis by the administration of President Jimmy Carter was a set of regulatory reform proposals that developed into the Staggers Rail Act of 1980.[3] These reforms had dramatic effects on the U.S. rail system, the most visible of which were downsizings of track networks

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[1] U.S. Department of Transportation (1978)
[2] Stover (1997, p. 192).
[3] Pub. L. No. 96-448,94 Stat. 1895, 1896 (1980)

and rail labor forces and upgrades in the quality of plant and equipment. The liberalized regulatory system that evolved helped railroads to reduce average rail expenditures (along with average rates) and this facilitated improvements in financial performance.

These changes did not occur without opposition, however. In 1980, when the Staggers Rail Act was passed, there were 18 Class I railroad systems operating in the U.S.[4] By the year 2000, that number had fallen to its current level of seven. Shipper groups noted the increasing level of industry concentration and expressed concern about the difficulty of challenging rates before the ICC and its successor agency, the Surface Transportation Board (STB).[5]

In March, 2000, the STB responded to concerns about concentration by announcing a freeze on the mergers of large railroads. It revoked the freeze in July, 2001, and there have been no major mergers or consolidations since, but shippers have continued to express concern over the level and pace of rail rate increases. On April 1, 2014, the Surface Transportation Board (STB) responded to these concerns by announcing that it would receive comments in a new proceeding (Docket No. EP 722) entitled Railroad Revenue Adequacy.[6] The Board stated that it would evaluate the relationship between revenue adequacy and the procedures it uses to judge the reasonableness of railroad freight rates. Of particular concern to rail executives were the following sentences taken from the ICC's 1985 *Coal Rate Guidelines* and cited in the April 1 Notice:

> [The] revenue adequacy standard represents a reasonable level of profitability for a healthy carrier. It fairly rewards the rail company's investors and assures shippers that the carrier will be able to meet their service needs for the long term. Carriers do not need greater revenues than this standard permits, and we believe that, in a regulated setting, they are not entitled to any higher revenues.[7]

This language raised the possibility that the Board would revise or supplement the post-Staggers approach to rate regulation it had termed "constrained market pricing" (CMP).

When it adopted constrained market pricing in August, 1985, the ICC noted that "CMP is based on rather sophisticated economic theories which require careful interpretation and application."[8] The aim of this paper is to provide a careful exposition of these theories and to explore the relationship between CMP and revenue adequacy–a topic that could have a significant impact on carriers and shippers. Section 2 explains the origins of CMP in the Staggers Rail Act of 1980

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[4] Class I railroads are defined by the Surface Transportation Board using an inflation adjusted revenue standard. The Class I standard in 1978 was $55 million. The current standard is $453 million.
[5] The ICC Termination Act of 1995 [Pub. L. No. 104-88, 109 Stat. 803 (1995)] abolished the ICC and assigned regulatory authority for railroads to the STB.
[6] The STB also announced that it would receive comments at the same time in EP 664 (Sub-No. 2) on the related issue of how the industry's cost of equity capital is measured.
[7] Coal Rate Guidelines, Nationwide I.C.C. Ex Parte 347 (Sub-No. 1) at 535. Page citations to the *Coal Rate Guideline, Nationwide* are to Interstate Commerce Commission Reports 1, I.C.C. 2d 520 (1985). (*Guidelines*)
[8] *Guidelines* at 525.

and its formal explication and adoption in the 1985 *Coal Rate Guidelines*. Section 3 traces the application of CMP since 1985 along with alternative approaches to rate regulation proposed by the STB. Section 4 explores the concept of railroad revenue adequacy as it developed before and after the *Guidelines*. Section 5 concludes the analysis by identifying a set of questions that the STB–along with affected policymakers and rail market participants–should address in the context of EP 722. Empirical estimates of the direct economic effects that a revenue-adequacy based rate jurisprudence could have on rail carriers and shippers are presented in Appendix A. Summaries of the arguments made by shippers, carriers and other interested parties in filings in EP 722 are presented in Appendix B.

2. The origins of constrained market pricing

The Staggers Rail Act of 1980 was a direct response by the Democratic Carter Administration to the crisis that railroads faced in the late 1970s but the bipartisan political impetus for reform of the rail regulatory system predated the legislation by many years. In 1955 Republican President Dwight D. Eisenhower established an Advisory Committee on Transport Policy and Regulation headed by Secretary of Commerce Sinclair Weeks. The Weeks Committee concluded that over-regulation was doing significant harm to the rail industry and recommended rate reform.[9] Seven years later, in a message to Congress on the "Transportation System of Our Nation", Democratic President John F. Kennedy suggested "greater reliance on the forces of competition and less reliance on the restraints of regulation." Kennedy said that "less Federal regulation and subsidization is in the long run a prime prerequisite of a healthy intercity transportation network."[10]

The Kennedy Administration's legislative initiative to reform the rail regulatory system stalled in Congressional committee in 1963 but the impetus for regulatory reform was sustained by policymakers, academics, and some market participants. In December, 1967, the Brookings Institution hosted a conference to discuss freight transportation policy. Ann F. Friedlaender, then Professor of Economics at Boston College, later Professor and Dean of Social Sciences at MIT, presented a background paper on *The Dilemma of Freight Transport Regulation*.[11] As Friedlaender saw it, the tight, administrative regulatory system that had developed in the 19th century to control railroad pricing and investment decisions had outlived its usefulness and was imposing heavy costs on the economy. The dilemma was that all of the proposed alternatives— flexible rate regulation, mergers, vertical integration between rail and trucking firms, voluntary contracts between carriers and shippers—were either administratively difficult to implement or

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[9] Weeks (1955).
[10] Kennedy (1962).
[11] Friedlaender (1969).

would be blocked by vested political interests. The challenge was to devise a feasible regulatory framework that would facilitate the transition to economically efficient rail operations.

Friedlander was especially critical of traditional cost-based ratemaking. Her own research had focused on the development of statistical techniques for estimating railroad costs and she was convinced that regulators would not—indeed, could not—possess the technical means to accurately identify the costs of specific rail movements.

> Cost functions are generalized statements about the relationships between costs and output. They mean relatively little for specific point-to-point movements for which the railroad must charge a specific rate.[12]

Cost-based regulated rates, based on the ICC's regulatory accounting system, would inevitably send the wrong price signals to both carriers and shippers. This, in turn, would lead to overutilization (or underutilization) of the rail system, overinvestment (or underinvestment) in the rail network, and loss of economic efficiency at the national level.

2.1 The Staggers Rail Act

The two key documents in the pre-enactment history of the Staggers Rail Act were the *Prospectus for Change in the Freight Railroad Industry*, a legislatively mandated study that the U.S. Department of Transportation (DOT) forwarded to Congress in October 1978, and *Innovation versus Nationalization: Proposals for Change in the Nation's Rail System*, a report that the DOT released to the public in January 1979.[13] Both were influenced by the work of Friedlaender and other economists, most notably John M. Meyer of Harvard, a highly-respected authority on railroad economics. Both DOT documents cautioned that short-term financial assistance would be appropriate only if accompanied by regulatory reform and network rationalization.

Congress began work on the Carter Administration's regulatory reform package in the spring of 1979. A series of negotiations between carrier and shipper representatives helped to shape the legislation and to build Congressional support. The Act was passed on September 30, 1980 and signed into law by President Carter on October 14.[14] The primary focus of the Staggers Rail Act was on facilitating a pricing regime that would restore railroad earnings while protecting shippers. The policy innovation that set the Staggers Rail Act apart was its emphasis on the role

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[12] Ibid., p. 132.

[13] U.S. Department of Transportation (1978); U.S. Department of Transportation, Federal Railroad Administration (1979).

[14] See Chapter 9 of Gallamore and Meyer (2014) for an excellent and detailed discussion of the legislative process that led to passage of the Staggers Rail Act and the transformation of the industry that followed. Gallamore led the development of the Staggers Rail Act as Deputy Administrator of the Federal Rail Administration from 1977 to 1980. Meyer's work (with Merton J. Peck, John Stenason, and Charles Zwick) on *The Economics of Competition in the Transportation Industries* (1959) helped lay the intellectual foundation for deregulation of both trucking and railroads.

of competitive market forces and on the railroads' own abilities to transform themselves into viable organizations. The critical economic insight was that demand-side price signals were at least as important as costs in enabling a complex network industry like the railroad industry to evolve and to accommodate the changing needs of its customers.

The challenge, of course, was to duplicate price signals and the functioning of competitive markets within the administrative framework of the ICC. A key tool that the ICC had used in monitoring railroad behavior was Rail Form A, a costing system that provided the regulators with estimates of movement-specific average variable costs.[15] Regulatory cost estimation was carried over into the Staggers Rail Act but not as a means of identifying appropriate rates. Instead, the primary role of cost estimation was to limit the ICC's jurisdiction over rates by defining regulatory thresholds—revenue-to-(average) variable cost (R/VC) ratios– below which rates were assumed to be reasonable (Sections 201, 202).[16] The provision in the Act (beyond regulatory thresholds) that best facilitated market dynamics was Section 208 which permitted voluntary contract agreements between carriers and shippers. Contracts had been forbidden by the Interstate Commerce Act on the grounds they favored some shippers. Contract negotiations between large, well-informed industrial shippers and large, well-informed railroads have led to fundamental changes in the way railroad freight markets function.[17]

2.2 Coal Rate Guidelines of 1985

The Staggers Rail Act left to the ICC the important administrative question of how to determine whether a rate that exceeded the R/VC threshold was "reasonable." The question was resolved in 1985 when the ICC issued its *Coal Rate Guidelines-Nationwide*. There the Commission adopted its CMP policy under which a captive shipper could not be required to pay more than the estimated *stand-alone cost* (SAC) of rail service.

ICC Chairman Reece Taylor explained the Commission's decision to reject variable cost standards in favor of SAC when he testified on July 26, 1983 before the Subcommittee on Surface Transportation of Senate Commerce Committee:

> The Commission has considered various constant cost allocation methodologies in this proceeding-ratio method…Ultimately, each of these methods has been found to be somewhat arbitrary, and not based on a sound economic or regulatory basis. Accordingly, they have been rejected.[18]

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[15] The Uniform Rail Costing System (URCS), an updated version of Rail Form A, was adopted by the ICC in 1989.
[16] Variable cost estimates were also used to define the limits of a "free zone" within which railroads were allowed automatic inflation increases (Section 203), and to test whether the surcharges imposed in a joint rate could be challenged by a participating railroad (Sections 217, 218).
[17] See McCullough and Thompson (2014).
[18] U.S. Senate (1983, p.48).

Taylor stressed that the SAC mechanism was a practical solution to the problem of identifying Ramsey prices for the railroad industry. Ramsey pricing is an ideal theoretical solution to the problem of regulating a firm that produces multiple services with high unattributable fixed costs when government subsidies are not available.

> ...the Commission proposed a modification of the theoretical framework of Ramsey pricing to allocate constant costs. Basically, the Ramsey pricing framework assigns a mark-up above marginal cost on the basis of inverse demand elasticity. Theoretically, this would yield the most economically efficient rates and the proper allocation of constant costs.[19]

As background here it is helpful to consider formally the basic problem faced by a regulator of a firm that provides multiple services and has significant fixed costs. Assume, for example, following Braeutigam (1989), that the firm's costs (C) can be represented by a simple function of the form

$$C = F + m_1 y_1 + m_2 y_2. \qquad (1)$$

F here is the fixed cost, y_1 and y_2 represent quantities of two types of service provided by the firm, and m_1 and m_2 are the marginal costs of providing those services. For example, y_1 might represent bulk rail service and y_2 higher-valued merchandise service, and m_1 and m_2 would be the marginal costs of fuel, labor, track maintenance and replacement, and so on, associated with the two services. F might be the opportunity cost of the land on which railroad right-of-way was located.[20]

The prime policy directive in economics is that markets work best when the prices users pay are equal to the marginal costs of the resources they consume. If the railroad in this case were to charge each of its shippers the marginal costs of service, setting $m_1 = p_1$ and $m_2 = p_2$, its revenue R would be $m_1 y_1 + m_2 y_2$ and its profits, the difference between revenues (R) and costs (C), would be negative, namely

$$m_1 y_1 + m_2 y_2 - (m_1 y_1 + m_2 y_2 + F) = -F. \qquad (2)$$

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[19] *Id.* p.48.

[20] The assumption here is that roadway and track structures are replaced by railroad crews on an ongoing basis and that locomotives and other rolling stock can be treated as leased equipment. This means that these expenses can be treated as marginal costs. See Ivaldi and McCullough (2001, 2008).

Without government agreement to subsidize fixed costs F the railroad would be forced into bankruptcy.

The traditional regulatory solution to this problem is *fully distributed cost pricing* (FDC) where the regulator requires that each type of user pay both marginal costs and proportional shares f_1 and f_2 of the fixed cost, with the proportions set by the regulator such that $f_1 + f_2 = 1$. This gives revenue

$$R = (f_1 + f_2)F + m_1 y_1 + m_2 y_2 \qquad (3)$$

and enables the firm to break even, covering both the *un-attributable* costs F and the *attributable* costs $m_1 y_1 + m_2 y_2$. There are, of course, numerous ways in which the shares f_1 and f_2 can be set equal to 1, but by FDC convention the shares typically are set using proportional revenues, proportional output levels, or proportional attributable costs. In the latter case, for example, the ratio would be $f_1/f_2 = m_1 y_1/m_2 y_2$.

In December, 1981, ICC staff had, in fact, proposed an FDC-style formula based on output levels for determining maximum rates, but this approach drew strong criticism from railroads and economists. As the ICC explains in the *Guidelines*

> Indeed, we concluded that a meaningful maximum rate policy could not be founded on a strictly cost-based approach. Because competition compels the railroads to price some of their services below an arbitrarily assigned "cost", they must be able to price other services above their assigned "cost" in order to compensate. Otherwise, the carriers may never be able to cover all their costs and earn adequate revenues. [21]

To illustrate this problem, consider a situation where the railroad's costs are as described in equation (1), and where it has monopoly power in the market for bulk services (y_1) but must compete aggressively with motor carriers for business in the high-value market (y_2). This means that the price p_2 and the *actual share* of fixed costs $f_2 F$ paid by high-value shippers would be determined by market conditions and not by the regulator. Even if the regulator were able to accurately identify the exact levels of f_1 and p_1 that would enable the railroad to cover its full costs, these levels would have to be adjusted continuously as p_2 and $f_2 F$ changed in response to market conditions.

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[21] *Guidelines* at 523.

The *Guidelines* proposed CMP "as a practical and economically sound method of applying competitive pricing principles to a regulatory framework".[22] Four principles or constraints were enunciated.

> – First, shippers should not be required to pay more than is necessary for the railroad to earn adequate revenues (Revenue Adequacy Constraint).

> – Second, no shipper should pay more than is required for efficient service (Management Efficiency Constraint).

> – Third, a captive shipper should not bear the costs of any facilities or services from which it derives no benefit. Its cost responsibility for shared facilities or services from which it benefits should be based on elasticity of demand (Stand-alone Cost Constraint).

> – Fourth, changes in the rate structure–even reasonable changes–should not be so precipitous that they would cause economic dislocation (Phasing Constraint).

The ICC's working assumption, expressed in the *Guidelines*, was that competitive conditions in the majority of rail markets would determine the extent to which most rail shippers could be required to pay rates that exceeded *attributable* marginal costs–and thus contributed to *un-attributable* fixed costs. The *Guidelines* also assumed (accurately) that contract negotiations would take the place of regulatory proceedings in several key markets where railroads had market power and where shippers had a right to challenge rates.[23] To provide shippers with incentives to negotiate, the ICC said that it would be "careful in applying these guidelines to avoid inhibiting or discouraging contract solutions".[24]

The novel development in the *Guidelines* from a regulatory perspective was the joint adoption of Ramsey pricing and SAC. Ramsey pricing was the conceptual solution to the deficit problem illustrated in equation (2). SAC was the procedural solution to the problem of identifying the approximate Ramsey prices in cases where effective modal or intermodal competition was missing.

2.3 Ramsey pricing

The term "Ramsey pricing" is derived from the work of British economist Frank Ramsey (1927) who proposed elasticity-based fees as a way of apportioning optimal tax levies among citizens. Subsequent papers by Boiteux (1956) and Baumol and Bradford (1970) extended Ramsey's concept to the problem of identifying optimal prices for regulated natural monopolies facing the deficit problem. The papers suggested that the deficit problem could be solved without

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[22] *Guidelines* at 523.

[23] The Inspector General of the DOT later audited shipper reports for the period 2004 to 2009 and found that the share of shipments that moved under voluntary contracts ranged from about 80 percent for coal shipments to 20 percent for wheat. See U.S. Department of Transportation (2011).

