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AMTRAK VERSUS CONRAIL: RAMSEY AS ARBITER

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ABSTRACT

This paper characterizes economically efficient tariffs and allocations of costs in the Northeast Corridor. The corridor is owned by Amtrak, but is also used by Conrail and commuter lines. The paper develops a set of second best (Ramsey optimal) pricing rules allowing for intercorporate transfers, government subsidies, and a break even constraint for each firm. It shows when an individual firm should contribute toward common corridor costs, with a numerical application in the case of Conrail. More general applications of the methodology include optimal pricing when a number of firms employ a common production facility such as airport facilities, highways, or inland waterways.

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1. INTRODUCTION

Much of the literature on the economics of regulation focuses on the social control of a single firm. Thus, a great deal of work has recently been done on optimal pricing for regulated firms that produce multiple outputs and have significant fixed or common costs, or exhibit scale economies over wide ranges of output. The public policy questions that arise typically include issues of optimal pricing and cost allocation among products, size of plant, quality of service, all within the context of a single firm.

The nature of regulation becomes more complicated if a regulated firm has either a cost or demand structure that interacts heavily with other firms in the economy. In either case, an appropriate scope for regulatory analysis may require a broadening of the analytical framework to incorporate all of the heavily interacting elements. A judicious choice of the breadth of that analytical framework is essential to sound public policy analysis.

In this paper we focus on a set of public policy questions that affect certain railroad firms. These firms use common facilities. Obvious and significant cost interdependencies exist among them. These interdependencies require a treatment of the public policy questions within an integrated framework in which the costs and demands of the different firms are considered simultaneously.

The "firms" involved in this study include Amtrak (inter-city passenger service), Conrail (freight), and a number of local commuter lines. These firms all have extensive operations in the corridor extending from Boston to Washington, D. C., the Northeastern Corridor. The firms share the right-of-way and its associated facilities, such as switching. The major public policy questions are:

(1) how the cost of maintaining and operating the common facilities should be shared;

(2) how the allocation of these costs affects the tariffs of the firms, and may in effect reallocate the subsidies they receive from government.

While our study deals with railroads, it is clear that the issues are broader and arise whenever firms, both regulated and unregulated, and individuals use a common facility, particularly one that is provided by government. For example, most airports are used by both commerical and general aviation aircraft. How should the fixed and common costs of operating and maintaining control towers and runways be allocated between the two users? How should the fixed and common costs of maintaining and operating highways be allocated between trucks and private cars? Congress is currently considering legislation to put the inland waterways on a self-financing basis by imposing user fees. How should be annual costs of maintaining channel depth and of maintaining, operating, and replacing locks be allocated between commercial and recreational craft?

The issue of cost allocation is one that has perplexed the railroad firms of our study and the Interstate Commerce Commission (ICC) for some years. The method of cost allocation that is adopted will strongly influence the rates they charge and the degree of revenue inadequacy they experience. All of these firms receive substantial government funding to cover operating deficits and capital improvements. The method of cost allocation may very well determine whether the subsidies received are sufficient to cover the deficits incurred.

The central purpose of this paper is to show how economic analysis can be used to determine the levels of tariffs and allocations of common costs in the Northeast Corridor in order to maximize net economic benefit. In the process we will also address the following questions. What special economic significance, if any, is attached to legal ownership of the right-of-way and other facilities in the corridor? Is it necessarily the case that all firms should contribute some amount of money toward coverage of common corridor cost? How are efficient cost allocations and tariffs affected by the levels of government subsidies?

The remainder of the paper is divided into three sections. Section 2 contains a description of the legal and institutional issues that enter into our analysis. A model for the formal economic analysis is developed in Section 3. In Section 4 we present a set of propositions that are designed to answer the questions that comprise the central focus of the paper. The final section contains a summary of conclusions, qualifications, and indicates areas for further research.

