

Defining Economic Terms Used in the Railroad Revitalization and Regulatory Reform Act*

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I. INTRODUCTION

The Railroad Revitalization and Regulatory Reform Act of 1976 (4-R Act)¹ dealt with a number of issues pressing upon the railroad industry. It contained provisions with regard to implementation of the Final System Plan (for the Northeast rail reorganization), commuter passenger subsidies, long-range planning, financing for private-sector railroad companies, and reforms of the Interstate Commerce Commission.

This paper focuses on the 4-R Act's use of five economic terms which set guidelines for Commission reforms. The five terms are:

- (1) avoidable costs,
- (2) cash-outlay costs,
- (3) incremental costs,

* Much of the research underlying this paper was conducted under a contract with the United States Department of Transportation. The remarks made in this article do not necessarily reflect the views of the Department.

Our research was aided substantially by Randall Geyerman.

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1. Pub. L. No. 94-210, 90 Stat. 31 (1976).

- (4) variable costs, and
- (5) contribution to going concern value.

Section 309 of the 4-R Act² amends section 205 of the Regional Rail Reorganization Act of 1973 (3-R Act);³ it deals with the responsibilities of the Rail Services Planning Office. "Avoidable costs" are mentioned in this section and then the term is raised again in section 802 which amends section 1(a) of the Interstate Commerce Act (ICA).⁴ Section 205(e)(1) of the amended 3-R Act instructs the Rail Services Planning Office to issue regulations which:

(A) develop an accounting system which will permit the collection and publication by the Corporation or by profitable railroads providing service over lines scheduled for abandonment, of information necessary for an accurate determination of the attributable revenues, *avoidable costs*, and operations of light density lines as operating and economic units, and (B) determine the '*avoidable costs* of providing rail freight service,' as that phrase is used in section 1a (6)(a)(ii)(A) of the Interstate Commerce Act. The Office may, at any time, revise and republish the standards and regulations required by this section to incorporate changes made necessary by the accounting system developed pursuant to this subsection.⁵

As amended, section 1a(6)(a)(ii)(A) of the ICA uses "avoidable cost" in comparing revenues and costs of potentially abandonable line. The Commission is to delay abandonment of such a line if a railroad is offered financial assistance which would would "cover the difference between the revenues which are attributable to such line of railroad and the *avoidable cost* of providing rail freight service on such line, together with a reasonable return on the value of such line. . . ."⁶

The 4-R Act amends section 15 of the ICA to set up provisions for separate rates for distinct services. These rates would be based on cash-outlay costs, a term heretofore not used by the railroad industry or its regulators. The 4-R Act language is:

In order to encourage competition, to promote increased reinvestment by railroads, and to encourage and facilitate increased nonrailroad investment in the production of rail services, a carrier by railroad subject to this part may, upon its own initiative or upon the request of any shipper or receiver of freight, file separate rates for distinct rail services. Within 1 year after the date of enactment of this paragraph, the Commission shall establish, by rule, expeditious procedures for permitting publication of separate rates for distinct rail services in order to (a) encourage the pricing of such services in accordance with the *carrier's cash-outlays* for such services and the demand therefor, and (b) enable shippers and receivers to evaluate all transportation and related charges and alternatives.⁷

2. *Id.* § 309.

3. 45 U.S.C. § 715 (1970).

4. 49 U.S.C. § 1(a) (1970).

5. Railroad Revitalization and Regulatory Reform Act of 1976, Pub. L. No. 94-210, § 802, 90 Stat. 31 (1976) (emphasis added).

6. *Id.* (emphasis added).

7. *Id.* § 202(d)(18) (emphasis added).

The 4-R Act also amends section 1(5) of the ICA, which deals with rates and market dominance; it states:

(b) Each rate for any service rendered or to be rendered in the transportation of persons or property by any common carrier by railroad subject to this part shall be just and reasonable. A rate that is unjust or unreasonable is prohibited and unlawful. No rate which contributes or which would *contribute to the going concern value* of such a carrier shall be found to be unjust or unreasonable, or not shown to be just and reasonable, on the ground that such rate is below a just or reasonable minimum for the service rendered or to be rendered. A rate which equals or exceeds the *variable costs* (as determined through formulas prescribed by the Commission) of providing a service shall be presumed, unless such presumption is rebutted by clear and convincing evidence, *to contribute to the going concern value* of the carrier or carriers proposing such rate (hereafter in this paragraph referred to as the 'proponent carrier'). In determining *variable costs*, the Commission shall, at the request of the carrier proposing the rate, determine only those costs of the carrier proposing the rate and only those costs of the specific service in question, except where such specific data and cost information is not available. The Commission shall not include in variable cost any expenses which do not vary *directly* with the level of service provided under the rate in question. Notwithstanding any other provision of this part, no rate shall be found to be unjust or unreasonable, or not shown to be just and reasonable, on the ground that such rate exceeds a just or reasonable maximum for the service rendered or to be rendered, unless the Commission has first found that the proponent carrier has market dominance over such service. A finding that a carrier has market dominance over a service shall not create a presumption that the rate or rates for such service exceed a just and reasonable maximum. Nothing in this paragraph shall prohibit a rate increase from a level which reduces the *going concern value* of the proponent carrier to a level which contributes to such *going concern value* and is otherwise just and reasonable. For the purposes of the preceding sentence, a rate increase which does not raise a rate above the *incremental costs* (as determined through formulas prescribed by the Commission) of rendering the service to which such rate applies shall be presumed to be just and reasonable.⁸

These economic concepts are the crux of the sections in which they are used. The way each is interpreted will be the fundamental determinant of how that section of the 4-R Act will be implemented. They are terms of art in railroading, accounting, and economics. Unfortunately, if one asks an expert from each field to define each term, it is likely that the definitions would differ both with respect to the theoretical interpretation and the language used in the definition.