[24] *Guidelines* at *524*.

government subsidies by allowing the firms to charge prices that were marked up *above* marginal costs but constrained in two ways: 1) the markups would be large enough in aggregate to cover fixed costs as well, and 2) the markups would be based on the willingness to pay (i.e. price elasticity) of each user. The second requirement is known as the inverse elasticity rule.

In the railroad context, the inverse elasticity rule meant that system users with lower price elasticity (bulk shippers, for example, who relied heavily on rail service) would pay larger markups over the marginal costs of the service they received. Rail shippers with higher price elasticity (merchandise shippers, for example, who could easily switch to trucks) would pay smaller markups over the marginal cost of the service they received.

To see this formally, let p_i represent the price of a good or service, m_i the marginal cost , and ε_{ii} the (own) price elasticity of demand for the good or service. The Baumol and Bradford paper showed that in a two-product multi-product market where costs were represented by equation (1) the combined benefits to producer and consumers would be maximized where

$$\frac{p_1 - m_1}{p_1} = \rho \frac{1}{|\varepsilon_{11}|} \qquad\qquad (4)$$

and

$$\frac{p_2 - m_2}{p_2} = \rho \frac{1}{|\varepsilon_{22}|}. \qquad\qquad (5)$$

The price p_1 and p_2 here are Ramsey prices and the Greek symbol ρ is the "Ramsey number" which lies between zero and 1. It is based on the firm's *break-even constraint*, the requirement that prices be high enough to cover total costs $F + m_1 y_1 + m_2 y_2$. The full effect of equations (4) and (5) is to *constrain* the potential monopoly pricing power of the regulated firm, allowing it to charge demand-based markups above marginal cost that cover unattributed fixed costs but that do not reach the level of monopoly prices.[25]

Ramsey prices maximize the combined economic benefits to users and producers. All system users are required to cover the marginal costs of the services that they use (the prime policy directive), and higher elasticity users have incentives to remain on the system and thus make

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[25] See Braeutigam (1989) for a formal derivation of the optimal Ramsey pricing rules.

some contribution to unattributed fixed costs. This benefits low elasticity users, as well, who would otherwise be required to pay a higher portion of unattributed costs. [26]

Notice that the markups in Ramsey pricing are jointly determined by the marginal costs of each service and by the price elasticity. This means that higher elasticity customers could be required to pay higher rates than low elasticity customers if their marginal costs were significantly higher. The railroad case is illustrated in Figure1 using illustrative commodity groups.

Figure 1. Illustrative Rail Rates

	Lower Elasticity	**Higher Elasticity**
Higher Marginal Cost	**Higher Rates** **Hazmat Chemicals**	**Medium Rates** **Food Products**
Lower Marginal Cost	**Medium Rates** **Finished Steel**	**Lower Rates** **Water-competitive Grain**

This figure compares the marginal costs and elasticity of demand of rail rates in differentiated multiproduct freight markets. Railroads have greater ability to raise rates above marginal costs on lower elasticity commodities such as hazardous chemicals and finished steel. These commodities depend more heavily on rail service and are less likely to divert to trucks. Railroads have limited ability to raise rates above marginal costs on higher elasticity commodities such as grain and food. These commodities are generally more likely to divert to alternate modes—barges in the case of water-competitive grain movements, and trucks in the case of food products. From a cost perspective, though, the risk involved in carrying hazardous chemicals—and the complexity involved in moving temperature sensitive food products—impose higher marginal costs on railroads. Large volume movements of steel products or grain, on the other hand, impose lower marginal costs. The result is that under a differentiated pricing regime chemical shippers face the highest rates while grain shippers with water alternatives face the lowest rates. Food shippers and steel shippers are in the middle.

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[26]Markets where users pay just the marginal costs of the services they receive are considered by economists to be "first-best". The markets described by equations (4) and (5) involve *optimal* departures from marginal costs and are termed "second-best".

Ramsey pricing is a theoretical solution to the problem of regulating a multiproduct natural monopoly without providing government subsidies. The *Guidelines* stress the practical difficulties of implementing Ramsey pricing.[27] To identify true Ramsey prices even on the simple rail system represented by equations (1), (4) and (5), a regulator would need accurate knowledge of the marginal costs of both services, the price elasticity of each of the two shippers, and the overall long-term economic costs of the system. These long-term economic costs, needed to sustain the system over multiple periods, would need to be identified in order to specify the break-even constraint.

In fact, actual railroads provide many more services to many more shippers and have cost structures that are far more complicated than those represented in equation (1) or equations (4) and (5). Nor are railroads or shippers anxious to reveal their cost structures or demand characteristics to regulators or to each other. The *Guidelines* characterize the practical requirements for full Ramsey pricing of a railroad system as "overwhelming."

> Ramsey pricing is based on a mathematical formula which requires both the marginal cost and the elasticity of demand to be quantified for every movement in the carrier's system. Thus, the amount of data and degree of analysis required seemed overwhelming. We concluded that while formal Ramsey pricing is useful as a theoretical guideline, it is too difficult and burdensome for universal application.[28]

The *Guidelines* propose CMP as a means of *approximating* Ramsey prices.

> As an alternative to pure Ramsey pricing, we proposed Constrained Market Pricing. Under CMP, the carriers are expected to use the market demand which they observed as the basis for their pricing, but they need not calculate the precise elasticity of demand for every movement. [29]

To better understand the notion of Ramsey pricing as it is developed in the *Guidelines* (and the relationship between Ramsey pricing and CMP), it is useful to recognize that the inverse elasticity concept is not limited to Ramsey pricing. A more general result in economics is the Lerner index which shows that the profits of a producer in a monopoly market will be maximized when the markup of price over marginal cost is based on the inverse elasticity of demand for the product. The Lerner index (L_i) in market i is

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[27] The simple Ramsey pricing model developed here has both practical and theoretical limitations. The practical limitations are described below. The theoretical limitations have been addressed by several economists. Sherman and Vischer (1978) develop the theory of Ramsey pricing when there is uncertainty about the demand structure. Braeutigam (1979) considers the case in which a multiproduct firm operating with monopoly power in some markets competes in other markets with firms with constant returns. Brock and Dechert (1983) and Braeutigam (1983) develop the Ramsey approach in a dynamic setting in which Ramsey prices (and investment levels) vary over time.
[28] *Guidelines* at 527.
[29] *Guidelines* at 527.

$$L_i = \frac{p_i - m_i}{p_i} = \frac{1}{|\varepsilon_{ii}|} \qquad\qquad (6)$$

where p_i is the monopoly price, m_i the marginal cost , and ε_{ii} the (own) price elasticity of demand. The difference here is the missing ρ. The Ramsey pricing conditions in equations (4) and (5) constrain the monopoly markup shown in equation (6) by virtue of the parameter ρ which lies between zero and 1. Ramsey pricing can be interpreted as *constrained monopoly pricing*.[30] What the *Guidelines* propose is an alternative to Ramsey pricing–*constrained market pricing*– where actual market competition in some cases and simulated market competition in others determine the extent to which rail shippers are required to pay mark-ups above attributable marginal costs.

The *Guidelines* stress the fact that competitive traffic on rail networks will contribute in some measure to covering un-attributable fixed costs.

> Under CMP, a carrier must charge its competitive traffic as much of the un-attributable costs as the demand will permit. It may not cover through differential pricing the portion of its un-attributable costs that it could (and should) charge to its competitive traffic.[31]

This is a critical point. In discussions of rail regulatory policy, one sometimes has the impression that railroads operate in two distinct market types—in competitive markets where prices are equal to marginal cost, and in captive markets where prices are marked up above marginal cost. What the *Guidelines* suggest is a more realistic view of rail markets as differentiated product markets. Freight rail operations take place on a continuum of markets where carriers (and shippers) have differing degrees of bargaining power. The differences can depend on product characteristics, carrier (or shipper) firm size, route structure, service quality, and other features. [32]

2.4 Stand-alone cost

The *Guidelines* assume that shippers in all (or at least most) competitive rail markets pay some form of mark-up that helps to cover un-attributable costs. For traffic where actual modal or intermodal competition is missing, however, the *Guidelines* face the problem of duplicating market dynamics. To accomplish this, the *Guidelines* propose the stand-alone cost (SAC) test as a means of simulating market prices. The simulated market price in this case is defined as "the

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[30] "Put more crudely, the Ramsey-Boiteaux prices are the same as those of an unregulated monopolist, just a notch down." Laffont and Tirole (2014, p. 63).

[31] *Guidelines* at 539.

[32] Anderson, de Palma and Thisse (1992) develop the general theory of differentiated product markets. Their analysis is based on the classic work of Hotelling (1929), Chamberlain (1933), and McFadden (1974). For an econometric analysis of behavior in U.S. freight markets on the assumption that these are differentiated product markets see Ivaldi and McCullough (2010).

rate that a competitor in the market place would need to charge (to break even) in serving a captive shipper or group of shippers who benefit from sharing joint and common costs."[33] The procedure by which the parties arrive at this rate is by determining the total costs of a hypothetical rail entrant--a "stand-alone railroad" (SARR)--designed by the shipper to serve an idealized traffic group that includes its traffic.

The SAC concept can be illustrated by again borrowing a cost function from Braeutigam (1989). Assume now that the railroad cost structure is

$$C = F + F_1 + F_2 + m_1 y_1 + m_2 y_2 \qquad (7)$$

The difference from equation (1) is that while the fixed cost F is un-attributable, fixed costs F_1 and F_2 are attributable to y_1 and y_2. These, for example, might be the opportunity costs of railroad right-of-way needed solely to accommodate the specific movements of y_1 or y_2. The *stand-alone costs* of y_1 and y_2 would be strictly defined here as follows:

$$SAC_1 = F + F_1 + m_1 y_1 \qquad (8)$$

and

$$SAC_2 = F + F_2 + m_2 y_2. \qquad (9)$$

The stand-alone cost, determined in this way, identifies the theoretical maximum rate that a railroad could charge a shipper without diversion of that shipper's traffic to a competing rail system. The *Guidelines* term it "a simulated competitive price."[34]

Notice, of course, that if both shippers using this railroad with the cost structure in equation (7) were required to pay full stand-alone costs SAC_1 and SAC_2, the railroad would realize profits of F.[35] On a larger system profits would grow by multiples of F as the number of shippers paying full stand-alone costs increased. The *Guidelines* recognize this problem and provide that the shipper complainant in an SAC case can identify "non-issue" traffic whose shippers will share

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[33] *Guidelines* at 528.
[34] *Guidelines* at 528.
[35] The railroad firm's revenue *R* would be *2F + F₁ + F₂ + m₁y₁ + m₂y₂*. Its costs *C* would be *F + F₁ + F₂ + m₁y₁ + m₂y₂*.

the un-attributable fixed cost F. The effect *ceteris paribus* of adding shippers other than the complainant to an SARR traffic group is to lower the amount of un-attributable costs for which the complaining shipper is responsible and thus lower the allowable rate that could be charged to the complainant.[36]

The *Guidelines* put it this way:

> CMP will have defined the total amount of un-attributable costs to which the shipper must contribute and focused on the traffic which can reasonably be expected to pay those costs. At that point, market forces will largely determine the share of the costs to be borne by each shipper.
>
> The result of this process is a rate structure which reflects long run marginal costs, demand elasticity, and the differential pricing of un-attributable costs–the same result that occurs under Ramsey pricing. Thus, in spite of the lack of mathematical precision in CMP, it should yield rates similar to those produced by Ramsey pricing.[37]

The overall result of the CMP process, the full set of a given railroad's rates at a given point in time, where some markups are determined by actual competition and others by simulated competition (the SAC procedure), is, in the *Guidelines* view, a set of rates that approximates Ramsey prices. Proponents of the SAC process might argue that this set of rates also generates a level of freight revenue that is *de facto* revenue adequate, that is, the (approximate) level of revenue that would be generated by fully competitive markets. These claims would be subject, though, to the critique of the SAC process described in Section 2.5.

2.5 Ramsey pricing and constrained market pricing

Justice Department economist Russell Pittman has questioned the relationship between Ramsey pricing and the SAC test, the component of CMP that has been recognized as "the most commonly used CMP constraint."[38] He bases his argument on a close analysis of Faulhaber (1975), the paper in which the SAC test was originally proposed. The aim of the test, Pittman notes, was not to identify competitive prices or Ramsey prices but to prevent situations in which the revenues from one user of a regulated public utility cross-subsidized the services provided to another user. SAC prices were subsidy-free prices arrived at through an analysis of the full cost of supply. Efficient (Ramsey) prices, on the other hand, are based on shippers' price elasticities and the carrier's marginal costs.

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[36] The c*eteris paribus* qualification is required here. In real world situations it might be the case that added non-issue traffic would *increase* the marginal costs of operation m_1 or m_2 due to congestion effects, or *decrease* the marginal costs of operation m_1 or m_2 due to economies of scope This would increase (or decrease) the levels of SAC_1 or SAC_2 in equations (8) and (9) and increase (or decrease) the allowable rate that could be charged to the complainant.

[37] *Guidelines* at 534.

[38] Pittman (2010b, p.315) citing testimony by former STB Chairpersons Linda J. Morgan (2002) and W. Douglas Buttrey (2006).

To see Pittman's point in more detail, consider equations (8) and (9) which identify the stand-alone costs of movement on a hypothetical railroad whose cost structure is represented by equation (7). Again following Braeutigam (1989), contrast these to the *incremental costs* of movements y_1 and y_2, namely

$$IC_1 = F_1 + m_1 y_1 \qquad\qquad (10)$$

and

$$IC_2 = F_2 + m_2 y_2. \qquad\qquad (11)$$

Faulhaber's cross-subsidy argument is that if the shipper of y_1 (for example) is paying more than its stand-alone cost SAC_1, and the railroad is constrained to break even, then the shipper of y_2 is paying less than the incremental cost IC_2 of its service. The logic here is straightforward. A zero profit constraint means that the railroad's total revenue $p_1 y_1 + p_2 y_2$ must just equal its total cost $F + F_1 + F_2 + m_1 y_1 + m_2 y_2$. If $p_1 y_1$ is greater than $F + F_1 + m_1 y_1$, and the constraint holds, then $p2y2$ is less than $F_2 + m_2 y_2$, and the y_2 shipper is being cross-subsidized.

Faulhaber's SAC test is an effective diagnostic for cross-subsidy in a multiproduct firm subject to a profit constraint, and the *Guidelines* endorse the elimination of cross-subsidies as a goal (and a consequence) of CMP.

> A captive shipper should not bear the costs of any facilities or services from which it derives no benefit. Responsibility for payment for facilities or services which are shared (to its benefit) by other shippers should be apportioned according to the demand elasticities of the various shippers.[39]

The overall effect of CMP, according to the *Guidelines*, is that cross-subsidies are eliminated and that the rates faced by all shippers are fair and efficient.

> Cross-subsidization of other shippers is effectively precluded. We expect the rate structure resulting from the interaction of market forces and the constraints we have described to produce rates that are economically efficient and fair to all shippers.[40]

Pittman's argument, though, is that CMP jurisprudence does not impose a zero profit constraint on U.S. freight railroads and that this "breaks the link" between SAC and IC.[41] If, in the

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[39] *Guidelines* at 523.
[40] *Guidelines* at 524.
[41] Pittman (2010b, p. 323). Revenue adequacy, as currently applied by the STB, is an accounting test that allows shippers to appeal a railroad's rate when the carrier's rate of return on investment exceeds its estimated cost of capital. This, Pittman notes, is not the same as a zero profit constraint. The CMP revenue adequacy constraint is discussed in more detail below in Section 4.

simplified example above, total revenue $p_1y_1 + p_2y_2$ is greater than total cost $F + F_1 + F_2 + m_1y_1 + m_2y_2$, then even if p_1y_1 is greater than SAC_1, there is no reason to conclude that $p2y2$ is less than IC_2. In Pittman's words, "failure to satisfy SAC for one set of products does not imply cross subsidization of a second set."[42]

In Pittman's view, lack of an effective constraint on profits weakens the claim that the Ramsey prices approximated by the SAC process are fair or efficient. (It is the ρ term in equations (4) and (5) that helps guarantee the efficiency of Ramsey pricing and this formal constraint on price markups is missing in CMP.) Now that railroads are profitable, Pittman argues, increases in rates to captive shippers come at the expense of the shippers' firms—their shareholders, customers and employees. The higher rates may help fund railroad investments but may also deprive shippers of investment resources. These are fairness questions and "political solutions may be inevitable."[43]

Macher, Mayo and Pinkowitz (2014) offer a more positive view of railroad financial performance under CMP. Economic returns in excess of the cost of capital may be generated by "expansion under competition" or "output restriction under monopoly".[44] Most railroad markets are competitive, and railroad profitability, in their view, is likely to be based on "expansion under competition."