2. THE CORRIDOR PROBLEM

The phrase "Northeast Corridor" refers to the former Penn-Central railroad lines between Washington, D.C. and Boston, Massachusetts, including lines that connect Philadelphia and Harrisburg in Pennsylvania, as well as New Haven, Connecticut and Springfield, Massachusetts. Historically, this corridor has carried significant amounts of freight, intercity passengers, and local commuter traffic. These activities were conducted by a number of different firms. It is not surpising that cost-sharing disputes have arisen among the current users of the corridor. The basic issue has been: Who shall pay for maintenance of corridor facilities? The dispute goes back at least to 1973, when the Penn-Central attempted to recover a share of the costs of maintaining the corridor from passenger railroads operating there.[1] The dispute took on new character when Amtrak acquired ownership of the corridor and was assigned resposibility for maintaining it by legislation passed in

1976.

Although the dispute has been carried on continuously since 1976, the need for resolution was accelerated with the passage of the Northeast Rail Service Act of 1981.[2] This law directed the ICC to establish a costing methodology that would be used to determine the compensation to Amtrak for the use of the corridor facilities by freight and commuter lines. Further, this was to be done within 120 days of the passage of the Act. The ICC proceeded with its consideration of the issues in Ex Parte No. 417.[3]

The statutory guidelines for this compensation have left room for legal argument. According to the Rail Revitalization and Regulatory Reform Act of 1976 (the 4R Act), "The Commission, in making such a determination [of pricing of corridor services for purposes of compensation], shall consider all relvant factors, and shall not permit cross subsidization among intercity, commuter, and rail freight services."[4] (The brackets have been added for clarity.)

Because the term cross subsidization was never defined, each of the parties has adopted its own definition. In Ex Parte No. 417, Conrail argued as follows:

> "It is Conrail's position that the only costing methodology which is fair and equitable... is a long-term incremental, or avoidable, costing methodology. Implementation of an avoidable methodology for freight service would put Amtrak in the same economic position it would be in if freight service were not operated on the Corridor."[5]

The notion of avoidable costs refers to the added costs that Amtrak incurs in the corridor specifically as a result of Conrail's operations. They are termed avoidable since they would not be incurred if Conrail ceased operations in the corridor. Conrail therefore argues that the only compensation it owes to Amtrak is avoidable cost. Further, Conrail claims that such a payment is "fair" since Amtrak is made no worse off when so compensated, even if this compensation contributes nothing toward the costs of the commonly used facilities. Effectively, Conrail has adopted a stand-alone test, defined in terms of long run costs, as the criterion for contributing to the maintenance of corridor facilities.

The commuter lines have argued that they are small users of the corridor, and should not pay any share of the common (or "base") costs. For example, the State Railroad Administration of the Maryland Department of Transportation (MDOT) has argued:

> "MDOT should not pay a share of the base costs. These costs must be assigned to the property owner - Amtrak. MDOT cannot control the size of the physical plant and the costs associated with maintaining it. Clearly, Amtrak is the dominant user and must bear the base costs."[6]

Amtrak believes that the costs of the commonly used facilities should be shared by all of the users. The cost alloction procedure it recommends involves two steps. First, each party would "...complete the process of indentifying the facilities and manpower that would be required for each service and pair of services standing alone..."[7] The second step in the Amtrak procedure would then involve the allocation of existing common costs in proportion to the stand alone costs of each service.[8] The virtue of this approach, according to Amtrak, is that there is no cross subsidization and no "free riders" since every party contributes something to covering the corridor's common costs. Having identified the issues we now turn to a formal economic analysis of the corridor cost and pricing problem.

3. AN ECONOMIC MODEL OF OPTIMAL PRICING

Our basic objective is to characterize those prices for Amtrak, Conrail, and commuter line services, including use of the Northeast Corridor facilities, that maximize net economic benefit. We proceed by developing a model of this problem in rather extensive detail. The economic principles that should be followed if prices are to be set in an economically efficient manner are then stated.