In this article, we have attempted to define these terms on a ground acceptable to all three disciplines. We documented our findings so that one can trace the underlying meaning and the interrelationships between the economists', accountants', and railroaders' languages used to describe the intuitive meaning of the term. Furthermore, because these terms are closely

8. *Id.* § 202(b) (emphasis added).

interrelated, we sought to ensure that the meanings were consistent among each other. Finally, we deliberately established definitions which are understandable in lay terms.

II. BASIC PRINCIPLES

As a foundation for postulation of definitions of the concepts, some important principles of economics, railroading, and accounting should first be set forth.

A. VARIABLE AND MARGINAL COSTS

As economists distinguish them, variable costs are those components of total costs which vary in response to changes in output. Economists often specify variable costs as positive mathematical functions of output. By estimating the first derivative of the cost function, the economist is able to examine the *incremental* changes in costs (marginal costs) due to a single, infinitesimal additional unit of output. By then estimating the second derivative of the cost function, the economist is able to specify whether the incremental change in costs is smaller or larger than the one immediately preceding it. This second order analysis is "The Law of (Eventually) Diminishing Returns to Scale," which essentially says that marginal costs first fall with each additional unit of output, but eventually must rise as fixed inputs are used more intensively. For a further review of these principles, the reader should refer to any authoritative economic text.⁹

Expressed in less rigorous terms, variable costs are those costs which, over a given time horizon, vary as the output level varies (the remainder of total costs being fixed). Distinctions exist between variable and marginal costs. Marginal cost is that addition to the total cost which will be incurred with additional output, or avoided by reducing output. For a given output change, all marginal costs are variable in nature. The distinction, however, is that variable costs measure a distinct part of total costs at a given output level, while marginal costs measure the change in variable costs incurred by an output change. In other words, marginal cost is equal to the additional variable costs incurred with an incremental unit of output.¹⁰ Variable costs, thus, connote those portions of total costs which change directly with output shifts.

B. NON-VARIABLE COSTS

It is important to understand why some portions of total costs do not change with shifts in output. There are essentially two types of costs which are not variable: (1) fixed costs and (2) joint costs.

9. See generally: C. FERGUSON, MICROECONOMIC THEORY 116-22 (1969); J. HENDERSON & R. QUANDT, MICROECONOMIC THEORY (1958); E. MANSFIELD, MICROECONOMICS THEORY AND APPLICATIONS 118-32 (1970); P. SAMUELSON, ECONOMICS 429-31, 452 (8th ed. 1970).

10. See, e.g., C. FERGUSON, *supra* note 9, at 188-93; J. HENDERSON & R. QUANDT, *supra* note 9, at 55-62; 1 A. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS 70-75 (1970); E. MANSFIELD, *supra* note 9, at 159-68; P. SAMUELSON, *supra* note 9, at 442-45.

As defined by Samuelson, fixed costs are

the total dollar expense that goes on even when zero output is produced. It is often called "overhead cost" and usually includes contractual commitments for rental, maintenance, depreciation, overhead, salaries and wages, etc. It is a sunk cost that is quite unaffected by any variation in [quantity]; in the time period for which it is sunk, the only rule is this: Disregard fixed cost because [it] cancels completely out of every decision.¹¹

An economic discussion of fixed costs and inputs, and their relation to decision making and total costs, can be obtained from many sources.¹²

Usually, no portion of fixed costs can or should be uniquely traced to a unit of output. Because they cannot be so traced, fixed costs can only be associated to specific service types by use of arbitrary allocation. Furthermore, some cost components which are fixed in the *very* short term, or are fixed with very small changes in output, may vary over a somewhat longer period or over larger changes in output. Thus, more cost items could become variable as the time horizon is lengthened. There may also be a range of output increments over which more and more cost items will vary as the size of the increment of output increases. There is a limit to this stretching of the incremental cost concept since some costs are invariant except in the long run.¹³ The consideration of the time frame and size of output considered in determining incremental cost is essentially a management pricing and marketing decision. (The problem of identifying variable cost components will be more fully discussed later.)

Some outputs may share certain component costs of production; these costs are popularly called "common" or "joint." Although some authorities treat joint and common costs as identical, Behling provides a distinction:

Common costs are outlays devoted to either of two or more classes of services which may be variably proportioned at the discretion of management, with the result that it is, in principle at least, possible to trace them to individual services.

Joint costs, in contrast, are costs for which the proportions of output are not variable, so that supplying one class of service in a given amount results automatically in making available another class of service in some unalterable amount. The practical consequence is that incremental joint costs are not traceable to individual railroad services and can be allocated only arbitrarily. In contrast, those common costs which are incremental are traceable in principle, although it may be impossible over a considerable range to do so in practice.¹⁴

11. P. SAMUELSON, *supra* note 9, at 443.

12. *See, e.g.*, C. FERGUSON, *supra* note 9, at 113-14; J. HENDERSON & R. QUANDT, *supra* note 9, at 55-62; E. MANSFIELD, *supra* note 9, at 116-18; P. SAMUELSON, *supra* note 9, at 441-44; SYSTEMS ANALYSIS & RESEARCH CORP., COST BASED FREIGHT RATES—DESIRABILITY & FEASIBILITY 47 (1966).

13. Behling, *et al.*, *The Role of Costs in the Minimum Pricing of Railroad Services*, 35 J. Bus. 357, 359 (1962).

14. *Id.* at 359. *See also* J. HENDERSON & R. QUANDT, *supra* note 9, at 67-68; 1 A. KAHN, *supra* note 10, at 77-83; SYSTEMS ANALYSIS & RESEARCH CORP., *supra* note 12, at 49-50.