> Rail services in this context are principally, though not in every instance, provided subject to effective competition. A firm's return in excess of its cost of capital is therefore as (or even more) likely to arise from competitive locations and commodities than non-competitive locations and commodities. For example, to the extent that a railroad improves the value of its product offering for a competitive shipment, it may experience enhanced sales, increased accounting profitability, and corresponding increases in its revenue adequacy measurement. Similarly, to the extent that a railroad is able to reduce the costs of providing its competitive services, its profitability as reflected in the STB's measurement of its revenue adequacy will increase.[45]

This suggests a possible counterargument to Pittman. Kessides and Willig (1995), for example, argue that SAC "imposes the same ceiling on rates for any traffic over which the railroad is dominant that the market would impose if it were subject to either active or potential competition."[46] If the *Guidelines* are correct that the SAC process simulates competition in captive rail markets, then there is no need for the STB to impose a profit constraint. SAC jurisprudence, on this view, would have the dual effect of identifying "expansion under competition" profit signals in captive rail markets and allowing these signals to function without

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[42] Pittman, op. cit. p. 323
[43] Ibid., p.323
[44] Macher, Mayo and Pikowitz (2014, p.25)
[45] Ibid. p. 27
[46] Kessides and Willig (1995, p. 15).

regulatory intervention in competitive rail markets. Pittman, on the other hand, concludes that "to the degree that railroads are now earning their cost of capital, they may be no longer effectively constrained in setting their prices: Ramsey prices may have been replaced by monopoly prices for some shippers."[47]

Even if one accepts the idea that the SAC process works after railroads are earning their cost of capital, SAC jurisprudence presents at least one additional methodological challenge (in addition to its current complexity and cost). The SAC equations (8) and (9) define upper bounds for the individual Ramsey prices applicable to services y_1 and y_2. The IC equations (10) and (11) define lower bounds. If both shippers using the railroad were required to pay full stand-alone costs SAC_1 and SAC_2 the aggregate rate level would exceed ideal Ramsey prices for that system. If both were required to pay incremental costs IC_1 and IC_2 the railroad would realize losses of F and the prices paid would be below Ramsey prices because they violate the break-even constraint. Combining the two shippers into a "traffic group" and allowing them to share the unattributable fixed costs F (as the *Guidelines* suggest) moves both shippers' prices in the direction of the (approximate) Ramsey prices.[48] These typically lay between incremental costs $F_i + m_i y_i$ and stand-alone costs $F + F_i + m_i y_i$.[49]

The procedural difficulty in this process, which the *Guidelines* acknowledge, is determining "how much of the SAC the complaining shipper should bear" and, by implication, how much of the SAC other shippers in the SARR traffic group should bear.[50] The *Guidelines* propose that the prices paid by non-complaining shippers be set at the levels that they are actually paying–but they allow for other approaches.

> For ease of administration, we think it reasonable and practical to assume that the revenue contribution of other (i.e. non-complaining) shippers will be at the level of their current rates. However, this presumption is rebuttable and, if it can be shown that their rates are not at the Ramsey optimal level, then their revenue contribution to the hypothetical system may be adjusted accordingly.[51]

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[47] Pittman (2010b, p. 323).
[48] Baumol and Willig (1986) describe this dynamic in a paper summarizing the regulatory application of contestable markets theory.
> In perfectly contestable markets, the price of a product will lie somewhere between its incremental and its stand-alone cost, just where it falls in that range depending on the state of demand…But if, in fact, market forces are not sufficiently strong, then there is likely to be a proper role for regulation, and the theoretical guidelines derived from the workings of contestable markets are appropriate ones to apply. That is, prices must be constrained to lie between incremental and stand-alone costs. (pp. 31-32).
[49] We assume here that both shippers are members of a legitimate traffic group. Two conditions must be met. First, they must in fact share the same fixed costs F in equations (8) and (9). (They might also share incremental costs by contributing to congestion-related increases or density-related decreases in each other's marginal costs.) Second, neither shipper is cross-subsidizing the other shipper by paying more than its incremental cost $F_i + m_i y_i$.
[50] *Guidelines* at 546.
[51] *Guidelines* at 544.

So the allowable rate paid by a complaining shipper in an SAC proceeding may be allocated using actual rates paid by non-complaining shippers in a traffic group, but the markups paid by these shippers may or may not approximate Ramsey prices. This means that the allowable rate paid by the complaining shipper may also miss the mark.

> We recognize that when the traffic of several captive shippers has been included in [the] stand-alone system, there remains an issue of how much of the SAC the complaining shipper should bear. This is an issue best left for a case-by-case resolution. But ideally, the SAC should be allocated among the stand-alone group on the basis of Ramsey principles.[52]

The *Guidelines* acknowledge the problem but leave it to be resolved on a case-by-case basis. The resulting procedural difficulty is described below in Section 3.2. This procedural difficulty is one of the principal reasons that a recent National Academy Sciences study of freight rail regulation, under the direction of MIT Professor Richard Schmalensee, recommended that the STB abandon the use of SAC.[53]

3. Constrained market pricing since the *Guidelines*

The idea of using the SAC test in rail regulatory proceedings was proposed by Princeton economists William J. Baumol and Robert D. Willig who appeared as experts for the railroad industry in the *Coal Rate* proceedings. It is related to the theory of contestable markets developed in detail in a classic study by Baumol, Panzar and Willig (1982). The theory of contestable markets, briefly stated, holds that in markets where entry is free and exit costless the threat of competition can preclude monopoly pricing even if the incumbents are monopolists.

U.S. freight railroads are not contestable, in the *Guidelines* view, but the SAC test proposed in the *Guidelines* allows for the simulation of a hypothetical stand-alone railroad that does not face barriers to entry or sunk costs. Again, the *Guidelines* assumed that the majority of rail rates would be set by effective competition between rail carriers, or between carriers and other modes, or by contract agreements between carriers and shippers. For traffic where effective competition was missing, however, the SAC test would provide an administrative procedural means of simulating what would happen if they were competitive. The overall effect would be a set of "second-best" rail rates that benefitted carriers and shippers.

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[52] *Guidelines* at 546.
[53] *Modernizing Freight Rail Regulation,* Transportation Research Board of the National Academies, Special Report 318, 2015, pg. 2-3.

3.1 Rail rate behavior since the Guidelines

Table 1 illustrates the path that rates have followed since publication of the *Guidelines*. It is based on the *Public Use Waybill File*, an annual report on rail movements and rates published by the STB. [The nominal rates in Table 1 are converted to real rates using the Bureau of Labor Statistics Producer Price Index (PPI) with 1982 as the base year.] The *Public Use* version of the *Waybill* is derived from the *Confidential Carload Waybill Sample*, a stratified sample of all U.S. rail traffic submitted by the railroads to the STB. An important *caveat* regarding the *Public Use Waybill File* is that contract revenues are masked to protect the confidentiality of shippers. This limitation is discussed in more detail in Appendix A.

The data in Table 1 exhibit a pattern of differentiation by commodity that has characterized rail rates since the 19th century when the ICC adopted a value of service pricing philosophy shortly after its founding in 1887. Under this philosophy of differential pricing, which was reaffirmed (in modified form) in the *Guidelines* and endorsed by the STB in subsequent rulings, shippers of higher valued products have paid higher rates for service.[54]

Table 1
U.S. Railroads
Revenue per Ton-Mile
($1982)

Description	1985	1990	2000	2010	2012
Farm Products	0.021	0.018	0.016	0.017	0.018
Coal	0.022	0.017	0.012	0.013	0.014
Nonmetallic Minerals	0.030	0.026	0.022	0.026	0.027
Food or Kindred Products	0.032	0.024	0.021	0.022	0.024
Lumber or Wood Products	0.030	0.025	0.023	0.022	0.023
Pulp, Paper, Allied Products	0.036	0.032	0.029	0.031	0.032
Chemical or Allied Products	0.037	0.032	0.026	0.030	0.031
Petroleum or Coal Products	0.041	0.033	0.025	0.032	0.033
Clay, Concrete, Glass, Stone	0.034	0.028	0.026	0.031	0.032
Primary Metal Products	0.034	0.027	0.024	0.033	0.034
Transportation Equipment	0.105	0.094	0.080	0.088	0.090
Mixed Shipments	0.038	0.025	0.023	0.027	0.029
All Commodities	0.031	0.025	0.021	0.022	0.024

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[54] Under the value-of-service (VOS) pricing system the ICC classified (and published) rates based primarily on type of commodity and distance moved. VOS rates, as such, did not reflect actual marginal costs or individual shippers' elasticities of demand. See Gallamore and Meyer (2014), Chapter 2, for a discussion of VOS.

Table 1 also shows a long-term decrease in average real rates for almost all commodity groups. Average real grain rates dropped by almost 15 percent and average real coal rates dropped by over 35 percent. Transportation equipment rates and chemical rates were also down by about 15 percent. Closer analysis of these movements shows that while real rates declined significantly between 1985 and 2000, these rates have been increasing on average since 2000. Average revenue per ton-mile for agricultural and chemical products increased by more than 15 percent on a real basis from 2000 and average revenue per ton-mile for coal increased by more than 20 percent.

The longer term decline in real rail rates helps explain why CMP jurisprudence has been supported by railroad officials, federal transportation policymakers, and some shippers. The recent increases help explain why some shippers, especially coal and chemical shippers, have been increasingly critical of STB procedures.

In a recent study commissioned by the STB, Christensen Associates (2010) offered an explanation of the post-2000 rate increases. Before 2000, Christensen noted, the prices of rail inputs (wages, fuel, materials, and equipment) increased by about two percent annually, but railroads also made annual productivity gains of nearly 5 percent a year. After 2000, input prices increased more dramatically, mostly due to fuel prices, but productivity gains slowed to about 2 percent annually. Christensen concluded that it was a combination of slower productivity gains and higher input prices—not an increase in market power—that led to higher rates.[55] Shipper interests, on the other hand, have attributed increases in real rates to increased rail market power and soft-handed regulation by the STB. They have been especially critical of the SAC procedure which requires them to design a hypothetical SARR to contest rates and to defend its projected performance against railroads' experts who have informational advantages.[56]

3.2 STB rate proceedings under CMP

The STB publishes on its website a summary of the rate cases that it had handled since its formation in 1996.[57] At this writing, the summary reported that 37 of a total 51 proceedings were conducted under full SAC guidelines. Of that total, 14 were resolved in settlement negotiations between carriers and shippers, 10 resulted in rulings that the rates were reasonable, eight in rulings that the rates were unreasonable, and two were withdrawn by shippers.[58] Three had not yet been decided. Most SAC cases were brought by coal shippers or chemical shippers. One

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[55] In 1999, CSX and Norfolk Southern, the dominant carriers in the eastern U.S., jointly acquired and then divided federally-supported Conrail between themselves. Gallamore and Meyer (2014) point out that the new structure was approved by both the STB and the Department of Justice on the grounds that it would increase rail competition between two strong carriers in the region.

[56] See Prater, Sparger and Oneil (2014) for a careful analysis of the relationship between rail rates and market power.

[57] http://www.stb.dot.gov/stb/industry/Rate_Cases.htm

[58] The totals include a 2009 coal case, AEP Texas v. BNSF that initially resulted in a rate reasonable decision, but on remand in 2011 resulted in a settlement.

SAC case involved non-coal minerals and the other, *McCarty Farms, Inc. v. Burlington Northern*, involved grain rates. In the *McCarty Farms* case the STB ruled that the rates were reasonable.

Pittman (2010) cites at length from a 1996 STB decision which describes the complex procedure by which a shipper establishes a stand-alone rate:

> To make a SAC presentation, a shipper designs a hypothetical new carrier (a stand-alone railroad, or SARR) that is specifically tailored to serve an optimum traffic group with the optimum physical plant (rail system) needed for that traffic. Projected traffic volumes, operating speeds, and traffic densities must be calculated to determine the requirements for locomotives, cars and train operating personnel. A detailed operating plan must be developed to further define the physical plant that would be needed for the SARR.

Also-

> …roadway must be sufficient to permit the attainment of the speeds and density that are presumed. The length and frequency of passing sidings must be able to accommodate the specific train lengths and frequency of train meets that are assumed, and traffic control devices must be designed to allow trains traveling in opposite directions on the same track to be handled safely and efficiently based on the density and congestion assumed in the operating plan.[59]

In the final stage of an SAC proceeding, the present value of the revenue required to sustain the SARR is calculated and this is compared to the value of the revenue that the defendant railroad would receive for the same service. If the defendant railroad's revenue is greater than the revenue required to sustain the SARR, the challenged rates are judged to be "unfair" and the STB prescribes new rates and/or reparations. Pittman notes that the stakes in these cases have grown from $11.4 million in reparations in *West Texas Utilities v. BN* in 1997 to an estimated $345 million in rate reductions and reparations in *Western Fuels Association and Basin Electric Power Cooperative v. BNSF* in 2009.[60]

In the years since the *Guidelines*, the level and revenue contribution of "non-issue" traffic added to SARR have become a major source of disagreement between shippers and carriers. This was to be expected. From a practical perspective, the effect of adding non-issue traffic is to reduce the allowable rate that complaining shippers can be charged. This gives shippers incentives to expand the non-issue traffic group and railroads incentives to limit it.

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[59] *West Texas Utilities Company v. BN Railroad, 1 S.T.B. 638 (1996)* at 13-14. Cited by Pittman (2010b, pp.315-316).
[60] Pittman (2010b, p.317).

The non-issue traffic question took on added complexity in 1994 when the STB allowed shippers to include so-called "cross-over traffic" in an SARR's traffic group.[61] This is traffic that would not originate and terminate on the SARR but would be routed over the SARR for a portion of its trip from origin to destination. Debate has centered on how much cross-over traffic should be permitted and how the revenue from cross-over traffic should be allocated between the SARR and a connecting railroad or railroads. The issue is still being litigated and the STB has made a number of procedural adjustments in an effort to resolve it.[62] On the issue of scope, the STB adopted a cross-subsidy test, namely, whether the proposed traffic would cover its collective attributable costs.[63] On the allocation issue, the STB had originally used a distance-based approach where revenue was divided based on relative mileage hauled over the SARR and the other railroads.[64] In a 2006 ruling on *Major Issues in Rail Rate Cases* it adopted a revised approach based on the relative "average total cost" of movements calculated by URCS.[65] This approach was itself modified in 2013 to correct for problems with URCS cost estimates.[66]

3.3 Constrained market pricing in federal court

Carriers and shippers have the option of appealing STB rulings in federal court.[67] The courts generally have supported CMP as a method for evaluating rate reasonableness. In the 1987 case of *Consolidated Rail Corp. v. U.S.*, for example, the U.S. Court of Appeals for the Third Circuit noted that Section 205 of the Railroad Revitalization and Regulatory Reform Act of 1976 (4R Act) had directed the ICC to establish adequate revenue levels for railroads, and that the agency had succeeded in meeting what it described as a "unique" regulatory challenge.

> If the railroad's customers were, like those of an electric company, all captive, compliance with Section 205 would be relatively simple. The task of complying with that section is complex, however, because the railroad's rates for its non-captive service are determined by market forces, while the non-captive service utilizes much of the same facilities. Therefore, the ICC had to develop some refined method of differential pricing[68]

Traditional fully distributed cost (FDC) methods of price regulation would not work in the railroad case, the court concluded, because "if non-captive shippers were required to pay fully allocated costs, they would divert traffic to competing carriers and would leave the remaining shippers subject to higher shares of common costs." Ramsey pricing was the "most efficient or optimum" solution but, as the *Guidelines* recognized, difficult to implement.

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[61] Bituminous Coal – Hiawatha, UT To Moapa, NV, 10 I.C.C.2d 259, 265-68 (1994) (Nevada Power)

[62] Detailed consideration of the legal and economic arguments involved is outside the scope of this paper.

[63] *PPL Montana, LLC v. BNSF Railway Co., STB Docket No. 42054 (STB decided August 19, 2002).*

[64] See *Otter Tail Power Co. v. BNSF Railway Co., STB Docket No. 42071 (STB decided January 25, 2006)*

[65] *Major Issues in Rail Rate Cases, STB Ex Parte No. 657(Sub-No. 1) (STB served Feb. 27, 2006.)*

[66] *Rate Regulation reforms, STB Ex Parte No. 715 (STB decided July 18, 2013).*

[67] Pittman (2010b) reports that estimated litigation costs in SAC cases can range from $3 million to $4.5 million for each side

[68] *Consolidated Rail Corporation v. I.C.C.* 812 F. 2d 1444.

Because pure Ramsey pricing is based on a complex mathematical formula requiring the exact quantification of marginal cost and demand elasticity in a carrier's system, the ICC concluded that it was not feasible…Instead the ICC opted to rely on market forces, whereby services may be priced above their attributable costs according to observable market demand, but only to the extent necessary to cover total costs, including return on investment of an efficient carrier.[69]

The appeals court also rejected traditional cost-based regulation in the *McCarty Farms* agricultural case that had been the subject of extended court litigation dating to 1980. After several procedural detours, the ICC had decided in 1988 to use estimated revenue-to-variable cost ratios to judge whether rates charged to Montana wheat and barley shippers were reasonable. A sample of shipments had been divided into subsamples that ICC staff judged to have similar demand characteristics, and rates were judged to be unreasonable if they exceeded the average estimated revenue-to-variable cost ratios in their subsamples. On the basis of this procedure the ICC concluded that the Burlington Northern owed the Montana shippers nearly $10 million in reparations.