At the outset it must be noted that Amtrak, Conrail, and the commuter lines have operations outside as well as inside the corridor.[9] Both activities involve costs and revenues for each firm, and each receives a government subsidy to help cover its overall costs. Our model includes a characterization of each firm's operations inside and outside the corridor.

First consider Amtrak. Inside the corridor, Amtrak provides a level of service (measure, say, in passenger-miles per year) which we will denote by X_a^i. The subscript "a" denotes Amtrak; the superscript "i" refers to operations inside the corridor. There are also Amtrak operations outside the corridor, whose level of output is denoted by X_a^o, where the superscript "o" refers to activities outside the corridor.

Conrail also provides services inside the corridor, measured say, in ton-miles per year. Their level is denoted by X_r^i. The level of Conrail services outside the corridor is symbolized by X_r^o.

There are several commuter railroads operating in the corridor. However, it poses no particular problem for the development of principles if we represent the commuter activities as though they were provided by a single firm with a single subsidy. Let X_m^i be the level of commuter servies inside the corridor (again, for example, measured in passenger-miles per year) and X_m^o commuter services outside the corridor.

There is a demand schedule for each type of service. For example, for Amtrak's in-corridor services, if passengers are charged a price P_a^i, X_a^i trips will be demanded. This demand schedule is denoted by the function $P_a^i(X_a^i)$. The demand for Amtrak's services outside the corridor is represented by the function $P_a^o(X_a^o)$. There are also demand schedules for Conrail services, inside and outside the corridor: $P_r^i(X_r^i)$, $P_r^o(X_r^o)$. Finally, there are demand schedules for commuter services inside the corridor, $P_m^i(X_m^i)$, and outside the corridor $P_m^o(X_m^o)$.

There are two other prices that are central to the problem being studied, the fee paid to Amtrak, the designated owner of the corridor's facilities, by Conrail and the commuter lines for their operations in the corridor. Conrail's payment to Amtrak for operations inside the corridor is P_r^t, the superscipt t denoting a transfer payment. P_m^t is the transfer payment to Amtrak for commuter services over corridor facilities.

Each of the carriers also receives an annual subsidy. The subsidy to Amtrak is denoted by S_a, to Conrail by S_r, and to the commuter lines by S_m. We turn now to the subject of costs.

Our goal is to find economically efficient prices. Hence, the costs represented below are the social costs of the various operations. Since social costs must reflect the opportunity cost of using resources in the railroad industry instead of elsewhere in the economy, these costs include a normal return on investment.

Amtrak incurs costs that are directly and unambiguously attributable to its in-corridor operations. Some of these costs are fixed. We employ the symbol F_a^i to represent these annualized fixed costs. All other costs of Amtrak's in-corridor operations are variable. We employ the symbol C_a^i to denote these costs, and we assume constant marginal cost.[10] Amtrak also incurs some costs that are directly attributable to Conrail's operations in the corridor. The symbol C_r^t is used to denote the marginal cost of Conrail operations in the corridor that are borne by Amtrak. Similarly, there are corridor marginal costs that are directly attributable to commuter operations but are borne by Amtrak in its role as overseer and coordinator of corridor operations. We represent these marginal cost by C_m^t. Finally, Amtrak has fixed, F_a^o and marginal costs, C_a^o, that are directly attributable to its operations outside the corridor.

Some corridor costs are directly attributable to Conrail's operations inside the corridor. Let F_r^i be the annualized fixed costs of such things as track that is exclusively used to provide access to the loading platform of a manufacturing establishment. C_r^i is the marginal cost incurred by Conrail for its in-corridor operations. Also, let F_r^o and C_r^o be the annualized fixed and marginal costs of Conrail's movements outside the corridor.

Finally, we come to those costs that the firms view as the crux of the problem. These are the fixed costs, F, for in-corridor operations that are not directly and unambiguously attributable to Amtrak, Conrail, or commuter movements. For example, there are fixed costs associated with the common track and right of way. How much should each firm contribute toward the coverage of this common cost? This is essentially the problem that has taken the parties to hearings before the ICC.