The key to the distinction between common and joint costs, lies in their traceability to output units. Joint costs are not traceable. An example of joint costs in manufacturing would be kerosene and gasoline. Both products result from a refinery apparatus and process which cannot be separated and are therefore joint. In railroads, for example, the maintenance of catenary structures which are utilized for freight and passenger service is a joint cost. Any attempt to allocate this joint cost to a particular service will be an arbitrary prorationment rule. For this reason, joint costs are irrelevant in evaluation of alternative choices. In fact, the only merit of joint cost allocation is as a method of inventory valuation under the accounting principle of full or absorption costing.

Inasmuch as joint costs by their very nature cannot be directly traced to units worked on, any method of apportioning such costs to various units produced is essentially arbitrary. The usefulness of joint-cost apportionment is limited to purposes of inventory costing. Such apportionment is useless for cost-planning and control purposes.¹⁵

Since inventory valuation is a relatively minor problem for railroads (their product is service), then even this use of joint cost allocations becomes tenuous.

C. DIRECT VS. VARIABLE COSTS

Although laymen often view direct and variable costs as identical concepts, they are clearly distinct. Horngren defines variable costs as "those which are expected to fluctuate, in total, directly in proportion to sales, production volume, or *other measure of activity*."¹⁶ Direct costs "are the costs that can be *specifically* related to particular units of output, such as direct labour and direct material costs Generally, direct costs are variable, in that they increase with output."¹⁷ But note that direct costs are not always equal to variable costs. Heiser sheds considerable light on the distinction by pointing to a direct cost which is, at least in part, fixed:

Analysis of direct labor in some companies indicates that there is a goodly sum of direct labor cost which is, in fact, fixed and will not vary with production volume. This is usually true of the highly skilled groups of workers. As a matter of fact, I know of one company employing highly skilled workers, in which the size of the labor force governs production rather than production governing the labor force. Of course, direct costing could not contemplate the exclusion of such labor cost from inventories, even though such cost did not vary with volume.¹⁸

A direct cost, then, is a cost of operating an enterprise which is directly identifiable as an input into production. Some direct costs will contain fixed and variable elements.

15. C. HORNGREN, *COST ACCOUNTING: A MANAGERIAL EMPHASIS* 372 (3d ed. 1972).

16. C. HORNGREN, *ACCOUNTING FOR MANAGEMENT CONTROL* 233 (2d ed. 1970) (emphasis in original).

17. H. WILSON, *FINANCIAL CONTROL—A SYSTEM APPROACH* 94 (1974) (emphasis in original).

18. Heiser, *What Can We Expect of Direct Costing*, in *READINGS IN COST ACCOUNTING* 316 (W. Thomas ed. 1960).

D. FUTURE-PERIOD COSTS

Perhaps a clearer picture of these concepts can be seen in terms of a definition of incremental costs to include any sacrifice of future value or any future realization of higher costs that are *causally attributable to present production*.¹⁹

The critical principle is that variable costs are not necessarily realized (i.e., paid for) at the same instant as the event which induced the costs. In economic theory, variable costs encompass any resources which are directly exhausted as the result of an incremental unit of output. Some of these resources will not in actuality be paid for until several years after the moment in which they are caused. Consider, for example, a machine whose lubrication is a function of units of output, but whose required frequencies of lubrication are such that the actual application of lubrication servicing only occurs every several years. Thus, it is an undisputed physical fact that an additional unit of output has as a variable cost an additional amount of required lubricant. But, because of the nature of servicing the machine, the *incurrence* of the expense will not be until a *future period* after the performance of the output.

These situations occur in railroading in areas such as maintenance. For example, wheel grinding, bolt tightening, painting, lubrication, tamping, and other aspects of normalized maintenance of way or equipment are variable costs which may not be realized until a year or more after the production which induced the variable cost. This point is made in order to demonstrate that variable costs in a true theoretical sense entail a short-run time horizon, but actual monetary expenditures to cover such costs may not occur for several accounting periods. Such future-period costs do not disqualify these sources of cost as being defined as variable. It is very important, however, to distinguish future-period variable costs from those costs associated with long-run investment decisions, for the latter are not variable costs. Even though variable costs are distinguished from fixed costs, if time horizons are extended so far that capital becomes variable, then investment costs become a future-period variable cost. This type of cost, though, is due to managerial adjustments of capital stocks based upon a decision-making time horizon at least as great as that required for carrying out investment expenditures. Thus, the test for variable costs is whether resources must be expended—either now or in the future—as a direct and immediate result of a change in output.

19. 1 A. Kahn, *supra* note 10, at 71. Kahn continues:

This element in variable cost is called user cost: it is the loss in the net value of a firm's assets to its having engaged in production. . . . It could be measured as the discounted present value of the additional prospective yield that could be obtained from the facilities if these were not used. . . . Or, it could be conceived as the (discounted) additional future cost of repair or earlier replacement attributable to current use.

Id. at 71 n.20. By this rationale, incremental cost is akin to both avoidable and cash-outlay cost.

The effect of this distinction is that variable costs, when defined for railroading purposes, should not include any prorations of overhead, fixed costs, common costs, or any other item of expenses over which management does not have short-run discretionary power with respect to the incurrance of these expenses. This painstaking distinction has been made in order to use complete rigor in development of the *economic* definitions of the five terms used below. With regard to accounting definitions, the distinction is, for all intents and purposes, moot since accounting systems do not, as yet, have the capability to record and match actual future-period costs with present-day events, whether they are capital costs or variable costs. Therefore, in light of the constraints of accounting technology, the future-period-incurred variable costs can only be recognized by making a special calculation—outside of the standardized costing formulas applied to accounting data—to estimate the future costs. For example, a measurement of those portions of maintenance of way which are variable with traffic might be calculated through use of major engineering or statistical studies.