The U.S. Court of Appeals for the D.C. Circuit rejected this cost-based procedure in a 1993 decision,

> …while the Commission urges that R/VC is really a variant of Ramsey pricing, this is so only in the vaguest imaginable sense, namely, that it leaves the railroad's lower rates alone. The principle for limiting the higher rates has no evident connection to any of the goals that the Commission said CMP/SAC was designed–indeed, well designed–to achieve.[70]

The *McCarty Farms* court noted that the shippers' own economics expert, Alfred Kahn, had conceded serious drawbacks in using an arbitrary revenue-to-variable cost ratio of 180 percent as a regulatory benchmark since it provided no economic principle against which the reasonableness of markups could be assessed. The case was sent back to the STB and the rates were ruled reasonable under the full SAC standard.

3.4 STB alternatives to constrained market pricing

After the *McCarty Farms* decision agricultural interests and others continued to express concern that the SAC proceedings were too costly to provide full regulatory protection to shippers, particularly in cases where the stakes were not as high as they often were in coal and chemical cases. Congress responded to these claims in the 1995 *ICC Termination Act*, directing the newly-

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[69] *Id.* at 1444
[70] *Burlington Northern R.R. Co. v. ICC*, 985 F.2d 589.

established STB to devise a "simplified and expedited" method for determining the reasonableness of challenged rail rates.[71]

In1996 the STB announced a new set of regulatory procedures that relied on revenue-to-variable cost benchmarks as alternatives to full CMP/SAC procedures.[72] The 1996 procedures were not used, reportedly because shippers who were unsure how the benchmarks would be applied.[73] The alternative procedures were updated and expanded by STB decisions in 2006 and 2013. Two alternative mechanisms are now available to shippers. [74]

A *Three-Benchmark Approach*, created for small rate cases, compares the revenue-to-variable-cost ratio for disputed traffic to three "benchmark" ratios on traffic that the STB staff judges to be "comparable". The benchmarks are all samples of railroad traffic where the revenue-to-variable cost ratios are greater than 180 percent. This is considered to be captive traffic.

> – The Revenue Shortfall Allocation Method (RSAM) Benchmark is the average R/VC ratio that all of a railroad's captive shippers would have to pay to provide coverage of the railroad's total fixed costs. The coverage in this case is determined by a four-year average of annual revenue adequacy determinations.[75]

> – The R/VC_{COMP} Benchmark is the average ratio on captive commodities with qualities that are similar to the commodity at issue.

> – The R/VC_{180} Benchmark is the average ratio for all captive traffic.

The variable cost component is estimated by STB staff using its Uniform Rail Costing System (URCS). Rates exceeding a formulaic combination of the three R/VC benchmarks are judged to be unreasonable.

A *Simplified SAC (SSAC) test,* designed for medium-sized rate cases, allows shippers to challenge the reasonableness of a particular rate by using actual operations on existing railroad networks as a basis for projecting stand-alone costs. The idea is to eliminate the requirement that litigants develop detailed hypothetical infrastructure systems and operating plans for a stand-alone railroad (SARR). URCS costs are used to estimate operating expenses of the SARR and to evaluate the revenue contribution of other traffic that uses the SARR's network.

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[71] ICC Termination Act of 1995 49 U.S.C. 10701(d) (3).

[72] See *Rate Guidelines – Non-Coal Proceedings*, 1 S.T.B. 1004 (1996) (Simplified Guidelines).

[73] *Simplified Standards for Rail Rate Cases (Simplified Standards),* STB Ex Parte No. 646. (Sub-No. 1), September 4, 2007.

[74] See *Simplified Standards for Rail Rate Cases (Simplified Standards), EP 646 (Sub-No. 1)* (STB served Sept. 5, 2007), affirmed sub nom. *CSX Transp., Inc. v. STB*, 568 F.3d 236 (D.C.Cir.), *Rate Regulation Reforms, EP 715* STB served July 18, 2013.

[75] Macher, Mayo and Pinkowitz (2014) note that the RSAM Benchmark involves the application of the revenue adequacy measure in the context of individual rate adjudication. See their discussion of RSAM on pp. 19-20 of their working paper.

The STB has, since 1996, reviewed eight cases under its Three Benchmark guidelines and an earlier, related, "Simplified" standard. [76] It has also reviewed just two cases under the Simplified Stand Alone Cost (SSAC) standard and four cases under a so-called "Stipulated R/VC" method in which the parties agreed to use R/VC ratios of 180 percent as a standard in lieu of SAC. Seven of the eight Three Benchmark or "Simplified" cases settled and in one Three Benchmark case rates were judged unreasonable. Both of the SSAC cases settled as did two of the "R/VC" cases. In two of the "R/VC" cases the rates were judged unreasonable.

The STB's *Three Benchmark Approach* and the *Simplified-SAC* procedure both rely on URCS estimates and are potentially subject to concerns that econometricians have expressed about the system's accuracy. In its recent Congressionally-mandated report on *Modernizing Freight Railroad Regulation* the committee of the Transportation Research Board (TRB) characterized URCS as "a cost allocation scheme that has no economic foundation" and that has no relevance to rate regulation.[77] The TRB committee concluded that the cost allocations made by STB using URCS were inevitably arbitrary and had no meaningful connection to a shipment's rate or to the level of market power possessed by the railroad. The study concluded that URCS-derived variable costs used to implement the law's 180 percent revenue-to-variable-cost formula have led to systematic biases in the traffic qualifying for rate relief and to other highly questionable results, showing, for example, that a quarter of rail traffic was priced by railroads below its URCS-derived variable cost estimates.

4. Constrained market pricing and revenue adequacy

In explaining its April 1, 2014, decision to consider the use of revenue adequacy in rate decisions the STB noted that it had a statutory responsibility under Section 205 of the Staggers Rail Act to determine annually which carriers were earning adequate revenues. The standard for revenue adequacy, which the STB and its predecessor ICC, have used since 1981, is that a railroad's rate of return on investment equal the rail industry's cost of capital.[78] The STB has regularly made technical adjustments to the standard "to improve the agency's ability to determine accurately revenue adequacy."[79]

The April decision went on to point out that the concept of revenue adequacy "is also a component of the Board's standard for judging the reasonableness of rail freight rates."[80] As noted above, it cited from the *Guidelines* the policy claim that carriers "do not need greater revenues than this standard permits, and we believe that, in a regulated setting, they are not

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[76] For STB's rail rate cases, see: http://www.stb.dot.gov/stb/industry/Rate_Cases.htm.
[77] TRB (2015, p. 72). See also G. McCullough. "Analysis of the Uniform Rail Costing System." *Surface Transportation Board Ex. Parte 431-3*. April, 2009, for an extended critique of URCS.
[78] *Standards for R.R. Revenue Adequacy*, 364 I.C.C. 803,811 (1981).
[79] *Railroad Revenue Adequacy*, Decision, STB Ex Parte No. 722, at 3.
[80] *Id.* at 3.

entitled to any higher revenues."[81] It was this part of the announcement, especially the last sentence, which raised expectations that the STB was prepared to make significant revisions in its approach to rail rate regulation.

4.1 Revenue adequacy as a general regulatory concept

Revenue adequacy is a common element in the theory and practice of cost-based public utility regulation, the type of economic regulation that has traditionally been applied to a variety of public service providers, including electricity, natural gas, postal delivery, telecommunications and water systems. Ratemaking of this type involves three discrete steps: 1) identification of a utility's costs and revenue requirements; 2) allocation of costs to the various types of service that the utility provides; and 3) rate design to recover costs from each type.

The Alliance for Water Efficiency, for example, describes the revenue adequacy component for water utilities this way:

> …a water agency must receive sufficient revenues to recover its costs, including operation and maintenance costs, capacity costs [represented either by depreciation allowances or by debt-related costs], customer costs, and administrative costs.[82]

Revenue adequacy is described by the Alliance as a necessary condition for maintaining a financially viable water agency. After the revenue requirements are identified, rates should be designed so that users pay in water rates for the costs they impose on the utility.

Application of revenue adequacy has not been limited to traditional cost-based regulation. The concept also plays a role in the more recent regulatory approach to liberalized electricity markets in the U.S. and Europe. Restructuring of these markets in the 1980s and 1990s has resulted in systems where the generation, transmission and distribution functions are separated into vertically disintegrated operations. The idea here is to impose competitive market discipline on electric utilities by facilitating competition among generators and distributors since these elements do not necessarily exhibit the same economies of scale and scope that often characterize transmission elements. Problems arise when the expected net revenues from sales of electricity at market prices provide inadequate incentives for investment in new generating capacity. The problem is especially acute when the new capacity is needed to match administrative reliability criteria. Joskow (2013) notes that these criteria have frequently been carried over from regulated vertically integrated utilities.

The revenue adequacy problem also appears at the transmission level in these markets. The transmission grids are operated under a bid-based system of economic dispatch in which electricity is sent from one point to another based on differences in locational prices. The problem arises from the fact that on electricity transmission networks it is impossible to

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[81] *Coal Rate Guidelines*, at 535.
[82] Alliance for Water Efficiency (1996, p. 3).

guarantee physical transmission rights to ship power from one location to another. Such guarantees are precluded by potential variations in actual load and generation conditions in real time. The solution is to grant financial transmission rights (FTRs) to participants and to pay off the FTRs with fees gained from economic dispatch. Hogan (2014) explains how revenue adequacy becomes an issue if the actual revenue collected from economic dispatch cannot fully fund the FTRs.

4.2 Alternate views of railroad revenue adequacy[83]

The Interstate Commerce Act of 1887 and subsequent amendments in 1903, 1906 and 1910, all focused on the protection of shippers. The Act required that rates be "just and reasonable" and that they not discriminate among shippers. The Transportation Act of 1920, a Congressional response to the deteriorating condition of U.S. railroads after World War I, was the first piece of legislation that focused on the revenue adequacy of rail carriers. It directed the ICC to set rates that would enable railroads to

> …earn an aggregate annual net railway operating income equal, as nearly may be, to a fair return on the aggregate value of the railway property of such carriers held for and used in the service of transportation.[84]

Congress set the initial fair rate of return at 5.5 percent and gave the ICC the authority to raise it by 0.5 percent.

This rule of ratemaking was amended by the Transportation Act of 1933 which directed the ICC to give balanced consideration "to the effect of rates on the movement of traffic…and to the need of revenues sufficient to enable the carriers…to provide service." The 1933 Act also required the ICC to consider the need for rail transportation "at the lowest cost." Subsequent versions of the Transportation Act in 1940 and 1958 dealt primarily with the question of the "inherent advantages" of rail versus truck versus barge. The DOT's 1978 *Prospectus for Change in the Freight Railroad Industry* notes that with each iteration of the Transportation Act the emphasis on revenue adequacy was diminished.

> The concept of fair return on fair value, embodied in the original rule, disappeared entirely. No clear direction was ever provided to the ICC regarding the use of its ratemaking authority to reconcile the needs of railroads to earn revenues adequate to sustain a fair rate of return with the concepts of inherent advantage, intermodal competition, and low rates for shippers.[85]

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[83] See Chapters 2 and 9 of Gallamore and Meyer (2014) for detailed discussions of the evolution of federal regulatory policy toward railroads.
[84] February 28, 1920. 41 Stat. 456.
[85] U.S. DOT (1978, p. 119).

It was the 4R Act of 1976, a response to the acute financial crisis of railroads in the Northeast and Midwest that reestablished the role of revenue adequacy. Section 205 of the Act stated

> …the Commission shall…develop and promulgate…reasonable standards and procedures for the establishment of revenue levels adequate under honest, economical and efficient management to cover total operating expenses, including depreciation and obsolescence, plus a fair, reasonable and economic profit or return (or both) on capital.

> Such revenue should (a) provide a flow of net income plus depreciation adequate to support prudent capital outlays, assure the repayment of a reasonable level of debt, permit the raising of needed equity capital, and cover the effects of inflation and (b) insure retention and attraction of capital.[86]

The context here is important. The 4R Act was written following the 1973-74 OPEC oil shock and at a time when the Congress was facing the need to provide large subsidies to railroads in the northeastern U.S. The level of revenue adequacy described here is a *lower bound* below which firms would eventually face insolvency.

The 1980 Congressional committee statement quoted in the *Guidelines* (p. 535) confirms this view of revenue adequacy as a lower bound.

> This provision sets forth for the first time a standard for the Commission to use in determining if a rate is reasonable, and that standard goes to *ensuring that railroads can continue to operate as private enterprises…*[Emphasis added.]

> Previous admonitions by the Congress that the Commission assist carriers in earning adequate revenue levels (49 U.S.C. 10704) have not achieved their goals…This is a clear directive to ensure financially sound railroads, and the Commission is not to misuse the term "reasonable" to circumvent the directive.[87]

This statement was written after the initial Conrail subsidies had been obligated and were running short, and after the 1978-79 oil shock had weakened the U.S. economy. Real Gross Domestic Product *fell* from $5.85 trillion to $5.84 trillion ($2005) between 1979 and 1980, inflation increased from 8.3 percent to 9.1 percent, and unemployment rose from 5.8 percent to 7.1 percent. Net revenue for the Class I railroad industry in 1979 was $913 million and ICC calculated rate of return was 1.68 percent.[88] The federal budget deficit had also grown from $40.7 trillion in 1979 to $73.8 trillion in 1980 and the national transportation policy expressed in both the *Prospectus for Change in the Freight Railroad Industry* and *Innovation versus*

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[86] *Railroad Revitalization and Regulatory Reform Act of 1976*, Pub. L. No. 94-210, 90 Stat. 31 (1976) (4R Act)

[87] H.R. 1035, 96th Cong., 2d. sess. 54 (1980), Cited *Coal Rate Guidelines, Nationwide*, at 535.

[88] AAR Analysis of Class I Railroads (1979) Lines 8 and 6.

Nationalization: Proposals for Change in the Nation's Rail System was to avoid permanent subsidies to railroads.

By 1985, the U.S. economy was growing at a rate of 4 percent a year, inflation was at 3 percent, and unemployment had dropped to 7.2 percent after reaching a high in 1983 of 9.6 percent. Conrail's prospects had improved significantly thanks to the combined effect of the economic recovery, the Staggers Rail Act, and funds provided by the Northeast Rail Services Act of 1981.[89] Total rail industry net revenue had grown to $2.7 billion and the ICC-calculated rate of return was 5.18 percent. In the 1985 *Guidelines*, the ICC defined revenue adequacy in a manner that was more forward looking than the Congressional statement. It was "the revenue level necessary for a railroad to compete equally with other firms for available financing in order to maintain, replace, modernize, and, where appropriate, expand its facilities and services."[90]

Later, though, the *Guidelines* also describe revenue adequacy as an *upper bound* on the revenues to which regulated railroads are entitled.

> Carriers do not need greater revenues than this standard permits, and we believe that, in a regulated setting, they are not entitled to any higher revenues.

> …captive shippers should not be required to pay differentially higher rates than other shippers when some or all of that differential is no longer necessary to ensure a financially sound carrier capable of meeting its current and future service needs.[91]

The difference here is important. The 1980 definition was framed by Congress and defined a lower bound that constrained the behavior of the ICC. The 1985 definition was framed by the ICC and defined an upper bound that would potentially constrain the behavior of railroads. Whether in fact the revenue adequacy constraint would constrain rates charged to captive shippers would also depend on the ability of individual shippers to show that a carrier was market dominant in a particular market. The current statutory requirement for market dominance is that a proposed rate be greater than 180 percent of URCS-estimated average variable cost and that the traffic in question not be subject to effective competition.

4.3 STB application of revenue adequacy

ICC and STB agency staff, railroad analysts and attorneys, shipper analysts and attorneys, even members of the federal judiciary, have spent a considerable amount of time clarifying the correct

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[89] Gallamore and Meyer (2014) also credit the skilled management of Conrail.
[90] *Coal Rate Guidelines, Nationwide,* at 535
[91] *Id.*, at 537-538

way to measure railroad revenue adequacy. Those discussions continue.[92] The basic definitions are straightforward.

> – Return on investment (ROI) measures the ability of a firm to derive income from its investments. In current STB accounting, it is defined as the ratio of net income from railroad operations to depreciated cost of assets.

> – Cost of capital measures what the railroad must pay to obtain funds to purchase major assets. In current STB accounting, the cost of capital is a weighted combination of interest on debt and the cost of equity.

> – Revenue adequacy is the simple comparison of ROI to cost of capital. If a railroad's ROI is greater than or equal to the industry-wide cost of capital, the railroad is considered revenue adequate. If ROI is less than the industry-wide cost of capital the railroad is considered not revenue adequate.