Our analysis of the problem begins with a definition of a net benefits function, which is to be maximized subject to a budgetary constraint for each firm. We enter G, gross benefits, into this function. It represents the standard economic measure of gross consumer surplus.[11]

$$G = \sum_{q,u} \int_{w=0}^{X_r^q} P_u^q(w)dw, \quad \begin{cases} q = i,0 \\ u = a,m,r \end{cases} \tag{1}$$

Then it follows directly that net economic benefit, N, is G less the total cost of providing the services. N can be written as:

$$N = G - \sum_{q,u} (C_u^q X_u^q + F_u^q) - F - C_r^t X_r^i - C_m^t X_m^i, \quad \begin{cases} q = i,0 \\ u = a,m,r \end{cases} \tag{2}$$

Since each firm must break even, including its government subsidy, each has a budgetary constraint. For Amtrak, the constaint is written as $B_a \geq 0$, where B_a is defined in (3):

$$B_a \equiv S_a + (P_a^i - C_a^i)X_a^i - F_a^i + (P_r^t - C_r^t)X_r^i + (P_m^t - C_m^t)X_m^i$$

$$+ (P_a^o - C_a^o)X_a^o - F_a^o - F \geqslant 0. \tag{3}$$

The first term of (3) is the system-wide or total government subsidy to Amtrak. The next two terms represent the revenues net of attributable costs for Amtrak's own in-corridor operations. The fourth term denotes the net revenue Amtrak receives from Conrail for Conrail's in-corridor operations. The fifth term represents the net revenue Amtrak receives from commuter lines for their in-corridor movements. The next two terms identify Amtrak's revenues net of attributable costs for Amtrak's out-of-corridor operations. The last term, as defined earlier, refers to the fixed costs shared by Amtrak, Conrail, and commuter lines in the corridor.

For Conrail, the budget requirement is $B_r \geq 0$, where B_r is defined in (4).

$$B_r \equiv S_r + (P_r^i - P_r^t - C_r^i)X_r^i - F_r^i + (P_r^o - C_r^o)X_r^o - F_r^o \geqslant 0. \qquad (4)$$

In (4), the first term represents the system-wide government subsidy to Conrail. The second and third terms together denote the revenues to Conrail net of attributable costs and payments to Amtrak for operations in the corridor. The last two terms account for revenues net of costs for Conrail's own out-of-corridor operations.

In order to avoid repetition, we note that for commuter lines, a constraint (5) must be satisfied, and that the constraint has the same basic form as (4).

$$B_m \equiv S_m + (P_m^i - P_m^t - C_m^o)X_m^i - F_m^i + (P_m^o - C_m^o)X_m^o - F_m^o \geqslant 0. \qquad (5)$$

The object of our analysis is to characterize the efficient prices $(P_a^i, P_a^o, P_r^i, P_r^o, P_m^i, P_m^o, P_r^t, P_m^t)$ that maximize (2) subject to (3), (4), and (5). (Formally we will solve for the quantities corresponding to the first six of these prices, as well as the two transfer prices themselves).

4. PRINCIPLES OF OPTIMALITY

The characterization of the solution to the constrained optimization problem outlined in the previous section can be developed using the well-known Kuhn-Tucker conditions. At the outset, we define a Lagrangean H, as in (6):

$$H = N + \lambda_a B_a + \lambda_m B_m + \lambda_r B_r, \quad (6)$$

where λ_a, λ_m, and λ_r are the non-negative Lagrange multipliers associated respectively with the budget constraints for Amtrak, commuter operations, and Conrail.

The subsidies received by the three firms are treated as exogenous in our analysis. This assumption accords with reality. It is clear that optimal prices will depend somehow on the levels of these subsidies. In fact, one should expect that economically efficient prices would equalize the added benefit of an additional dollar of subsidy for all three firms. Proposition 1 shows that this is true.