E. INTERDEPENDENCE OF THE ECONOMIC CONCEPTS

The five economic concepts—variable, incremental, avoidable, and cash-outlay costs, as well as, contribution to going concern value—are all interrelated. Total variable costs are all the marginal resources required to produce a given quantity of output; they are to be distinguished from fixed costs. Incremental, avoidable, and cash-outlay are each marginal concepts of costs. Thus, these terms are the variable-type costs which must be incurred (reduced) with an addition (deletion) of a discrete change in output. Variable costs are empirically identical to these three concepts if the increment over which output is varied is equal to total output.

This equality of variable and incremental costs is exemplified by an attempt to distinguish between variable costs and incremental costs associated with discontinuance of transit privileges for grain movements to Gulf coast ports from North Dakota. No matter how the costs are compiled, the increment of providing the total service is equal to the total variable costs required to provide the distinct service. When computed from a location-specific direct cost responsibility accounting system, the cash-outlay (or incremental or avoidable) costs of the transit privileges are taken directly from the direct cost base supplied by the accounting system. In this case, the answer would be precisely the same as a variable cost computation for the same service.

Sometimes, incremental costs will specifically differ from variable costs, as computed on the basis of direct cost accounting information, when the definition of the time horizon in which costs can vary differs for the two concepts. For example, if variable costs are defined on the basis of annualized data—therefore a year-long time horizon—then, incremental costs of a managerial decision to send out an extra way freight on a particular day, will be less than the variable costs of that train as rigorously

Exhibit 1
Definitions

DISCIPLINE CONCEPT	Economic	Railroading	Accounting
Variable Costs	<i>DEFINITION:</i> Variable costs are those costs which, over a given time horizon, vary with changes in output.	<i>DEFINITION:</i> Variable costs are those present and future resources whose consumption varies as a direct result of some output change.	<i>DEFINITION:</i> Variable costs are those elements of costs which vary with output; as measured from each element of direct costs in the chart of accounts.
Incremental Costs	<i>DEFINITION:</i> Incremental cost is the present value of present and future costs incurred by the firm due to discrete changes in output.	<i>DEFINITION:</i> Incremental costs are those additional resources directly required to facilitate a finite and discrete change in output.	<i>DEFINITION:</i> Incremental costs are the total of those items of costs (as taken from each element of direct costs in the chart of accounts) that directly increase (decrease) with a discrete change in output.
Avoidable Costs	<i>DEFINITION:</i> Avoidable costs are equal to decremental (incremental) costs.	<i>DEFINITION:</i> Avoidable costs are equal to the savings in resources due to the elimination of a particular activity.	<i>DEFINITION:</i> Avoidable costs are the total of those items of costs (as taken from each element of direct costs in the chart of accounts) that directly decrease with a discrete decrease in output.
Cash-Outlay Costs	<i>DEFINITION:</i> Cash-outlay costs are the value of (including the present value of all directly traceable future) costs incurred by the firm due to discrete changes in output.	<i>DEFINITION:</i> Cash-outlay costs are those additional resources directly required to facilitate to finite and discrete change in output.	<i>DEFINITION:</i> Cash-outlay costs are the total of those items of costs (as taken from each element of direct costs in the chart of accounts) that directly increase (decrease) with a discrete change in output.
Contribution to Going Concern Value	<i>DEFINITION:</i> Contribution to going concern value is the amount by which the revenues attributable to a service exceed its total variable costs.	<i>DEFINITION:</i> The contribution to going concern value is equal to the excess of total revenues attributable to a service over the total variable costs that were incurred to provide that service.	<i>DEFINITION:</i> The contribution to going concern value of a service is the excess of revenues attributable to the service over the total variable costs that were incurred to provide the service.

computed on the basis of the accounting data. The disparity is due to the fact that the avoidable costs of the way freight are principally equal to fuel, possibly some crew expenses, and possibly per diem. If the time horizon were lengthened to one year—equal to the definition for computation of variable costs—additional cost items such as yard supervision, clerical, and equipment maintenance might all be added into the computation. Thus, as will be shown more exactly in the definitions below, variable costs are frequently empirically equal to incremental, avoidable, and cash-outlays, but not always.

Contribution to going concern value is a concept emergent from marginal notions underlying microeconomic theory. The concept is used by management to assess the viability of a particular activity of an enterprise—its marginal contribution to pay for fixed costs. Total variable costs of the entire service are netted out from its revenue contribution to the enterprise. The accompanying table in Exhibit 1 relates the definitions of all five of these concepts across each of the three disciplines.

Before commencing the definitions of the five concepts, it is important to point out that both the concepts and the three definitions for each concept are interdependent *and should be read in this context*.

III. DEFINITIONS OF THE ECONOMIC CONCEPTS USED IN THE 4-R ACT

A. VARIABLE COSTS

1. Economic Definition

Definition Variable costs are those costs which, over a given time horizon, vary with changes in output.

Because the 4-R Act requires the use of this concept in certain regulatory matters, a definition of variable costs that enables measurability is needed.²⁰

20. The concept must be a term that can be measured, not just identified. Because of the need for a workable measure of variable costs, average variable costs (AVC) will undoubtedly be required in the computation of costs associated with certain services. Ferguson provides a formal definition: "Average variable cost is total variable cost divided by output." In terms of pure economic theory, this definition is certainly an acceptable way to define variable costs. As will be discussed in the railroading and accounting definitions, the rigorous application of this term is not simple. Typically, AVC will decline with increased output, reach a minimum, and then increase. C. FERGUSON, MICROECONOMIC THEORY, 190-92 (1969).