It must also be noted that while the revenue adequacy of individual railroads is determined annually, the *Guidelines* emphasize that "revenue adequacy is a long-term concept that calls for a company, over time, to average return on investment equal to its cost of capital." [93]

Debates have focused over various accounting and econometric issues involved in measuring ROI and cost of capital. These have included the use of betterment versus depreciation accounting standards, embedded versus current cost of debt measures, and the use of a single indicator for revenue adequacy versus multiple indicators. The STB's current practice is to apply standard accounting procedures to measure ROI and to combine the Capital Asset Pricing Model (CAPM), an econometric measure of stock returns, and the Morningstar/Ibbotson Multistage Discounted Cash Flow Model to calculate cost of equity.

Detailed treatment of the technical accounting and legal issues involved here is outside the scope of the current paper.[94] The primary regulatory issue, treated in Section 4.2 above, is whether the revenue adequacy measure described in the Staggers Rail Act defines a lower bound, below which railroad operations are not sustainable, or an upper bound, above which contributing railroad rates are unfair. Another key issue, with significant economic content, is how to measure the railroad asset base. Under current STB guidelines, the asset base is measured using the net book value of a railroad's assets, the historical cost of the assets less depreciation. Railroads have argued that replacement costs are a better standard because these measure the railroad's ability to compete for investment funds in current capital markets. In 2008 the STB denied the railroads'

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[92] When it announced EP 722 the STB also announced at the same time that it would receive comments in EP 664 (Sub-No. 2), a proceeding dealing with the methodology for determining railroad industry cost of equity capital and (by extension) revenue adequacy.
[93] *Coal Rate Guidelines, Nationwide*, at 536.
[94] See Macher, Mayo and Pinkowitz (2014) for a more detailed analysis of the accounting and financial issues involved and for an empirical assessment of revenue adequacy in the rail industry relative to comparable industries and to a broader set of firms.

requests to use replacement costs on the grounds that it would be difficult to identify and value the relevant assets.

Table 2 provides a listing of the railroads which the STB has determined to be revenue adequate since the agency was established in 1996. In 2013 the industry-wide cost of capital was 11.32 percent and five railroads were judged to be revenue-adequate. The BNSF was 14.01 percent, Grand Trunk 11.84 percent, Norfolk Southern 12.07 percent, Soo Line 12.03 percent, and Union Pacific 15.39 percent. CSX at 10.0 percent and Kansas City Southern at 8.67 percent were not judged to be revenue-adequate.

In its April announcement the STB acknowledged that it had not yet had the opportunity to address how the revenue adequacy constraint would work in rate cases since nearly all of these cases had relied on SAC methodology. It said it would reconsider "what it means to be revenue adequate and how such a finding should impact the railroads, and how to apply the revenue adequacy constraint in regulating rates."[95]

Table 2
STB Revenue Adequacy
Revenue Adequate Railroads

Year	
1996	Illinois Central, Norfolk Southern, Soo Line
1997	Illinois Central, Norfolk Southern, Soo Line
1998	Illinois Central
1999	Grand Trunk
2000	----
2001	----
2002	----
2003	----
2004	Norfolk Southern
2005	Norfolk Southern
2006	BNSF, Norfolk Southern, Soo Line
2007	Norfolk Southern, Soo Line
2008	Norfolk Southern
2009	----
2010	Union Pacific
2011	BNSF, Norfolk Southern, Union Pacific
2012	BNSF, Norfolk Southern, Union Pacific
2013	BNSF, Grand Trunk, Norfolk Southern, Soo Line, Union Pacific

While most major rate challenges have been brought by rail shippers using the SAC approach there are two exceptions. One was *West Texas Utilities v. Burlington Northern RR Co.*, a 1996

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[95] *Railroad Revenue Adequacy*, at 4.

proceeding in which a rail shipper identified alleged inefficiencies and cross-subsidies in the BN's operations.[96] The shipper recouped $11.4 million under the management efficiency constraint, the requirement that no shipper should pay more than is required for efficient service. The other case was *CF Industries, Inc. v. Koch Pipeline Company, L.L.P.*, a pipeline rate dispute decided by the STB in May, 2000.[97] The basis for that decision was the revenue adequacy constraint.

The plaintiffs in *CF Industries, Inc. v. Koch Pipeline Company, L.L.P.* produced and shipped anhydrous ammonia for fertilizer from Louisiana to the Midwest using Koch's pipeline. They challenged Koch's rates under a reasonable level of profitability standard, and the STB agreed to consider the challenge, citing the rule in the *Guidelines* that regulated carriers are not entitled to revenues greater than a revenue adequate level. The STB cautioned that the plaintiffs would need to provide more than single period snapshot of Koch's costs and revenues.

CF Industries responded with a multi-year discounted cash flow analysis suggesting that Koch's ROI had exceeded its cost of capital in each year between 1988 and 1996. In 1996, for example, the plaintiff's estimate of Koch's ROI was 21.52 percent and the estimated cost of capital was 11.8 percent. The STB, noting that Koch had failed to show "with particularity" a need for revenues greater than the revenue adequate level, ordered the pipeline company to reduce its rates to pre-increase levels and to pay reparations.

Both parties challenged the STB's ruling in federal court. Koch challenged the STB's decision to rely solely on a revenue adequacy determination and to overlook the pipeline company's SAC analysis which yielded different results. CF Industries challenged the STB's decision to restore the rates to their original level and not to review them further. In July, 2001 the U.S. Court of Appeals for the D.C. Circuit rejected both appeals. The court noted the "contrast" between the system-wide revenue determination using revenue adequacy and the specific revenue determination using SAC was consistent with the Guidelines. The court also supported the STB's decision not to review the pre-increase rates on the ground that such review would be untimely.

> Koch contends that the STB should have accepted its SAC model, or at least refused to employ a revenue adequacy methodology that yielded different results. The Board's conclusion to the contrary, however, is consistent with the agency's rate guidelines. Those guidelines state that SAC and revenue adequacy are "separate constraining factors" on the maximum rates a carrier may charge, *Coal Rate Guidelines*, 1 I.C.C.2d at 521, and that "carriers do not need ... and ... are not entitled to any higher revenues" than the revenue adequacy standard permits, id. at 535.

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[96] 1 S.T.B. 638,655 (1996)
[97] 4 S.T.B. 637 (2000)

Moreover, the guidelines expressly contemplate that "the rate to an individual shipper may vary depending upon which of the two CMP approaches is used," and that it is the complaining shipper who may "decide which approach to pursue." Id. at 534[98]

The STB's decision to cap Koch's rates at pre-increase levels stood.

4.4 Revenue adequacy and constrained market pricing

The *Guidelines* do not provide explicit guidance on *how* the revenue adequacy constraint and the stand-alone cost constraint would be used in combination in a single regulatory procedure. In practice, the two constraints have been applied differently. When stand-alone cost has been applied, as it has been in numerous cases, it takes the form of an administrative procedure which identifies an approximate Ramsey price for a particular set of shipments. When revenue adequacy was applied in the *Koch* case it resulted in a cap on pipeline rates charged to CF Industries.

Mathematical derivation of the Ramsey prices does, in fact, require the specification of a nonnegative constraint on profits for the regulated firm and the use of the mathematical parameter ρ which assures that markups over marginal cost cover the total economic cost of operation. Braeutigam (1989) argues that there is a fundamental difference between accounting-based FDC pricing and Ramsey pricing.

> Under Ramsey pricing, no allocation of common costs is made on the way to determining economically efficient prices. *After* the efficient prices are found, it may be possible to determine how the common costs would have to be allocated in order for the second best prices to be generated from an FDC process. However, this is an *ex post* exercise in allocating common costs. Although an allocation that is entirely cost-based may be desirable from an accounting perspective, it is not useful in the determination of efficient prices.[99]

His point here can be illustrated by referring again to equation (1) which describes a railroad operating with cost structure $C=F + m_1y_1 + m_2y_2$, where m_1 and m_2 are the marginal costs of outputs y_1 and y_2. Assume that the railroad is operating at a Ramsey optimum with zero economic profits and Ramsey prices p_1 and p_2 set by a regulator applying equations (4) and (5). The portions f_1 and f_2 of fixed cost F allocated to the two services could then be identified for accounting purposes after the fact by $(p_1y_1 – m_1y_1)/F$ and $(p_2y_2 – m_2y_2)/F$. This example assumes, of course, that the regulator has accurate knowledge of shipper elasticities and carrier marginal costs—a state of affairs that the *Guidelines* concluded did not prevail at the ICC.

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[98] *CF Indus., Inc. v. STB*, 255 F 3d 816 (D.C. Cir. 2001).
[99] Braeutigam (1989, pp. 1326-27).

In a section of the *Guidelines* entitled "Application of Constrained Market Pricing" the ICC notes that the revenue adequacy and SAC constraints provide alternative approaches to identifying reasonable rates that are "necessarily interrelated."[100] The description of how the revenue adequacy constraint would be applied focuses on the relationship between the revenue adequacy and management efficiency. The *Guidelines* describe the management efficiency constraint as comprised of three elements, plant efficiency, operating efficiency, and pricing efficiency.[101]

The rate regulatory process based on revenue adequacy is described as follows:

> The revenue adequacy constraint is a limit on the total revenues a carrier can collect. The adjustments to eliminate plant and operational inefficiencies reduce the costs which may be covered by differential pricing. The adjustments to account for revenues lost through inefficient pricing practices also reduce the allowable differential pricing. Through these steps, the total amount of permissible differential pricing is determined.

> The pricing efficiency constraint directs that the resulting pool of un-attributable costs be allocated among the carrier's shippers in accordance with Ramsey principles (i.e., on the basis of the relative demand elasticities), recognizing that contract solutions may be superior to Ramsey prescriptions.[102]

The exact process by which un-attributable costs are "allocated among the carrier's shippers in accordance with Ramsey principles" is not specified, and how this could take place in the context of individual rate proceedings is unclear. As the Koch court noted, the *Guidelines* recognized that there would be a difference in the rates that shippers would be entitled to under revenue adequacy versus SAC. In fact, the *Guidelines* explicitly warned shippers about the risks of using the revenue adequacy approach in rate proceedings on the grounds that the total un-attributable costs of the existing system would be subject to recovery in that proceeding.

> If a shipper adopts the revenue adequacy approach, adjusted for demonstrated management efficiencies, to determine the reasonableness of the rate, the total unattributable costs of the existing system are subject to recovery via differential pricing. Thus, the shipper's rate reflects the recovery of these costs whether or not the shipper benefits from all the system's services.[103]

There is a good economic argument that a cap on all of the rates charged by a regulated public utility can be an effective means of approximating Ramsey prices. The 2014 Nobel Laureate, Jean Tirole, and his colleague Jean-Jacques Laffont make this argument in a 1996 paper in the *Journal of Regulatory Economics*. The price cap regime analyzed by Laffont and Tirole (1996) is

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[100] *Coal Rate Guidelines, Nationwide*, at 547-548.
[101] *Coal Rate Guidelines, Nationwide*, at 537-542.
[102] *Coal Rate Guidelines, Nationwide*, at 547.
[103] *Coal Rate Guidelines, Nationwide*, at 534.

significantly different, however, from the simple cap the STB imposed in the *Koch* case. In the first place, it is a *global* price cap that applies to all of the regulated firm's prices. Second, the mechanism that Laffont and Tirole propose gives firms full autonomy to vary individual prices as long as the overall effect of prices is to keep revenue (or revenue growth) at or below a specified level. Third, in the case of a network industry like railroads, the Laffont-Tirole mechanism assumes that service providers have access to each other's networks and that the access prices themselves are based on Ramsey principles and are included in the computation of the price cap.[104]

5. Conclusion

The critical economic doctrine articulated in the Staggers Rail Act and operationalized in the *Coal Rate Guidelines* is that demand-side signals (market-based prices) are at least as important as supply-side characteristics (costs) in enabling a complex network industry like railroads to evolve and to adapt to the needs of a modern economy. In applying this doctrine over the past 30 years the ICC and its successor agency, the STB, have relied on a novel and sophisticated regulatory approach called constrained market pricing (CMP). The STB's announcement in EP722 raises the possibility that it is ready to revise or supplement the CMP approach to rail rate regulation.

The history of rail regulation since the Staggers Rail Act and the *Coal Rate Guidelines* suggests at least four questions that the STB could address in deciding the future of CMP, especially the relationship between rail revenue adequacy and SAC.

First, does the STB's revenue adequacy measure define a lower bound (floor) or an upper bound (ceiling) for the revenues of Class I freight railroads?

The revenue adequacy measure developed by the DOT in the late 1970s and legislated by Congress in 1980 was a lower bound aimed at protecting railroads by constraining the behavior of regulators. It is described by Congressional committee as the revenue level that enables

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[104] To see this formally, let *a* stand for quantity of access (e.g. ton-miles produced on another railroad's right of way). The global price cap for a revenue adequate railroad serving two shippers as described in equation (1) would be

$$w_1 p_1 + w_2 p_2 + w_a p_a \leq \bar{p}$$

where the weights w_i used to compute the price cap would set independently and would proportional to the forecasted quantities of y_1, y_2, and a. Laffont and Tirole argue that the carrier would respond to this global price cap by adjusting all three prices, p_1, p_2, and p_a, to their approximate Ramsey levels. The access price p_a would cover the marginal cost of maintaining infrastructure plus a markup reflecting the price elasticity of the commodity being shipped. A discussion of proposals to mandate open access on the U.S. freight railroads is beyond the scope of this paper. See Pittman (2005) for a thorough analysis of the issues involved in railroad network access.

railroads to *continue* to operate as private enterprises. Revenue levels below that bound over an extended period of time, presumably, would force railroads into bankruptcy and shutdown unless federal support were provided. An alternate description of revenue adequacy, articulated in the *Guidelines* five years later, is of an upper bound, aimed at protecting shippers by constraining the behavior of railroads. It is described by the ICC as the *highest* level of revenue to which regulated railroads are entitled. Above that bound, the Guidelines state, "captive shippers should not be required to pay differentially higher rates than other shippers."[105]

There is of course no *direct* contradiction between the 1980 Congressional view of revenue adequacy and the 1985 ICC view. One could imagine a perfect theoretical level of revenue adequacy, a razor's edge, which could serve as both lower bound and upper bound for revenue. It is difficult to imagine, though, how this revenue level could be accurately determined by the STB or prudentially applied. The *Guidelines* recognize this difficulty. They stress that revenue adequacy is a long-term concept, that railroads are subject to the business cycle like other firms, and that the constraint should not be used to "freeze" a carrier's revenue at the break-even point. Nevertheless, as the STB notes in announcing EP 722, the details of how the constraint would be applied in rate cases have not been worked out.

Second, are the revenue adequacy constraint and the stand-alone cost constraint described in the Guidelines mutually exclusive procedural alternatives or can they be applied jointly in STB rate reasonableness proceeding?

Mathematical derivation of Ramsey prices requires the use of a mathematical technique which guarantees that markups over marginal cost cover the total economic cost of a firm's operations. The question though is whether an accounting-based revenue adequacy constraint is consistent with Ramsey pricing–or with the CMP process in which, its proponents argue, rates are constrained by real competition in some markets and by simulated competition using the SAC test in others.

In practice, the revenue adequacy constraint and the stand alone cost constraint have been used as procedural alternatives. The SAC test has been used to identify "approximate" Ramsey prices for particular sets of shipments. The revenue adequacy constraint was used in the Koch case to support mandated reduction of the pipeline rates paid by CF Industries to their pre-increase level. The *Guidelines* themselves do not provide clear guidance on how the two constraints could be integrated into a single CMP procedure. Proponents of SAC might argue that a full set of existing railroad rates, arrived at through a combination of actual competition and SAC-simulated competition, generate revenue levels that are competitively-determined and therefore *de facto* revenue adequate. From a procedural perspective, however, it seems clear that the two key constraints in CMP must be viewed as alternative regulatory procedures.

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[105] *Coal Rate Guidelines, Nationwide*, at 535.

Third, do the simplified procedures that the STB has adopted since the Guidelines provide reasonable alternatives to full SAC proceedings in cases where a defendant railroad is not revenue adequate?

In 1996, when it first adopted simplified procedures for determining rate reasonableness, the STB warned that these procedures, based primarily on estimates from the Uniform Rail Costing System (URCS), were "much cruder" than CMP. In its 2010 *Report to Congress on the Uniform Rail Costing System*, however, the STB noted that cost-based regulatory methods would play "a more prominent role in determining whether a rate is reasonable and what relief a rail shipper should receive." [106]

Pittman (2010) has argued that the SAC test has become too expensive and too time-consuming and that it is time to retire the notion and replace it with a simpler mechanism, possibly a price-to-variable-cost ceiling. He acknowledges the difficulty of measuring variable costs but argues that URCS "is already a standard methodology for this." [107] Other economists, including the TRB Committee on Modernizing Freight Railroad Regulation, have been more skeptical of URCS's ability to accurately estimate movement-specific variable costs.