<u>Proposition 1</u> At economically efficient prices, the payments from Conrail and the commuter lines to Amtrak will be set so that the marginal social benefit an additional dollar of subsidy to Amtrak, to the commuter lines and to Conrail will be the same.

<u>Proof</u>: At an interior optimum (with all quantities positive), the conditions for optimality require that:

$$\frac{\partial H}{\partial P_r^t} = \lambda_a X_r^i - \lambda_r X_r^i = 0 \Rightarrow \lambda_a = \lambda_r; \quad (7)$$

and that
$$\frac{\partial H}{\partial P_m^t} = \lambda_a X_m^i - \lambda_m X_m^i = 0 \Rightarrow \lambda_a = \lambda_m. \quad (8)$$

Thus $\lambda_a = \lambda_r = \lambda_m$, which establishes the proposition.

Four important points follow from this proposition. First, Amtrak and

Conrail subsidies are established at the federal level, but in hearings that are substantially independent. At least some of the commuter subsidies are determined by state and local government. Still, optimality can be achieved even if the subsidy levels of the three firms are set without regard to the interrelated aspect of their corridor operations. The transfers between Amtrak, Conrail, and the commuter lines can be adjusted so as to equalize the marginal benefit to society of another dollar of subsidy. With optimal prices it is not possible to take a dollar of subsidy from one use and transfer it to another use without reducing social welfare.

The second point can be observed by letting $\lambda = \lambda_a = \lambda_r = \lambda_m$ in (8), and then rewriting (6) as follows:

$$H = N + \lambda(B_a + B_m + B_r). \tag{9}$$

Equation (9) indicates that, from the perspective of economic efficiency, only the aggregate budget constraint.

$$B_a + B_m + B_r \geqslant 0, \tag{10}$$

matters. Specifically, observe that at an economically efficient set of prices it is the aggregate size of the subsidy $(S_a + S_m + S_r)$ that is important, rather than the size of the subsidy to any individual firm.

Our third point is that it does not matter who owns the common facilities. This follows from (9) since only the aggregate constraint is relevant to the setting of economically efficient prices. This point provides an important perspective on the arguments of such parties as the Maryland Department of Transportation, who, as cited above, states that, "MDOT should not pay a share of the base costs. These costs must be assigned to the property owner - Amtrak."[12] Such an argument has no basis in economic efficiency.

Finally, proposition 1 together with (9) indicates that from the standpoint of economic efficiency, all of the subsidized firms should be treated as one regulated enterprise. Net social benefit should be maximized, subject to the aggregate budget constraint, (9). In other words, the optimal pricing problem can be viewed as a variant of a second best, Ramsey optimal pricing problem.[13] A characterization of these Ramsey optimal prices, then, will relate the optimal deviation of price from marginal cost in a market in a fashion inversely proportional to the elasticity of demand. Let ε^i_a and ε^o_a be respectively the price elasticities of demand for Amtrak movements inside and outside the corridor. Let ε^i_r and ε^o_r be the analogous price elasticities of demand for Conrail's movements. Also, let ε^i_m and ε^o_m be the price elasticities of demand respectively inside and outside the corridor for commuter movements.

Economic efficiency requires that prices be set as shown below:

<u>Proposition 2</u>. At an optimum, prices will be set so that (10) and (11) will be satisfied, where

$$\frac{P^i_a - C^i_a}{P^i_a}\,\varepsilon^i_a = \frac{P^o_a - C^o_a}{P^o_a}\,\varepsilon^o_a = \frac{P^i_r - C^i_r - C^t_r}{P^i_r}\,\varepsilon^i_r = \frac{P^o_r - C^o_r}{P^o_r}\,\varepsilon^o_r$$

$$= \frac{P^i_m - C^i_m - C^t_m}{P^i_m}\,\varepsilon^i_M = \frac{P^o_m - C^o_m}{P^o_m}\,\varepsilon^o_m = -\frac{\lambda}{1+\lambda} \qquad (11)$$

<u>Proof</u>: The proof follows from the first order conditions for optimality derived from (9), i, e.,