The shape of the AVC curve is explained by the law of diminishing marginal returns, which is reflected in the eventual rise in marginal costs—the contributor to total variable costs.

Accountants arithmetically treat these costs as having a linear correlation with the applicable activity measure. In reality, this assumption can usually be made only over a small, finite range of measurement. Horngren acknowledges, however, that with a wide enough range of output shifts, variable costs are probably curvilinear. C. HORNGREN, *supra* note 16, at 238-39. This phenomenon is important because it means that average variable costs are not an accurate measure of marginal cost concepts when large changes of output are under measurement. For further discussion of average variable costs, See, e.g., J. HENDERSON & R. QUANDT, *supra* note 9, at 55-56; E. MANSFIELD *supra* note 9, at 163-71; P. SAMUELSON, *supra* note 9, at 445-47.

Variable costs should meet several basic tests; they must:

- (1) vary with identifiable changes in output and time rather than being a simple average over some *level* of output.
- (2) encompass the discounted change in *future* replacement costs *directly* due to the change in output rather than the change in book value of current assets.
- (3) not encompass portions of fully allocated costs by apportioning untraceable components of cost to costs arising from changes in output.

These are the criteria for identifying variable costs. Note that they encompass future costs directly traceable to the present production decision.²¹ They do not include costs fixed in the short run. Fixed costs are sometimes called sunk costs and are included in fully allocated cost pricing schemes. (Note also, that to the economist fixed costs contain opportunity costs of capital or normal profit.)

2. *Railroading Definition*

The definitions of variable costs in theoretical and accounting terms are highly dependent upon the identification of those costs that vary with output. Variable costs generally (but not always) have as surrogates specific direct cost items in a location-specific direct cost responsibility accounting system. Cost items that are truly inflexible with changes in output are invalid as components of variable costs.

Baumol explains:

"Fully distributed cost" refers to any method of apportionment of a company's total costs among the individual services it provides. *In addition to the costs directly attributable to a particular service on an incremental basis* (that is, those costs which are responsive to the volume of the service, including the decision to provide or discontinue the service), *it includes an allocation of the unattributable residue*-that is, those costs which are incurred in common for several company services and some portion of which *does not vary* with the volume of the individual services supplied including inauguration or elimination of the service.

The significant cases usually involve costs, portions of which are attributable directly but which involve a significant unattributable residue. This is typically true of plant which serves several company outputs in common such as the railroad track and switching equipment used by

21. The relevant incremental costs are a function principally of the prospective volume in relation to present volume and unutilized capacity in existing plant and organization. The rate over time at which the prospective volume is likely to be achieved, the prospects for its continuance over the longer term, and its distribution over stated time periods (for example, seasonality and peaking characteristics) are all relevant to the determination of appropriate incremental costs. From consideration of the prospective volume and its characteristics it may be feasible to estimate those elements of plant and organization which will require ultimate replacement, allowances for the use of which should figure currently in costs. If volume promises to build up substantially over time, the likelihood and cost of the required expansion in capacity must be recognized,

Behling, *supra* note 13, at 362 n.4. In other words, any opportunity costs in the form of a need to replace certain capital resources are variable costs if directly traceable as a result of the output.

several types of traffic. There is no economic basis on which these residual costs can be apportioned, since they cannot be attributed logically to any one service. They must be allocated on some arbitrary basis, usually on the basis of a rule of thumb selected as a convention. Thus, as just two out of many possible examples, these costs may be divided in proportion to relative revenues or relative incremental costs.

While the choice is an arbitrary one, it is of great importance to the customers of the various services and for the allocation of society's resources, because if fully distributed costs determine the price, the arbitrary criterion selected will decide which portion of a company's services will be required to charge a relatively high rate with a corresponding limitation in its sale volume.

Yet, so far as I am aware, there exists nowhere in the pertinent literature anything that can be said to resemble an affirmative analytic case for fully distributed cost. *There is never an analysis based on fundamental principles which asserts that this measure rather than any other measure is required to achieve efficiency or to prevent noncompensatory operation or to accomplish any other well-defined objective of public policy.*²²

With respect to the measurement of variable costs, the railroad industry is especially perplexing as the number of items of expense which are capable of varying with output continually expands as the time horizon lengthens:

TIME HORIZON	SAMPLE CHANGE IN OUTPUT	SAMPLE OF VARIABLE COSTS
Very short run (e.g., 8 hr. workday)	Spot an extra car	Fuel (No labor assuming no overtime)
Short run (e.g., one week)	Run an extra way freight	Fuel, crew, per diem
Intermediate run (e.g., one to five years)	Schedule a train	Fuel, crew, motive power, maintenance
Long run (e.g., ten to thirty years)	Schedule a train	Fuel, crew, motive power, maintenance, way and structures

Therefore, what accounts are variable? The answer lies in three areas:

(1) A responsibility form of direct cost accounts should *by definition* classify accounts in such a way that assignments do not occur—all expense items are identified and matched with service units of inputs. For each, it is easy to change the label from "fixed" to "variable" as the time horizon expands.

22. Statement of William J. Baumol at 12-13, 16, Determination of Compensation under Section 402(a) of the Rail Passenger Service Act of 1970, ICC Finance Docket No. 27353 (Sub-No. 1), 342 I.C.C. 820 (1973) (emphasis added) [hereinafter cited as Baumol Statement].

(2) The appropriate time horizon for defining variability is a function of the leeway of managerial discretion. If the matter relates to investment in plant, then variable costs should encompass these capital items. If the matter relates to rates, then the appropriate horizon is more probably set at the intermediate term.