There is no *a priori* reason why the STB could not initiate other procedural changes--not based on URCS-- to make the SAC procedure more accessible and more efficient. That said, a simplified SAC would still face methodological challenges. To approximate ideal Ramsey prices, the SAC procedure must be able to identify prices that lie somewhere between incremental costs and stand-alone costs. The *Guidelines* address this procedurally by giving complaining shippers the right to add non-complaining shippers to the SAC traffic group to share costs. They recommend that the rates paid by non-complaining shippers be allocated "on the basis of Ramsey principles" but implementation of this suggestion has been contentious.

Fourth, should SAC-based rate regulation be abandoned in cases where a defendant railroad is revenue adequate and replaced by a revenue adequacy-based procedure?

The goal of STB intervention in captive rail markets is to duplicate the outcomes that would occur in competitive markets. How can the STB achieve this goal using the administrative tools at its disposal?

One approach is to require that the rate charged by a regulated railroad for an individual freight movement not exceed the average variable cost of that movement by an unreasonable amount. This is the revenue-to-variable cost test. It makes sense because large revenue-to-variable cost margins do not exist in competitive markets where they attract entry by competing firms.

A second approach is to require that the revenue a regulated railroad receives for serving a particular customer or set of customers not exceed the total cost of providing that service. This is

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[106] STB 2010 *Report to Congress on the Uniform Rail Costing System.*
[107] Pittman (2010b, p. 324).

the stand-alone cost test. It makes sense because revenues that exceed stand-alone cost in competitive markets would also attract entry by competing firms.

A third approach is to require that the total revenue that the regulated railroad receives not exceed the overall total costs—capital costs included—of viable multi-year operations. This is the revenue adequacy test. It makes sense because firms operating successfully in competitive markets are expected to make what the STB's governing statute terms "a reasonable and economic profit or return (or both) on capital employed in the business."[108]

In each of the three approaches, the STB *observes* the rates that a railroad charges (or proposes to charge) and the revenue that it actually receives (or would receive under a set of proposed rates). In each of these approaches, though, the STB must depend on *estimates* of the costs involved, and this is where the difficulties begin. At one end of the spectrum is the problem that Friedlaender identified in 1967--the difficulty of estimating the variable costs of specific point-to-point rail movements. At the other end of the spectrum is the problem identified in EP 664--the difficulty of estimating the multi-period cost structure of a "revenue adequate" Class I railroad that must respond to changing operating requirements and changing investment horizons. Midway between the two (figuratively, at least) is the difficulty of measuring the stand-alone costs of providing service on a hypothetical rail system to a particular shipper or set of shippers.

The STB faces significant potential challenges here. One is to identify which, if any, of the three regulatory processes allows for the accurate *measurement* of rail costs. The other is to identify which of the *procedures* best approximates competitive market outcomes. Underlining the importance of these challenges is the TRB Committee on Modernizing Freight Regulation's conclusion that none of the three potential STB approaches mentioned above works very well. The TRB committee recommended that Congress simply eliminate the STB's direct role in maximum rate determinations. It suggested that rate disputes be handled as they are in Canada by independent arbitrators and that competitive rate benchmarking replace URCS in screening rates for eligibility to be challenged.[109]

The TRB Committee characterized the SAC process as "slow, costly and inappropriate to many shippers." It cited, as an example, the problems that grain shippers would face in using SAC.

> Grain shippers in particular have argued that the design of a standalone railroad entails large litigation expenses that cannot be justified when a grievance involves a relatively small claim. In addition, these shippers, whose traffic may not be the dominant flow (or remotely close to it) in a corridor or set of corridors, must depend heavily on the profits generated by any crossover traffic to cover common costs and lower the revenue-

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[108] 49 U.S.C. § 10704(a)(2) and (3).

[109] Detailed discussion of the TRB report and its recommendations is beyond the scope of this paper.

adequate rate as determined by SAC. These profit contributions in turn are computed from R/VC markups derived from the unreliable URCS. Complainant shippers can therefore face substantial uncertainty about a fundamental aspect of their SAC case.[110]

The report was even more critical of the STB's use of the revenue-to-variable cost criteria in its *Three Benchmark Approach* and *Simplified-SAC* procedures which are dependent on the "unreliable and arbitrary cost allocations of URCS" and offer "even less predictable decision criteria and lack even [SAC's] weak conceptual basis."[111] And the report recommended elimination of the STB's annual revenue adequacy determination which it characterized as "ritualistic, while offering little substantive information for regulators or policymakers."[112]

When the STB announced its decision to receive comments in EP722, it said that it would focus on two issues—its methodology for "determining" revenue adequacy and its "use" of revenue adequacy in rate proceedings. The focus of this paper has been on the latter task, the potential regulatory *application* of revenue adequacy as opposed to the regulatory *measurement* of revenue adequacy. Both issues are important, of course, and it may be that the STB will focus its decision on the *measurement* of revenue adequacy. However, as discussed in this paper, EP 722 also presents a timely opportunity for the Board to address fundamental questions about regulatory *procedure* that are of importance to shippers, carriers, the public, and to the STB itself.

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[110] TRB (2015, p. 85)
[111] TRB (2015, p. 4)
[112] TRB (2015, p. 5)

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Estimated empirical effects of a revenue adequacy-based rate regime

Passage of the Staggers Rail Act of 1980 and subsequent actions by railroads, shippers, regulators and courts have resulted in a freight rail system that is well capitalized and financially strong. This is consistent with the legislative intent of the Act which was "the restoration, maintenance and improvement of the physical facilities and financial stability of the rail system of the United States." However, the stand-alone cost (SAC) test that the Surface Transportation Board (STB) has used to implement the 1980 legislation is costly and time-consuming and has limited the ability of shippers to challenge rates. What then would be the effect of a revenue adequacy-based rate jurisprudence?

Appendix A estimates the empirical effects that a revenue adequacy-based rate regime would have had on rail rates during the period 2002-2012. The results are based on three assumptions.

First, it is assumed that that all of the railroads in the U.S. industry were judged to be revenue adequate in each of these years. In other words, the STB-measured return on equity for each railroad was greater than or equal to the STB-measured industry-wide cost of capital.[113]

Second, it is assumed that all revenues for freight movements at rates above 180 percent of STB-estimated variable costs would be reduced by the STB to exactly 180 percent of STB-estimated variable costs. This is the statutory jurisdictional threshold for shipper rate challenges at the STB.

Third, it is assumed that revenues from commodities that moved at rates at or below the STB-estimated 180 percent revenue to variable cost level would be unaffected.

Data for the simulation is from the STB's *Public Use Waybill File*, an annual sampling of freight movements derived from reports that railroads are required to provide to the Board. The *File* contains commodity-specific information on industry-level carloads originated, tons originated, revenues, and ton-miles, along with STB estimates of movement costs for commodity. The *Public Use* version is derived in turn from the STB's *Confidential Carload Waybill Sample* which contains disaggregated data on point-to-point rail movements. The confidential *Waybill* is used by regulators and in litigation.

Important *caveats* apply in using revenue and cost data from the *Public Use Waybill File*. On the revenue side, contract revenues are masked to protect the confidentiality of carriers and shippers who enter into these agreements. Recent work by McCullough and Thompson (2013) finds that the net effect of revenue masking has been to make commodity specific revenues reported in *Public Use Waybill* data appear significantly higher than they actually are. On the cost side,

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[113] See Section 4.2 above for a discussion of the STB's revenue adequacy criterion.

there are concerns in the opposite direction that the estimates from the STB's Uniform Rail Costing System overstate the costs of various commodity movements. In a report prepared for the Federal Railroad Administration, for example, Wilson and Bitzan (2003) provide a detailed comparison of URCS costs with average variable costs projected using a modern econometric cost function.[114] The URCS generated unit costs are uniformly higher than those generated by the econometric cost function and in some cases the differences are quite significant.

To provide context for the empirical results in this appendix, Table A1shows (masked) industry-level revenues for each of 12 major commodity groups for the even years 2002 through 2012. Relative contributions by the various commodities remained fairly constant over the period. Coal represented the largest contribution to total industry revenue, followed by chemicals, intermodal, automobiles, food, and farm products. Total income reported by the *Public Use Waybill File* grew by 87.6 percent from $46.2 billion in 2002 to $86.7 billion in 2012.[115]

Table A1
Composite Waybill 2002-12
Railroad revenue
($ billions current)

	2002	2004	2006	2008	2010	2012
Description						
Farm Products	3.13	3.48	5.16	6.24	6.16	5.76
Coal Products	9.03	10.33	13.27	16.39	17.35	18.59
Minerals	1.17	1.34	1.75	2.06	2.24	3.21
Food Products	3.23	3.56	4.65	5.60	5.84	6.64
Wood Products	2.49	2.54	3.58	2.39	1.79	2.21
Pulp & Paper	2.30	2.34	3.15	3.37	2.75	3.14
Chemicals	6.26	6.40	8.08	10.11	10.70	12.09
Petroleum	1.33	1.59	2.22	2.47	2.32	2.99
Stone & Glass	1.42	1.69	2.14	2.07	1.72	2.10
Metal Products	1.60	1.98	2.83	3.34	2.52	3.30
Automobiles	5.34	5.42	6.39	5.68	5.63	7.78
Mixed Freight	5.41	7.16	9.23	9.72	8.61	10.88
ALL	46.20	52.05	68.01	75.39	73.28	86.70

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[114] Wilson, W.W. and J. Bitzan. 2003. Costing individual railroad movements: A report prepared for the Federal Railroad Administration. http://www.ugpti.org/pubs/pdf/DP153.pdf
[115] Real income reported in the *Public Use Waybill* grew by 22.9 percent from $34.9 billion ($1982) for 2002 to $42.9 billion ($1982) in 2012.

Table A2 presents revenue-to-variable cost ratios for each of 12 major commodity groups for the even years 2002 through 2012. It should be emphasized that the R/VC ratios reported here are aggregate ratios, not the ratios for specific movements by specific railroads. Nevertheless the ratios do provide insight into the relative margins that the railroad industry enjoyed in different markets and different years. For most commodities and years R/VC ratios for the 12 major commodity groups are less than the captive shipper standard of 180 percent (1.8). These are markets where the STB would judge that the railroads are not market dominant. The higher margins are in coal, chemicals and petroleum products.

Among the 12 major commodity groups revenue-to-variable cost ratios for chemicals were highest, growing from 2.16 in 2002 to 2.25 in 2012. Coal ratios, the second highest, grew from 1.83 to 2.05 and ratios for shipments of petroleum products grew from 1.77 to 2.04. Agricultural commodities and important truck-competitive commodities (food, wood, paper, finished automobiles and auto parts) all moved at ratios below 1.8. Ratios for farm products grew from 1.63 in 2002 to 1.70 in 2012 and ratios for food products grew from 1.41 to 1.61. Mixed shipments (intermodal containers) also moved at low estimated ratios.[116] Hazardous wastes and ordinance showed the highest ratios, reflecting the high risk premiums associated with these commodities.

The estimated effects of STB price caps on nonmetallic minerals, petroleum products, stone and glass, metal products and automobiles are relatively small. Chemical shippers and coal shippers, on the other hand, would experience significant reductions in rates. Rate savings for the coal industry grow from $1.4 billion in 2010 to $2.3 billion in 2012. Rate savings for chemical shippers grow from about $1 billion in 2002 to $2.4 billion in 2012.

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[116] The 0.95 revenue-to-variable cost estimate for mixed shipments for 2002 implies that–on average–Class I railroads moved containers at a loss that year. The STB has acknowledged a problem with URCS intermodal cost estimates in various URCS-related ex parte proceedings and in its 2010 *Report to Congress on the Uniform Rail Costing System* (p. 18).

Table A2
Revenue to Variable Cost Ratios

Commodity	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Farm Products	1.63	1.62	1.69	1.66	1.73	1.66	1.63	1.69	1.68	1.63	1.70
Forest Products	1.24	1.62	1.67	2.43	2.30	1.93	2.20	2.33	2.02	2.26	2.22
Marine Products	0.89	1.43	1.10	1.12	1.41	1.17	1.33	1.31	1.53	1.45	1.49
Metallic Ores	1.62	1.48	1.74	1.86	2.11	1.96	1.95	2.03	1.84	1.89	1.96
Coal Products	1.84	1.80	1.74	1.70	1.76	1.68	1.76	1.88	1.96	2.01	2.06
Petroleum Products	1.84	1.99	1.81	1.73	1.80	1.81	1.58	1.55	1.40	1.58	1.87
Nonmetal Minerals	1.54	1.60	1.66	1.68	1.83	1.78	1.80	1.87	1.90	1.83	1.97
Ordinance	2.48	2.94	3.54	3.61	3.84	5.01	4.12	3.89	4.12	2.92	3.35
Food Products	1.41	1.44	1.49	1.47	1.54	1.52	1.51	1.57	1.57	1.55	1.61
Textile Mill Products	0.97	1.64	1.95	1.83	1.67	1.59	1.62	1.71	1.62	1.26	1.33
Finished Textiles	1.04	1.60	1.77	1.87	1.86	1.73	1.74	1.72	1.90	1.62	1.65
Lumber	1.43	1.48	1.52	1.58	1.60	1.55	1.46	1.36	1.41	1.38	1.43
Furniture	1.10	1.74	1.90	1.98	2.07	1.71	1.79	1.95	2.13	1.85	1.93
Pulp & Paper	1.44	1.49	1.58	1.66	1.67	1.63	1.59	1.53	1.59	1.56	1.59
Printed Matter	1.13	1.83	2.08	2.16	2.09	1.63	1.57	1.54	1.61	1.46	1.34
Chemicals	2.16	2.17	2.03	2.00	2.05	2.13	2.10	2.20	2.23	2.16	2.25
Petrol Products	1.77	1.92	1.84	1.87	1.85	1.86	1.84	1.93	1.95	1.94	2.04
Plastic Products	1.06	1.65	1.78	1.82	1.87	1.78	1.71	1.75	1.75	1.67	1.68
Leather Products	1.20	1.91	2.19	2.36	2.70	2.19	2.51	2.85	2.61	2.87	2.72
Stone & Glass	1.71	1.74	1.81	1.85	1.94	1.91	1.90	2.00	1.94	1.84	1.99
Metal Products	1.50	1.56	1.61	1.68	1.79	1.77	1.73	1.59	1.72	1.76	1.80
Fabricated Metal	1.77	1.94	1.82	1.87	2.73	2.21	1.95	2.21	2.27	2.17	2.24
Machinery	1.68	2.05	2.02	2.01	2.52	2.47	2.43	2.45	2.90	2.57	2.59
Electrical Machinery	1.46	1.62	1.62	1.61	1.72	1.71	1.81	1.69	2.20	1.84	1.93
Transportation	1.76	1.61	1.72	1.68	1.46	1.36	1.39	1.41	1.76	1.79	1.84
Instruments	1.24	2.34	2.61	2.25	2.07	1.85	1.76	1.84	1.92	1.78	1.88
Misc. Products	1.20	1.90	1.94	1.77	1.91	1.77	1.80	1.76	1.83	1.76	1.72
Scrap Materials	1.34	1.37	1.50	1.61	1.74	1.65	1.68	1.63	1.73	1.46	1.65
Misc. Freight	1.50	1.96	2.14	1.90	1.92	1.72	1.64	1.94	1.91	1.73	1.90
Empty Containers	0.67	1.03	1.09	1.12	1.18	1.07	1.08	1.15	1.11	0.97	0.90
Express Mail	1.27	1.64	2.08	1.87	1.73	1.58	1.36	1.57	1.68	1.67	1.68
Forwarder Traffic	1.12	1.77	1.73	1.77	1.99	2.28	1.92	1.99	1.95	2.03	2.03
Association Traffic	1.83	2.83	2.63	3.03	3.80	3.23	2.76	3.46	3.01	2.23	2.25
Mixed Shipments	0.96	1.51	1.55	1.51	1.58	1.45	1.45	1.56	1.62	1.43	1.48
Small Packages	1.30	2.16	2.08	2.21	2.63	2.45	2.43	2.44	2.70	2.72	2.68
Hazardous Waste	2.39	2.67	2.88	2.61	2.69	2.51	2.52	2.67	2.66	2.54	2.57

Table A3
Projected Revenue Reductions
($ millions current)