$\partial H/\partial X^i_a = \partial H/\partial X^i_a = \partial H/\partial X^o_a = \partial H/\partial X^i_r = \partial H/\partial X^o_r = \partial H/\partial X^i_m = \partial H/\partial X^o_m = 0$,

assuming an interior optimum.[14]

In summary, proposition 2 requires that the inverse elasticity rule (11) be satisfied at an economically efficient set of prices, and that the aggregate budget constraint (10) also be satisfied. Propositions 1 and 2 taken together indicate that at an economically efficient set of prices, not only is the aggregate budget constraint (10) satisfied, but so are the individual budget constraints (3), (4) and (5). This follows from the observation that the Lagrangeans (6) and (9) are equivalent when the Lagrange multipliers are equal, as they are in this problem. Thus, at an optimum, all three kinds of firms would be breaking even, once government subsidies to the firms and transfer payments among them are taken into account.

If the total of the subsidies is large enough to allow the firms to break even with marginal cost pricing, then the value of λ in (11) is zero, and each price should be set equal to marginal cost. With respect to the prices of operations in the corridor, then $P_a^i = C_a^i$, i.e., Amtrak's in-corridor price and marginal cost would be equal. For Conrail, we would have $P_r^i = C_r^i + C_t^i$. That is, the price for Conrail's in-corridor movements would equal the sum of the marginal costs that both Conrail and Amtrak incur as a result of the movements. As (11) shows, a similar statment can be made for the commuter lines.

On the other hand, if the total of the subsidies is not large enough to allow the firms to break even with marginal cost pricing (so that $\lambda > 0$), then price will exceed the relevant marginal cost in each market. Thus, for example, Conrail would set a price for its in-corridor movements that would exceed the sum of the marginal costs that Conrail and Amtrak incur as a result of those movements. Similarly, a commuter line would set a price for in-corridor movements that would exceed the sum of marginal costs that are incurred by the commuter line and Amtrak for commuter movements in the corridor. These principles can be observed directly by noting that all of the terms in parentheses in (11) would be positive.

This discussion brings us to a crucial point in the debate over pricing in the Northeast Corridor. Under what conditions should Conrail and the commuter lines pay for a portion of the common costs incurred in the corridor? To answer this question we first recall that when the total subsidy to all three carriers is not large enough to allow the firms to price at marginal cost and still break even, the case of interest, then the budget constraints of the individual firms are binding.

Since the cases for Conrail and the commuter lines are symmetric, we deal with Conrail here to establish the point. We may rewrite Conrail's budget constraint (4) as follows:

$$(P_r^t - C_r^t)\, X_r^i = (P_r^i - C_r^t - C_r^i)\, X_r^i + (P_r^o - C_r^o)\, X_r^o + (S_r - F_r^i - F_r^o). \qquad (12)$$

Equation (12) has four terms. The term on the left hand side represents the amount that Conrail would pay to Amtrak in excess of the costs that Amtrak incurs as a result of Conrail's traffic in the corridor. In other words, the left hand side represents the amount of Conrail's contribution to the common costs in the corridor.

On the right hand side, the first two terms represent the amount by which Conrail's prices exceed the marginal costs incurred as a result of its operations, both inside and outside the corridor. Proposition 2 indicates that both of these terms will be positive. Thus, Conrail's contribution to common costs in the corridor will be positive if the last term is positive. This proves propositon 3.

Proposition 3. If government subsidies to Conrail (commuters) are at least as large as the total annualized fixed costs directly attributable to Conrail (commuters) then with optimal prices, Conrail (commuters) contributes toward coverage of the common costs in the corridor.

It should be noted that a positive $(S_r - F_r^i - F_r^o)$ term is sufficient , but not necessary, to yield a positive contribution to common costs. It is also clear that, absent any constraints on cross subsidization, the contribution to common costs can be negative at economically efficient prices. This is not surprising since efficient transfer prices effectively redistribute the subsidies so that a dollar of added subsidy to any firm leads to an equal increase in net economic benefit, as shown in Proposition 1.