(3) Even though one can identify which cost items are, in fact, variable, the computation of average variable costs is complicated by the task of defining the appropriate denominator for the averaging. This problem relates to costing; it should not be an accounting task. That is to say, what units of output or input are the best surrogates for apportioning the variable items among the disparate services they supported?

The point is that the railroads must treat in a discrete manner those costs which are variable. This objective is the crux of a direct cost accounting system. Railroad variable costs therefore, can be defined as:

Definition Variable costs are those present and future resources whose consumption varies as a direct result of some output change.

3. Accounting Definition

Definition Variable costs are those elements of costs which vary with output as measured from each element of direct costs in the chart of accounts.

Currently, corporate information systems are unable to identify and record resource expenditures as they actually occur *and* match them with units of output produced. Essentially, these systems cannot identify true marginal costs. Only when a level of a new technology in recording costs is developed will actual measurement of marginal costs on a systematic basis be feasible.

In the interim, the best available alternative is to identify those items of expense which are the components of incremental costs and then develop surrogates for identification and measurement of output directly affecting the use of these resources. In other words, the variable costs associated with a particular function must be identified.

In a direct cost accounting system, the variable cost components are identified and labeled as a supplement to the base of raw accounting data. That is to say, a classification of direct costs as either variable or fixed (or apportioned between the two) will be displayed as an addition to the accounting system. In this way, direct cost information will not be distorted by a cost accountant's arbitrary categorization of variable versus fixed. The raw data remains available for the Commission to analyze in an unfettered manner. Thus, for each proceeding, a time horizon of managerial discretion is established, and then, the segregation of variable costs can be applied. This separation should be aided by railroad-supplied reports which indicate what portion of each direct cost account is defined as variable during the annual accounting period. Such distinctions are already required since the carrier must distinguish between capital and operating expenses.

Although this separation of fixed and variable is conceptually rather straight forward, its implementation is not so easy. Ideally, for example, roadway maintenance should be divided into that which is required to bring the road condition up to a given standard (*i.e.*, recovery of deferred) and that which is continually required to keep it at a normalized standard (*i.e.*, current maintenance expense). These classifications should then be further divided into a portion which is fixed (contributes to capital stocks) and a variable or use-related portion. In practice, of course, these delineations of costs are made by bookkeepers and maintenance foremen whose allocations are likely to be less than an accurate rendition of the true economic relationship. In theory, these subdivisions should be made from the raw data by engineers and other professionals with the aid of scientific measurement and statistical tools. Even here, of course, some cost distinctions will be lost because of the technological limitations of current tools.

Even though accounting data can cope with identification of variable costs, there is a problem in applying economic theory to the management information systems using technology of the 1970's. The problem is that variable costs are not, in theory, identical to marginal costs. But, because the state-of-the-art of accounting has not achieved a level of matching variable costs with specific outputs, these costs are accumulated over a period of time and matched against a like *accumulation* of those units of output for which the variable costs were responsible for the production. By relating the output to the costs, it is possible to develop a "variable unit cost of production." Over a period of time, this measure is empirically akin to the economist's notion of average variable cost. (Average variable costs differ from marginal costs in that the marginal costs are the additional variable costs incurred to increase (decrease) output from a given level to the next finite increment of output. Average variable costs, on the other hand, are the average of all the market variable cost components divided by all the units of output during the time.)²³

23. It is theoretically possible for average variable cost (AVC) to equal marginal cost (MC). Let $AVC=f(q)/q$ where q is output. AVC reaches its minimum $d(AVC)/dq=0$. Taking the first derivative of AVC ,

$$\begin{aligned}\frac{d(f(q))}{dq} &= \frac{qf'(q) - f(q)}{q^2} \\ &= \frac{1}{q} \left(f'(q) - \frac{f(q)}{q} \right) = 0\end{aligned}$$

$$AVC = MC \text{ or } f'(q) = \frac{f(q)}{q} \text{ when } AVC \text{ reaches its minimum.}$$

Empirically in this industry, this condition can be approximated over a significant range of output because of the "flatness" of the incremental (marginal) cost curve with respect to many activities of railroad operations.

Other difficulties encountered in deriving variable costs stem from:

- (1) their curvilinear behavior over wide ranges of activity,
- (2) their variance depending on the measure of activity used,
- (3) the fact that the time horizon plays a major role in determining variability (since, in the very long run, all costs are variable), and
- (4) the fact that some direct costs may be quasi-variable, or mixed, being composed of fixed and variable portions.

Identification of variable costs is essential in deriving avoidable, incremental, contribution, and other marginal figures. Any measurement of variable costs will probably need verification through engineering estimates or statistical analyses. The process of segmenting variable from fixed within an account is most accurate if the account is comprised of homogeneous expenses rather than aggregations of expenses from several facets of the railroad's operations.

For this reason, primary accounts must be kept on the basis of direct costs—the most elementary form of accounting information. No manipulations, prorations, apportionments, or decisions with respect to variable or fixed should be done prior to recording of direct costs. Direct costs per se are not surrogates for variable costs, but they offer the raw data from which variable costs can best be developed. The identification and measurement of surrogates for variable costs will succeed, provided that the following conditions are met:

- (1) the accounting data base must consist of direct cost accounts,
- (2) the direct cost account must be sufficiently disaggregated to minimize allocations,
- (3) the direct cost account must be sufficiently disaggregated so that the relationships of the resource expenditures to outputs, reflected in those accounts, are homogeneous,
- (4) the techniques of segregating variable portions must be sensitive to the variations in time horizons and output level (activity level),
- (5) the engineering or statistical manipulations must be sensitive to changing technologies, and
- (6) direct cost accounts must be segregated by site in order that line-segment-specific variable costs will not be biased by system-wide averages.