Commodity	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Farm Products	0	0	0	0	0	0	0	0	0	0	0
Forest Products	0	0	0	(2.3)	(2.6)	(0.4)	(1.4)	(1.7)	(1.0)	(2.1)	(1.7)
Marine Products	0	0	0	0	0	0	0	0	0	0	0
Metal Ores	0	0	0	(19.1)	(94.8)	(51.6)	(60.3)	(57.7)	(14.9)	(36.4)	(68.7)
Coal Products	(173.4)	0	0	0	0	0	0	(624.7)	(1428.0)	(2082.6)	(2316.7)
Petrol Products	(0.3)	(1.8)	(0.1)	0	0	(0.4)	0	0	0	0	(53.6)
Minerals	0	0	0	0	(32.0)	0	0	(58.9)	(115.1)	(48.2)	(270.4)
Ordinance	(4.3)	(5.7)	(12.6)	(10.5)	(17.4)	(35.7)	(31.9)	(28.8)	(20.5)	(14.5)	(17.3)
Food Products	0	0	0	0	0	0	0	0	0	0	0
Textile Products	0	0	0	0	0	0	0	0	0	0	0
Finished Textiles	0	0	0	(6.8)	(6.6)	0	0	0	(15.9)	0	0
Wood Products	0	0	0	0	0	0	0	0	0	0	0
Furniture	0	0	(4.7)	(9.2)	(12.7)	0	0	(8.0)	(20.5)	(4.0)	(12.6)
Pulp & Paper	0	0	0	0	0	0	0	0	0	0	0
Printed Matter	0	(0.5)	(4.7)	(6.3)	(3.9)	0	0	0	0	0	0
Chemicals	(1042.2)	(1024.5)	(734.5)	(684.3)	(996.1)	(1433.3)	(1438.6)	(1632.6)	(2065.3)	(1965.6)	(2433.1)
Petroleum	0	(85.7)	(37.1)	(74.3)	(59.0)	(77.9)	(59.6)	(142.1)	(176.1)	(185.9)	(357.1)
Plastic Products	0	0	0	(1.9)	(6.6)	0.0	0	0	0	0	0
Leather Products	0	(0.2)	(1.7)	(1.5)	(2.7)	(1.2)	(3.0)	(2.5)	(2.2)	(3.7)	(2.1)
Stone & Glass	0	0	(12.6)	(51.0)	(157.4)	(116.4)	(105.9)	(153.5)	(126.9)	(41.3)	(199.1)
Metal Products	0	0	0	0	0	0	0	0	0	0	(3.9)
Fabricated Metal	0	(4.1)	(0.6)	(2.8)	(44.6)	(22.4)	(9.3)	(21.1)	(33.6)	(36.3)	(40.8)
Machinery	0	(9.0)	(10.2)	(11.8)	(50.2)	(48.1)	(55.1)	(41.7)	(75.2)	(76.2)	(105.0)
Electrical	0	0	0	0	0	0	(2.2)	0	(54.6)	(6.1)	(20.0)
Transportation	0	0	0	0	0	0	0	0	0	0	(150.9)
Instruments	0	(1.4)	(2.6)	(2.4)	(1.6)	(0.3)	0	(0.3)	(1.1)	0	(0.8)
Misc. Products	0	(3.2)	(4.9)	0.0	(3.7)	0	0	0	(1.6)	0	0
Scrap Materials	0	0	0	0	0	0	0	0	0	0	0
Misc. Freight	0	(21.9)	(43.9)	(12.7)	(18.2)	0	0	(18.2)	(14.2)	0	(15.1)
Empty Containers	0	0	0	0	0	0	0	0	0	0	0
Express Mail	0	0	(11.7)	(1.2)	0	0	0	0	0	0	0.4
Forwarder Traffic	0	0	0	0	(30.5)	(78.8)	(23.3)	(25.4)	(23.8)	(44.4)	(56.0)
Association Traffic	(0.8)	(11.6)	(6.3)	(7.3)	(7.6)	(4.9)	(2.0)	(0.7)	(0.9)	(0.3)	(0.5)
Mixed Shipments	0	0	0	0	0	0	0	0	0	0	0
Small Packages	0	(23.0)	(20.9)	(32.8)	(53.5)	(36.9)	(40.9)	(45.2)	(70.3)	(92.9)	(92.6)
Hazardous Waste	(13.1)	(20.6)	(20.2)	(20.4)	(32.2)	(30.5)	(39.7)	(36.9)	(32.8)	(40.2)	(39.1)
TOTAL	**(1,234)**	**(1,213)**	**(929)**	**(959)**	**(1,634)**	**(1,939)**	**(1,873)**	**(2,900)**	**(4,294)**	**(4,681)**	**(6,257)**

Table A3 simulates the revenues that the Class I railroad industry in the U.S. would have generated if rates had been capped by the STB at the 180 percent revenue-to-variable cost level. In 2002, only coal and chemicals, among major commodities, would have been affected if the STB had applied the Revenue Adequacy Constraint in this way. By 2012, though, seven of the 12 major commodities –coal, nonmetallic minerals, chemicals, petroleum products, stone and glass, metal products and automobiles–would have been affected. Major commodities not affected include farm products along with the "commonly important commodities"–food, wood, paper and intermodal containers–where there is significant competition between rail and truck.

The overall direct effects of a revenue-adequacy based price cap are shown in Table A4. The projected effects before 2009 are relatively small, amounting to less than three percent of *Waybill* revenue in those years. For 2009, though, the projected reduction is $2.9 billion, or 4.73 percent of *Waybill* revenue. By 2012 the projected reduction is $6.2 billion or 7.2 percent of revenue.

Table A4
Total Projected Revenue Reductions
($ billions current)

Year	CMP Basis	Revenue Adequacy Basis	Percent Reduction
2002	46.20	44.96	2.67
2003	45.85	44.64	2.65
2004	52.05	51.12	1.79
2005	58.86	57.90	1.63
2006	68.01	66.37	2.40
2007	69.68	67.74	2.78
2008	75.39	73.51	2.48
2009	61.26	58.36	4.73
2010	73.28	68.98	5.86
2011	82.11	77.43	5.70
2012	86.70	80.44	7.22

There are two other cautions which must be raised here in addition to those that apply to revenue and cost data from the *Public Use Waybill File*. First, as indicated above, the analysis is based on aggregated reports so it does not take into account the revenue-to-variable cost ratios for individual shipments by individual railroads. These might vary considerably from the average

revenue-to-variable cost measures for each commodity group. Second, the results presented here are static results based on cross sectional reports for each of the years in question. They do not account for possible dynamic responses by carriers or shippers. Carriers, for example, might lower rates or investment levels in certain commodity groups, and raise rates or investment levels in other groups, in response to such price caps. Shippers, on the other hand, might find it advantageous to engage more frequently in regulatory proceedings and less advantageous to engage in commercial negotiations with carriers. It is also difficult to predict how regulators will respond.

Bearing all of these *caveats* in mind, there are a number of potential negative effects that are not quantified here.

One potential effect would be an increase in the rates that shippers of agricultural products and other commodities might be required to pay if railroads attempted to recoup the lost revenue. *Waybill* revenue from farm products and food products reported in Table A1 totaled $12.4 billion in 2012 or 14 percent of total Class I revenue in that year. The estimates in Table A2 show that these rail dependent commodities were moving at levels below the 180 percent threshold and could be subject to upward rate adjustments. It would be more difficult for railroads to adjust the more "competitive" types of rail shipment. Using the revenue-to-variable cost standard as a guide—these would include mixed shipments moving primarily in intermodal containers. These generated about 11 percent of Class I revenue in 2012.

A second potential effect would be reductions in the quality or extent of service provided to rail shippers. The question here is whether the reductions in revenue caused by imposition of a revenue adequacy constraint would materially affect railroads' abilities to operate and maintain their systems safely and efficiently. Since 1980 maintenance and renewal of track infrastructure alone has required expenditures of $5-10 billion dollars each year by Class I railroads. In 1980, for example, Class I railroads spent $5.5 billion on track maintenance and renewal and generated $2.4 billion in cash flow. The ratio of required road capital investment to cash flow was greater than two-to-one. That ratio has improved significantly since passage of the Staggers Rail Act and has grown to the point where railroads are generating enough cash to maintain and strengthen their networks without relying on external funding.

A third potential negative would be external to both railroads and shippers. In its annual freight forecast for 2014 the American Trucking Association (ATA) predicted that overall freight tonnage in the U.S. will grow 23.5 percent by 2025. To meet this volume, the ATA calculated, truckload volumes on U.S. highways would increase by 3.8 percent a year through 2019, and by 1.2 percent annually from 2020 to 2025. This could lead to increases in truck-related highway congestion and highway deterioration.[117] Railroad intermodal services have competed

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[117] The problem could be compounded by the fact that the federal Highway Trust Fund has sustained shortfalls in fuel tax revenues since 2008 and has had to rely on over $40 billion in transfers from the U.S. Treasury's general fund.

effectively with trucks for a growing portion of the higher value freight traffic. The ATA itself forecasts that truckload carriers will make greater use of intermodal rail for intermediate and long distance hauls. This growth could be hampered by a reduction in rail levels of service caused by revenue shortfalls.

All of these effects, of course, should be weighed against the benefits received by rail shippers– coal and chemical shippers, especially–in the form of lower rates. The simulations in Table A3 project annual savings of nearly $1-2 billion in recent years for these industries. Some of these savings, presumably, would take the form of new investment in these industries and the benefits would be passed on to producers and consumers.[118]

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[118] On the other hand, Friends of the Earth argued in testimony in EP 722 that reduced coal rates would result in an increase in railroad coal movements and that this would lead to environmental damage.

Appendix B

Railroad Revenue Adequacy

Synopses of Opening Comments and Reply Comments

On September 5, 2014 The Surface Transportation Board (STB) received Opening Comments by private parties–principally carriers and shippers–and government agencies interested in *Ex Parte 722*. On November 4, 2014, STB received Reply Comments in which the interested parties addressed each other's points of view. What follows is a brief synopses of these statements. Shipper perspectives are presented first, followed by carrier perspectives and the perspective of government agencies and other interested groups. The synopses are introduced by brief descriptions of the organizations and their memberships.

A.1 Shipper perspectives

The Alliance for Rail Competition (ARC)

[ARC is a coalition of shippers and industry trade associations, formally organized in March, 1997 in response to concerns over rail service. It members include producers of agricultural products, coal, consumer and industrial products, chemicals, minerals and petrochemicals. ARC did not submit Opening Comments.]

Reply Comments

ARC stresses the fact that railroads are common carriers subject to a common carrier obligation and the legal requirement that rates be reasonable. ARC contends that railroads have achieved revenue adequacy, and it is now time to develop new regulatory mechanisms beyond SAC, SSAC, and the Three Benchmark Approach. At a minimum STB should "apply the revenue adequacy constraint to limit future increases of rates on captive traffic." Revenue adequacy should also shift evidentiary burden in rate cases to railroads rather than shippers.

In ARC's view, the simplest summary of how the Revenue Adequacy Constraint could work is set forth in the *Coal Rate Guidelines* at 536:

A railroad seeking to earn revenues that would provide a long term return on investment above the cost of capital would have to demonstrate with particularity a need for the higher revenues, (2) the harm it would suffer if it could not collect them, and an explanation why captive shippers should provide them.

Arkansas Electric Coop

[Arkansas Electric Coop includes 17 electricity distribution cooperatives that provide power to the state of Arkansas. Their customers include more than 500,000 homes, farms and businesses.]

Opening Comments

In the Arkansas Electric Coop's view rail revenue adequacy has been achieved and this mandates to a "turning point" in rail regulation. The Coop supports simplification of SSAC (by eliminating the requirement that plaintiffs provide detailed analyses of Road Property Investment). It also supports a rollback of "super-competitive" rail earnings as was done in the *Koch* pipeline case.

Reply Comments

In Reply Comments, Arkansas Electric Coop calls attention to a point made by the DC Circuit Court that the Staggers Rail Act "set forth as the nation's rail transportation policy fifteen different and not entirely consistent goals." (Baltimore Gas and Electric Co. v. United States, 260 U.S. App. D.C. 1, 11, 817 F.2d *108,* 112 1987) The STB, therefore, has a responsibility to balance and trade-off the extent to which specific individual goals are achieved. When rail rates provide revenues which exceed the amount necessary to maintain the rail system and to attract capital, an additional obligation is imposed on the Board "to maintain reasonable rates where there is an absence of effective competition."

In a competitive marketplace, firms may temporarily succeed in achieving earnings that exceed the cost of capital, but such earnings systematically tend to attract market entry by new competitors. There is no foundation in competitive market principles for the type of open-ended license to engage in differential pricing that the railroads are seeking. Revenue adequacy constrains "supracompetitive" earnings that produce distortions in resource allocation.

Concerned Shipper Associations

[The Concerned Shipper Associations is an umbrella group representing the American Chemistry Council, the Fertilizer Institute, the Chlorine Institute and the National Industrial Traffic League. The Association members identify themselves as "primarily carload shippers" for whom SAC has not been practical or effective.]

Opening Comments

The Concerned Shippers Associations begin by noting that revenue adequacy has not been developed into a methodology for regulating rates because railroads had not been judged to be revenue adequate. That situation has changed and it is now the STB's task to develop a revenue-adequacy based rate regulatory mechanism. The first task for the STB to accomplish in developing a revenue adequacy-based procedure is to define a relevant time period over which a rail firm could be judged to revenue adequate or inadequate. A time period they suggest is the average period of the U.S. business cycle which is estimated by the National Bureau of

Economic Research (NBER) to be 5.7 or 5.8 years (depending on whether the measurement is peak-to-peak or trough-to-trough).

With a time period defined, the regulatory process would proceed as follows. A shipper would be required to establish a) that a railroad firm was revenue adequate over the 5.7 or 5.8 year period, and b) that the railroad firm was market dominant in a particular category over that period. Affirmative findings on both points would require that the railroad to make rebates to the affected shipper or shippers. The amount and (if necessary) the division among shippers would be determined by STB. Further rate increases for the affected traffic would be limited by input price appreciation reflected in the AAR's Rail Cost Adjustment factor (RCAF-A). Limited exceptions would be allowed.

The Associations append expert testimony by economist Gerald R. Faulhaber, an emeritus at Wharton. This is significant since his earlier work on cross-subsidy played a key role in the development of the stand-alone cost concept in the *Guidelines*. He argues here that the model of the industry assumed in Faulhaber (1975) bears no relation to the STB-regulated freight industry and that the use of SAC as a regulatory mechanism is unjustified.

Faulhaber states that "if the firm is not profit-constrained, the stand alone cost has no meaning in the context of cross-subsidy (although incremental cost still does). As a consequence, the use of the stand alone cost test by the STB has nothing to do with cross-subsidy, as railroads are not subject to a profit constraint and by any measure are highly profitable today."

Reply Comments

In Reply Comments the Concerned Shippers Associations stress that a revenue adequacy constraint is required by the framework of Ramsey Pricing. In CSA's view, shippers are not advocating a revenue adequacy constraint that would reduce railroad revenues that would exceed an "adequate" level as long as such revenues are produced by competitive traffic. But captive traffic should not be forced to differentially provide revenues in excess of revenue levels that are "adequate" under the statute.

CSA also argues that a railroad's assertion that the Board's SAC procedures show that the calculation of replacement costs in measuring revenue adequacy is now possible is laughable. In fact, current SAC procedures show just the opposite. The time, money and expertise that go into a multi-year, multimillion dollar rate case that develops a SARR for one portion of one rail carrier would be multiplied many-fold to develop the replacement cost for the entire investment of every railroad in the country

Faulhaber extends his testimony in the CSA's Reply Comments. He argues *contra* current SAC procedure that shippers should be permitted to identify competitive option(s) that best "mimic competition" for its business, and use these options to test for rate reasonableness. Such options should be constrained only by the existing rail network structure and pricing. Only then will the STB's SAC procedure truly "mimic competition" in testing for rate reasonableness."[119]

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[119] Faulhaber notes in this regard that the STB has failed to develop a general Stand-Alone Cost computer model, into which shippers, regulators and railroads could plug parameters and data and have the model calculate the Stand

Consumers United for Rail Equity (CURE)

[CURE is a coalition of freight rail shippers concerned about what it considers unrestrained freight rail monopoly power. Its membership includes large trade associations representing more than 3,500 electric, utility, chemical, manufacturing, agriculture and forest and paper companies and their consumers. CURE submitted Opening Comments but did not submit Reply Comments]

Opening Comments

CURE submits a brief statement noting that "we look forward to discussing this matter in more detail in the future." It claims that the Staggers Rail Act goal of revenue adequacy has been achieved and that the STB should discontinue its annual revenue adequacy evaluation. Carriers could decide whether they were revenue inadequate and apply for this status to STB. Given the fact that railroads are now revenue adequate, CURE recommends rate case reform, access provisions that would increase railroad sharing of lines, reconsideration of decisions exempting certain commodities from price regulation, and STB adoption of a revised methodology for calculating cost of capital.