To illustrate this idea, suppose that instead of giving a subsidy of S_a^1 to Amtrak and a subsidy of S_r^1 to Conrail, the government gave a subsidy of S_a^2 to Amtrak and no subsidy to Conrail. Further, suppose that

$$S_a^1 + S_r^1 = S_a^2, \tag{13}$$

so that the total size of the subsidy to both firms together is unchanged. Then our analysis has shown that the economically efficient prices characterized in proposition 2 would remain unchanged since the aggregate budget constraint (10) is unchanged. However, since the individual budget constraints for Conrail and Amtrak must remain satisfied, it is the transfer price P_r^t that must change as the subsidy changes.

To put this idea another way, observe that Conrail's budget constraint (4) must remain satisfied. Yet, if the total subsidy $(S_a + S_r)$ is unchanged, proposition 2 shows that P_r^i and P_r^o (Conrail's tariffs inside and outside the corridor) will be the same when they are economically efficient. Thus, if S_r is reduced (goes to zero in our example), then P_r^t (the transfer price) will also be reduced. In principle, it could be the case, if S_r were low enough, that P_r^t would be less than C_r^t. In this case Amtrak would make a payment to Conrail.

Proposition 3 makes the issue of whether Conrail should contribute to the common corridor costs an empirical one. To gain insight into the nature of the empirical question, we observe from the 1979 annual report of Conrail that its system wide subsidy (S_r in our analysis) was $729 million.[15] As a crude measure of an upper bound on the size of fixed costs, we use the value of property and equipment, less accumulated depreciation, which was about $2.899 billion.[16] Just as a first approximation assume that in order to annualize those fixed costs, we allow an opportunity cost of capital of ten percent, and another five percent for depreciation. Thus, a $3 billion figure would be annualized to about $450 million. Our approximation suggests that the subsidy does exceed annualized fixed costs. This is especially true since the property and equipment entry in the annual report's balance sheet undoubtedly includes a good deal of capital that is not really fixed. This information, coupled with proposition 3 indicates that at economically efficient prices Conrail would contribute to the corridor's common costs.

5. CONCLUSIONS

The problem that motivates this paper is the determination of economically efficient tariffs and allocations of common costs among railroad firms using the Northeast Corridor. However, there is a much more general application of the analysis which includes optimal pricing when a number of firms employ a common production facility. The problem is especially interesting when the facility they employ is provided by government, as is the case with airport runways, highways, and improved inland waterways.

In the case at hand, one firm, Amtrak, holds legal ownership of corridor facilities that are used by Conrail and some commuter lines. Each of these firms receives a substantial government subsidy. At the present levels of these subsidies, it appears that the firms could not break even under marginal cost pricing. As a result, the problem involves the principles of second best pricing with subsidies taken into account.

We have shown that it is possible to transform this problem, involving several firms using the corridor, into a Ramsey optimal pricing problem. We have included the effects of government subsidies and intercorporate transfers, and derived rules for optimal pricing with binding break even constraints for each firm. Economically efficient prices should satisfy an inverse elasticity principle, so that prices deviate more from marginal cost in more inelastic markets. One should be careful to note that the marginal cost of interest here is the marginal cost that movements impose on the system as a whole, i.e., as if all three firms in all of their operations were one firm.

Our ability to transform the multiple firm problem of this paper into one of Ramsey optimality shows that possible variations of the problem we have examined here can be addressed using results from the extensive literature already published on Ramsey pricing.[17] For example, the analysis in this paper has been performed in a static framework. Under some circumstances it may be desirable to cast the problem in a dynamic setting. One may want to know how economically efficient prices should be set over time as plant size is adjusted in some specified manner, taking into account interfirm transfer payments, government subsidies and the costs of adjusting plant size. Or, at a slightly more general level, one may ask what choices of plant size and prices are economically efficient over time. Because our multiple firm problem is in fact one of Ramsey optimality, the basic inverse elasticity rules and other other properties of economically efficient prices, as demonstrated in the Ramsey pricing literature, would hold in a dynamic version of our problem as well.