In sum, a chart of accounts keeping direct costs will provide the best raw data base for the managerial manipulations needed to compute variable costs.

B. INCREMENTAL COSTS

1. Economic Definition

Definition Incremental cost is the present value of present and future costs incurred by the firm due to discrete changes in output.

Incremental costs are an empirical measurement of marginal costs. The former measures cost changes over finite or discrete changes in output, while the latter does the same for an instantaneous (*i.e.*, continuous and infinitesimal) change in output.

Because few production functions are continuous and because output changes are not infinitesimal, many costs can be identified only in discrete amounts. For these reasons, incremental costs are used as a practical substitute for marginal costs.²⁴ In fact, the term incremental costs is seldom used by economic theoreticians, but is used more commonly by those who translate the theory into practice. The translation of the theoretical concept of marginal to its applied approximation, incremental, is replete with pitfalls. In addition to the problem of unbundling fixed, common, and joint costs, real world outputs are not definable in infinitesimal units. Furthermore, marginal costs vary from one moment to the other due to changes in demand that alter the point on the marginal cost curve on which the firm is operating. Therefore, while the theoretical discussion of marginal cost is useful from a conceptual standpoint, it cannot be rigorously applied in practice.²⁵ Yet, perhaps the most serious problem in developing incremental costs is that of determining the future cost implications of current production activity. Such factors as changes in price level, operating techniques, and technology cannot be accurately predicted.

As will be shown below, incremental costs can be computed. Despite all the deficiencies in these rudimentary computations, there are strong reasons for using this concept in pricing. The economist can readily show that marginal cost and incremental cost are relevant in the pricing of outputs.

Incremental costs indicate (by comparison with the incremental revenues they will bring) whether additional outputs of any commodity are worth producing and (by incremental costs comparisons) which of the alternative ways of satisfying wants or requirements is the most efficient.²⁶

Marginal cost pricing is one of the most fundamental principles of the modern microeconomic theory of resource allocation.

What, then, are the relevant costs which can be properly called incremental? For the economist, the proper approach to this identification problem is to determine those costs which vary with a change in output—for a *given scale of plant*. Often in the case of small changes in output the majority of these costs are direct labor and material payments and other costs associated with varying the size or utilization of the work force. In addition, "incremental costs include cost increments associated with new investment. For example, if special equipment is acquired in order to handle certain additional traffic, the costs are incremental to that traffic."²⁷

24. 1 A. KAHN, *supra* note 10, at 66-67; P. SAMUELSON, *supra* note 9, at 444-45.

25. See, e.g., 1 A. KAHN, *supra* note 10, at 66-67; P. SAMUELSON, *supra* note 9, at 444-45.

26. Behling, *supra* note 13, at 358.

27. *Id.* at 358.

In general, incremental costs should not equal price since there are problems in estimating future costs. Indeed, there are difficulties in estimating costs due to short run incremental changes in output. Thus, incremental cost should be used as a price floor:

The application of this principle (using incremental cost as a price floor) in particular situations may require special care in estimating the pertinent incremental costs and incremental revenue. Especially in the short run they may be different from what they superficially appear. Example: the hidden incremental costs of dismissing and later reassembling a key workforce; and the hidden, foregone incremental revenue that may result in losing a profitable customer by refusing to take an occasional order below incremental cost.²⁸

As a result of these problems in estimating incremental costs, they should be carefully used as a price floor. The advent of intermodal and intramodal competition ensures that equitable prices based on incremental (marginal) costs will be sought in any event:

Since demands for rail services have become increasingly elastic as alternative means of transportation (both for hire and private) have become evermore available, the greatest total contribution to net income will for many items and hauls result from a low unit margin above incremental cost and a large volume. Estimating the volume of traffic which might move at different levels of rates and the effect on net income is a key aspect of pricing. This vital function is a primary management responsibility which should be performed on the basis of managerial and not regulatory judgment. Rates so determined, however, can legitimately continue to be subject to regulation of maximum rates and to legal rules against unjust discrimination.²⁹

In other words, railroad pricing strategy is likely to lead to incremental cost pricing anyway. Both competitive forces and the elimination of arbitrary markups designed to cover fixed assets will give the railroads sufficient incentives to change to the lowest rates possible.

2. *Railroading Definition*

Railroads must understand the importance of incremental concepts in management decision making. Cash-outlay, avoidable, and incremental costs are each empirical estimates of marginal costs, a theoretical term. This concept is critically important for management and regulators to understand. In discussing pricing of rail service in the Northeast Corridor, Baumol explains:

No advocate of incremental pricing standards has, to my knowledge, ever maintained that a private firm whose operations are not sustained by subsidy should be expected to sell its services at prices *equal* to their incremental costs. Specifically, if the operations of that firm are characterized by economies of scale, financial viability requires that it be able to sell its services at prices sufficiently above its incremental costs to permit it to cover, overall, the residue of the total costs necessary for the services it provides, plus an acceptable rate of return on its investment.

28. *Id.* at 362.

29. *Id.* at 363.

Firms operating in free markets are able to achieve such earnings if their performance is sufficiently good to meet the terms offered by competition and to make their product attractive to consumers. Their costs must, however, not be excessive, nor must the quality of their product be poor. If they fail on either of these scores, nothing will guarantee them revenues that are financially viable. That, of course, is one of the crucial features of the pricing mechanism—of the invisible hand that guides economic activities into channels and patterns that serve consumer interests effectively.³⁰

Baumol explains that "cost plus pricing"—setting rates on the basis of fully allocated costs—distorts the powers of the free market mechanism by arbitrarily assigning costs to functions. As a result, both the railroad's and society's resource allocation is affected by these arbitrary cost assignments. "Cost plus pricing" also provides no inducement for high quality performance since the supplier of service knows that costs are covered. Of course, management should set its rates at that level which maximizes profits, but profit maximization can only occur by directing attention to marginal concepts.