National Grain and Feed Association
[The NGFA, established in 1896, consists of more than 1,050 grain, feed, processing, exporting and other grain-related companies that operate more than 7,000 facilities and handle more than 70 percent of all U.S. grains and oilseeds. The NGFA also consists of 26 affiliated State and Regional Grain and Feed Associations, has a joint operating and services agreement with the North American Export Grain Association, and has a strategic alliance with the Pet Food Institute. NGFA did not file Opening Statement]

Reply Comments

The National Grain and Feed Association begins by noting that rail carriers hauled approximately 28 percent of all commercial movements of U.S. whole grains and oilseeds in 2011, the most recent year for which data were available. While that was down significantly from the 50 percent share hauled by rail at the time of enactment of the Staggers Rail Act of 1980, rail still represents a significant modal share for major agricultural commodities. NGFA claims that many shippers of agricultural commodities nationwide are captive or potentially captive to a single railroad for service. Some facilities have access to only a single railroad to transport their commodities hundreds of miles to an interchange point with another railroad or to a final destination – and do not have access to economically viable or competitive truck or barge transportation.

NGFA's principal claim is that the competitive railroad market envisioned by the framers of the Staggers Act, ICCTA, and their predecessor statutes has not existed for at least a decade or more. The current market for rail transportation is not the competitive market envisioned by Congress

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Alone Cost. Cites the Federal Communications Commission TELRIC (total element long-run incremental cost) model which became the standard regulatory cost model.

in 1980. NGFA maintains that the primary reason for the railroads' adherence to the SAC test is precisely because it is useless for all but a very few high-revenue, high-volume, single-routing movements.

Western Coal Traffic League (WCTL)

[WCTL is a voluntary association of public utilities that consume coal produced from mines located west of the Mississippi River. It was founded in 1977.]

Opening Comments

The Western Coal Traffic League's position is that the *Guidelines* preclude a market dominant, revenue adequate carrier from imposing any additional differential prices on a captive shipper. Its expert in the case is Dr. Harvey Levine, former director of economics at ICC and former Vice President for Economics at AAR. In WCTL's view, application of the Revenue Adequacy Constraint in rate cases would be straightforward. The Board would ask (1) whether a carrier was market dominant in the relevant market, and (2) whether the carrier was revenue adequate. If the shipper demonstrated both claims were true the challenged rate increase would be judged "unreasonable and unlawful." Exceptions would involve justified increases due to input price inflation (the Rail Cost Adjustment Factor) or to avoid specific harms.

WCTL also argues for a revision of the Revenue Adequacy Test that would focus on flow of funds. The WCTL cites a 2010 staff report by the U.S. Senate Committee on Commerce, Science and Transportation which finds that railroads have attracted sufficient capital to maintain and expand their systems but that "they have also doubled dividend payments to their shareholders and spent billions more dollars repurchasing their publicly-traded shares to boost the short-term value of their stocks."

Reply Comments

In Reply Comments WCTL argues that the railroads' campaign for the use of replacement costs in revenue adequacy proceedings conflicts with 49 U.S.C. § 11161, which provides that "to the maximum extent practicable, the Board shall conform [its cost accounting] rules to generally accepted accounting principles."

WCTL also challenges a railroad claim that the federal appellate courts have not evaluated the "economic validity" of the Revenue Adequacy Constraint. In WCTL's view the U.S. Court of Appeals Third Circuit addresses the question in a 1987 ruling in *Consolidated Rail Corp. v. I.C.C.* The court's language, cited by WCTL, is as follows:

> By imposing revenue adequacy as a ceiling, the ICC intends to insure that adaptive shipper will 'not be required to continue to pay differentially higher rates than other shippers when some or all of that differential is no longer necessary to ensure a

financially sound carrier capable of meeting the current and future service needs.' In other words, when a carrier has achieved revenue adequacy, the rate charged to a captive shipper will be the same as that determined by competition for non-captive shippers. 812 F. 2d at 1450-51.

A.2 Carrier perspectives

Association of American Railroads (AAR)

[AAR represents major freight railroads in the U.S., Canada and Mexico as well as Amtrak. Its members also include non-Class I railroads, suppliers, engineering firms and railcar owners.]

Opening Comments

AAR's emphasizes that the Staggers Rail Act set the framework for rail regulation in the U.S. and that the Act required that competition and demand for services establish reasonable rates to the maximum extent possible. The role of the SAC test is to "reproduce competitive outcomes" in cases where regulatory intervention is needed. The effect is to identify a "competitive price" that provides adequate regulatory protection for captive shippers and is consistent with Staggers. Revenue adequacy is treated in Staggers but the revenue adequacy constraint is not found in the statute. In the AAR's view "this constraint lacks substantive content and a firm basis in either law or economics".

AAR also argues that in evaluating return on investment the STB does not in fact calculate a *true economic return* for freight railroads, and that the calculation it does make does not properly treat asset values and deferred taxes. This means the STB could not rationally base its rate regulatory scheme on revenue adequacy. This would be inconsistent with the Board's *de facto* use of economic value in SAC cases.

Reply Comments

The Association of American Railroads ("AAR") Reply Comments are supported by the verified statements of Professor Joseph P. Kalt, Dr. Roger Brinner, and Professor Robert Willig. AAR stresses that shippers construe revenue adequacy as a means of regulating overall railroad profits, rather than individual rates. Shippers also take it as a given that railroads have now attained the status of revenue adequacy, without acknowledging the methodological flaws in the STB's annual determination.

If there are legitimate concerns about the administration of SAC, in AAR's view the proper way to deal with these is to look for ways to make the methodology more accessible and easier to administer without violating the CMP principles. Imposing an upward limit on revenues would lead to an asymmetry because the upside cap on revenues could not be matched with a guaranteed reasonable return on investment.

Willig's Verified Statement addresses the issues raised by shipper witness Faulhaber. In fact, Willig testifies, his colleague Baumol and Faulhaber published a paper in the *Journal of Economic Literature* that characterizes the stand-alone cost test as an innovative practical product of theoretical economic research. [120] The stand-alone cost serves as a surrogate for competition: it enforces a competitive standard on rail rates in the absence of any real competitive alternative. And because SAC represents the cost of reproducing service capability the cost of facilities must be based on replacement cost. Faulhaber's assertion that SAC does not permit shippers to benefit from scale and scope ignores the fact that the stand-alone cost test allows a complaining shipper "to include in its test any and all the additional traffic that the shipper believes contributes economies of scale or scope to the railroad's provision of its services."

BNSF

[BNSF Railroad covers 32,500 route miles in 28 states and two Canadian provinces. It has 43,000 employees and generated $21.7 billion in revenues in 2013 BNSF filed an Opening Statement but did not file Reply Comments.]

Opening Comments
BNSF supports the AAR statement in this proceeding and adds an 11- page statement relating BNSF's specific concerns. Its position is that the revenue adequacy yardstick is inappropriate for use as a tool for rate regulation. There is no relationship between firm-wide returns on book value of assets and the competitive market forces and negotiating dynamics that set rail rates. Rate limitation based on a revenue adequacy measure would be "arbitrary and capricious" in BNSF's view. The railroad stresses the competitive dynamics in the major markets its serves including agriculture.

BNSF also argues against RSAM as a regulatory procedure. The RSAM benchmark is based on the amount of revenue that a railroad must generate from its non-competitive traffic. If a railroad succeeds in increasing revenue and margins from competitive traffic this reduces the RSAM benchmark and reduces allowable rates on non-competitive traffic. This is contrary to public interest.

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[120] He refers here to Faulhaber, G.R. and William J. Baumol, "Economists as Innovators: Practical Products of Theoretical Research," *Journal of Economic Literature*, Vol. 26, No. 2 (Jun., 1988), pp. 595-596. Willig also cites a *Verified Statement of Economists Supporting the Principles of Constrained Market Pricing,* signed by Marcus Alexis (Northwestern University), Kenneth Arrow (Stanford University), Elizabeth Bailey (Carnegie Mellon University), Professor William J. Baumol (Princeton and New York Universities), Professor Charles H. Berry (Princeton University), Ronald R. Braeutigam (Northwestern University), Professor Ann F. Friedlaender (M.I.T.), Professor Richard Gilbert (Stanford University), Stephen M. Goldfeld (Princeton University), Professor Janusz Ordover (New York University), Professor John Panzar (Northwestern University), Professor Almarin Phillips (University of Pennsylvania), Professor James Rosse (Stanford University), Professor David Sappington (University of Pennsylvania), and Professor Robert D. Willig (Princeton University).

CSX

[CSX Railroad operates a network of 21,000 route miles covering 23 states east of the Mississippi River. It employed 31,000 persons in 2013 and earned revenues of $12.02 billion.]

Opening Comments
CSX argues that the STB's calculation of revenue adequacy is flawed because it is based on book values and not on replacement costs. Replacement costs not historical costs are the costs that investors consider when deciding to allocate capital. (CSX appends to its statement a 1985 *Economists Statement in Support of the Staggers Act* which makes the argument for replacement costs.)
CSX argues that the STB should defer consideration of the relationship between revenue adequacy and rate regulation until it has revised its approach to measuring revenue adequacy. And even if the STB does change its calculation to reflect replacement costs, the Board should continue to rely on SAC for rate regulation.

SAC time and cost could be reduced by streamlining the discovery process. In CSX's view increased costs of SAC cases also are attributable to the tactics of complainant shippers who posit "fantastic and infeasible" SARRs. CSX also notes that STB emphasis on RSAM both in rate determinations and in market dominance in fact establishes a relationship between revenue adequacy and rate reasonableness. This gives added importance, CSX notes, to the use of replacement costs in the revenue adequacy calculation.

Reply Comments

CSXT reaffirms this position in its Reply. It is essential that the agency
first correct a fundamental flaw in its annual revenue adequacy calculations by developing a methodology that uses replacement costs to value rail carrier assets shipper. The shipper proposals for rate freezes provide "no logical, principled basis for determining the reasonableness of specific individual rates."

Norfolk Southern Corporation (NSC)

[Norfolk Southern is one of four major rail carriers in the U.S. with 20,006 route miles in 22 states east of the Mississippi River and 30,103 employees. Its revenue in 2013 was $11.2 billion.]

Opening Comments

NSC stresses that the original revenue adequacy mandate was aimed at preventing the collapse of the U.S. railroad industry as a result of excessive regulation. It argues that the STB's current regulatory procedures incorporate revenue adequacy principles.

> One of the many advantages of the SAC test is that it considers the defendant carrier's revenue adequacy needs and is designed to give complainants relief if they can show that a SARR replicating part of the defendant's network would earn more than a reasonable

return on its investment. SAC complainants are required to posit a SARR that could serve the selected traffic group "while fully covering all of its costs and earning a reasonable return on investment." …Thus, to say that a SARR is earning a reasonable return on its investment is effectively to say that the SARR would be revenue adequate.

In NSC's view, the current EP 722 proceeding is "laden with ambiguity and unresolved issues." These stem from problems in the original *Guidelines*.

To identify a more authentic version of revenue adequacy NSC refers to the 1983 Notice of Proposed Rulemaking (NRPM) that was the basis for the *Guidelines*. There the ICC noted that its concern was "primarily about a "consistent" pattern of returns "substantially" in excess of a carrier's revenue needs" The USDOT and even some shippers supported a flexible interpretation of revenue adequacy but, according to NSC, "much was lost in translation between the NPRM and *Guidelines*". NSC argues that the concept of revenue adequacy as a limit beyond which regulated railroads are not entitled to higher revenues described in EP 722 has never been reviewed in court. Revenue adequacy was applied in the *Koch* pipeline case, but there, according to NSC, "the appellant made clear that it was challenging the Board's application of the constraint and not the constraint itself" (p. 36).

Finally, NSC stresses the negative effect that revenue adequacy-based regulation would have on rail investment, which is needed to deal with new capacity constraints facing railroads. It links these needs to national policy citing (p. 41) the FRA's *Preliminary National Rail Plan* (2009), the Executive Office of the President's *National Climate Action Plan* (2013), and the Council of Economic Advisors' *Economic Analysis of Transportation Infrastructure Investment* (2014).

Reply Comments

In Reply Comments Norfolk Southern Railway Company ("Norfolk Southern") reiterates its view that the railroads have demonstrated significant economic problems that would be created by a top-down revenue adequacy constraint, and that Board's current remedies already incorporate revenue adequacy principles and effective constraints. NSC again stresses that revenue adequacy should determinations be based on "the replacement value of rail assets" and that the Board incorrectly deducts deferred taxes from the investment base. Excluding deferred taxes from the investment base creates a disincentive for railroad investment.

NSC expert witness Sappington notes that "performance-based" regulation has been displacing traditional rate of return regulation both in US and overseas, largely because of the poor incentives created by a regulatory policy of capping earnings at a level the regulator deems to be sufficient. He points out that even Concerned Shipper Association witness Faulhaber agrees that "rate-base rate-of-return calculations have been virtually abandoned (except at the STB)."

Union Pacific Corporation (UP)

[Union Pacific Railroad covers 31,800 route miles in 23 states across western two thirds of U.S. Has 46,500 employees and revenues of $21.96 billion in 2013.]

Opening Comments

UP stresses that revenue adequacy-based regulation would reduce investment in the railroad's capacity and lead to what it terms "capital flight" from the railroad system. In fact, UP maintains, its current earnings are not sufficient to attract enough capital to meet projected shippers' needs, or to make investments needed to promote growth and meet policy goals. Average ROI as measured by STB is irrelevant, claims UP, since investors focus mainly on return on newly-invested capital. UP is required to make investments in areas that are increasingly risky. These include energy where there is international risk, agriculture where there is harvest risk, and intermodal facilities where there is risk that markets will not materialize.

UP presents evidence which it claims shows that railroad financial performance lags performance in comparable industries. UP expert Wilner uses Bloomberg data to calculate (2004-2013) Return on Invested Capital for railroads and other industries. Railroads are at 7.28 percent, Wilner reports, versus a comparable group at 13.72 percent

UP also stresses that recent improvement in its financial performance is due to its ability to compete more effectively in competitive markets and not to markets where it has more market power. UP Expert Witness Murphy compares growth in revenue-to-variable cost margins in exempt versus non-exempt traffic categories from 2004 to 2012. Margins in exempt (i.e. more competitive) categories increased by 17 percent versus 14 percent in nonexempt.

Reply Comments

In Reply Comments UP challenges shipper claims that all Class I railroads are revenue adequate now or soon will be. UP argues this assertion is wrong because it relies on (1) the STB's flawed annual revenue adequacy determinations, and (2) various Wall Street metrics that focus on short-term changes in financial condition. In UP's view, the STB already has a rate test that incorporates both revenue adequacy concepts *and* current asset costs: the stand-alone cost test. This is an established, economically sound, statutorily based, and judicially approved standard for determining rate reasonableness. It asks whether a rate exceeds "the rate that would prevail in a competitive market."

A.3 Environmental and governmental perspectives

Friends of the Earth

[Friends is the U.S. affiliate of Friends of the Earth International, a global network representing more than two million environmental activists in 75 different countries. It was founded in 1969 after an offshore oil spill off Santa Barbara, CA. Friends of the Earth submits an Opening Comment but does not submit a Reply Comment.]

Opening Comment

Friends insists that the STB is required to submit an Environmental Impact Statement (EIS) in EP 722. The reason is that this proceeding could have a significant positive impact on rail coal movements and this in turn would impact the environment.

To support this claim FOE submits a statement by economic consultant Gerald W. Fauth III, former Chief of Staff to STB Vice Chairman Burkes. Fauth argues that revenue adequacy could become a major factor in future railroad rate cases and this would constrain rates charged to captive coal shippers. Constrained coal rates would result in an increase in railroad coal movements and this could lead to environmental damage.

U.S. Department of Agriculture

[USDA provides federal leadership on food, agriculture, natural resources, rural development, nutrition, and related areas. The Secretary of Agriculture is charged with the responsibility under the Agricultural Adjustment Act of 1938 and the Agricultural Marketing Act of 1946 to represent the interests of agricultural producers and shippers in improving transportation services and facilities. USDA did not file an Opening Comment in September. It filed Reply Comments.]

Reply Comments

USDA notes that, as a matter of principle, the STB should facilitate competition in the market for agricultural transportation, allowing market forces to discipline rates to shippers. USDA states that greater reliance on competition will reduce the need for regulatory intervention, and thus reduce the complexities, costs, inefficiencies, and ambiguities that accompany administrative regulation. In instances where competition is limited, the STB should make efforts to ensure that its regulatory approach serves to approximate a competitive solution.

At the same time, USDA stresses, procedures for challenging transportation rates should be accessible to shippers and should provide them cost-effective protection against noncompetitive behavior. In USDA's view, shippers have demonstrated that the SAC test is increasingly expensive and complex, and several studies have called into question the validity of the theoretical underpinnings of the SAC test. As it stands, the SAC test attempts to approximate a

competitive outcome by assuming no barriers to entry for a competing railroad. Yet the test itself stands as a significant barrier for most shippers to challenge rates.

USDA follows shippers' expert witness Faulhaber in questioning whether the use of the SAC test is appropriate in the context of 21st century U.S. railroads. STB should consider strengthening its simplified rate challenge procedures developed specifically for use when a railroad is determined to be revenue adequate.