We have shown that legal ownership of right-of-way and other facilities in the corridor has no special economic significance. From the standpoint of economic efficiency and optimal pricing, it simply does not matter who owns the facilities.

We have also shown that it is perfectly possible for a firm to contribute nothing toward the common costs of the corridor at economically efficient prices. Optimality could even conceivably also require that some firms pay all of the corridor common costs and a share of the fixed costs attributable to another use. What contribution a firm makes depends on the size of the subsidy it receives, and the amount of its own fixed costs, among other things considered in this paper. Of course, if policy makers wish to employ the concept of cross subsidization and wish to impose some arbitrary constraint on the relationship between revenues and variable costs, the approach suggested in this paper can still be used to find the most efficient prices that satisfy the constraint. Imposition of such a constraint may involve some, perhaps considerable, sacrifice of efficiency.

Finally, we have applied the principles developed in the paper to determine whether Conrail should contribute to the common costs of the corridor under a Ramsey optimal pricing scheme. Using data for 1979, our analysis suggests that the answer to that question is affirmative.

May, 1982

FOOTNOTES

1. See, for example, ICC Finance Dockets 27353 and 27353 (Sub-No. 1), "Penn-Central -- Compensation for Passenger Service," 342 ICC 820 (1973). At that time the ICC ruled that Penn-Central was entitled to reimbursement of fully allocated costs plus a fully-allocated return on investment as compensation for intercity passenger operations within the corridor.

2. The Northeast Rail Service Act of 1981 (Northeast Rail Act) was included as Subtitle E of Title XI of P.L. 97-35, the Omnibus Budget Reconciliation Act of 1981. Subtitle E became effective on August 13, 1981, the day the bill was signed into law.

3. "Costing Methodologies for the Northeast Corridor; Commuter Service," ICC Ex Parte No. 417, and "Costing Methodologies for the Northeast Corridor; Conrail Freight Service," ICC Ex Parte No. 417 (Sub-No. 1).

4. The Railroad Revitalization and Regulatory Reform Act of 1976, P.L. 94-210, 90 Stat 31 (February 5, 1976), Section 402(a).

5. "Comments of Consolidated Rail Corporation," Ex Parte No. 417 (Sub-No. 1), October 9, 1981, p.5.

6. "Comments of Maryland Department of Transportation, State Railroad Administration," Ex Parte No. 417 (Sub-1), October 7, 1981, p. 10.

7. "Comments of National Railroad Passenger Corporation," Ex Parte No. 417 and 417 (Sub-No. 1), October 9, 1981, p. 6.

8. Ibid.

9. In practice, it would probably be appropriate to ignore commuter line activities outside the corridor, since there is little movement of this type for commuter lines also operating in the corridor. This is a special case of the model we developed here, and therefore we present the more general case in the text.

10. The assumption of constant marginal cost is consistent with the cost reporting system used by the Interstate Commerce Commission (Rail Form A). It could be relaxed without altering the basic nature of the results in this paper.

11. In using the notion of consumer and producer surplus, here we are assuming that there are zero income effects. For a discussion of this, see Willig [1976].

12. See footnote 6, supra.

13. Our solution is predicated on the assumption that it is either socially optimal or socially mandated that all three services continue to exist. Of course, there are circumstances in which total surplus would be greater if one or more of the services were discontinued.

14. See Ramsey (1927), and Baumol and Bradford (1970).

15. See the Annual Report of Consolidated Rail Corporation, 1979, Consolidated Balance Sheet, p. 22.

16. This exercise is intended to be illustrative. We do not enter the debate as to whether net book value should be adjusted to account for inflation or replacement value. This important question is beyond the scope of the present paper.

17. For recent work, see for example, Baumol, Panzar, and Willig (forthcoming) and Braeutigam (forthcoming).

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