In any event, it is clear that a reward for efficiency virtually becomes impossible under any arrangement that resembles cost plus pricing. That sort of pricing rule is indeed the antithesis of an inducement for efficiency. It involves payment of whatever costs the supplier chooses to incur, and whatever the quality of the product he is prepared to supply. It is an open invitation to waste, shoddy performance and all the undesirable characteristics which have so frequently accompanied that sort of pricing in practice.³¹

The temptation to employ fully allocated costs is enhanced in the case of the railroad industry because relative to highway, water, and air carriers, such costs make up a disproportionately large share of total costs. Because fully allocated cost pricing schemes introduce an upward bias in the rate floor, the railroads are subject to underutilization (through over pricing) of capacity.

With the persistent and serious underutilization of capacity which is characteristic of the railroad's basic plant and organization, large amounts of fixed costs remain fixed indefinitely. The least effective way to cope with unutilized railroad capacity would be to include its fixed costs in floors for pricing. For the high prices which would result could only discourage utilization of these facilities and aggravate the condition.³²

The practice of fully allocating common and fixed costs is contradictory to a marginal cost pricing scheme and can produce substantial differences

30. Baumol Statement, *supra* note 22, at 8-9. By distinguishing cost from profit, Baumol is implicitly using the accountant's definition of incremental cost. The difference from the economist's definition is explained in a later section.

31. *Id.* at 10-11.

32. Behling, *supra* note 13, at 361.

when making pricing and service output decisions. Most economists realize the shortcomings of fully distributing fixed costs.³³

Behling further underscores this point by stating that incremental costs are the appropriate *guide* for pricing railroad services, but they are *not* the number with which rates should be equated:

As a general rule, any rate below incremental costs is both unprofitable and socially wasteful of resources because the additional (incremental) revenue obtained is less than the additional cost incurred. However, this does not mean that the railroads should set rates at that cost level or that they should be required to do so. On the contrary, this cost reference is uniquely important as a guide in determining the specific rates which will provide the maximum contribution to the overhead burden and thus to net income. The margin above incremental costs which maximizes this contribution depends upon the price sensitivity demand, *determined primarily by the alternatives available to shippers*. The judgment of management should be relied upon to make this determination, subject to limitations imposed by regulation of maximum rates and discrimination. *Thus, while incremental costs should not determine prices or rates, they set the lower boundary (and demand conditions and regulation the upper boundary) within which pricing decisions should be made.*³⁴

Based upon this comprehensive explanation of what the purposes of incremental costs are, a definition can be given:

Definition Incremental costs are those additional resources directly required to facilitate a finite and discrete change in output.

Incremental costs can be positive or negative depending on the direction of the change in output.

3. Accounting Definition

Management information systems are almost completely incapable of calculating marginal concepts. One must identify and then measure the amount of variable-type cost expenditures which occur with an incremental unit(s) of output. In addition, as the length of the accounting period for which costs are recorded and computed is decreased, the variable cost measurements more closely coincide with short run marginal costs. (An accounting period equal in length to the period for production of just one unit of output, would actually have incremental costs equal to marginal costs equal to variable costs.)

Accounting systems are also incapable of making distinctions between short run marginal costs and long run marginal costs. Accounting is completely insensitive to differing time horizons. The problem is that as the time

33. See, e.g., A. FRIEDLANDER, THE DILEMMA OF FREIGHT TRANSPORT REGULATION 24-25, 132-35, 140-42 (1969); 1 A. KAHN, *supra* note 10, at 70-75, 134-37, 150-58, 198-99; D. LOCKLIN, ECONOMICS OF TRANSPORTATION 143-46 (7th ed. 1972).

34. Behling, *supra* note 13, at 362 (emphasis added).

horizon is increased, the different components of the production function which are variable expand; but the accounting system does not have any way to indicate the components which have become variable. Therefore, the array of true variable costs widens and any computation thereof should bring in a greater number of expense accounts.

The best definition of long run marginal costs is set up by first postulating the time horizon in which costs are, in fact, variable. Then, it is appropriate to identify the direct cost accounts on the chart of accounts which are wholly, or in part, variable. From these items, long run variable costs could be calculated; however, this measure is not in consonance with true economic variable costs because the accounting system does not: (1) match items of expense that will occur in the future to the units of output which are directly responsible for the future costs or (2) compute such costs on the basis of replacement costs.

In other words, long run marginal (incremental) costs are almost impossible to compute purely on the basis of accounting data because it is necessary for one to determine what is actual incremental quantities of fixed and semi-fixed inputs which vary with production. In railroading, this means one must identify how much additional investment in plant and equipment is needed to accommodate given additional outputs:

- (1) a ton of freight in a car,
- (2) a car over a line segment,
- (3) a line segment in a system,
- (4) a train,
- (5) a track in the system, or
- (6) a locomotive in a train.

Despite these difficulties, the need for understanding and estimating incremental costs—whether long run or short run—is undeniable. Because it measures the change in total cost of some increased activity, "it is an important measure, since the process of decision making is essentially one of choosing between alternatives."³⁵ The quality of the decision made, then, will largely be a question of the accuracy of the variable costs involved. As previously explained, the inability of present systems to measure true variable costs, compels us to rely on the more workable concept of average variable cost.

Variable costs, where averaging occurs, is an imperfect substitute for incremental cost because:

average variable cost [is] averaged over some period of time in the past and assumed to remain constant over some period in the future—until there occurs some clear, discrete shift caused by an event such as a

35. H. WILSON, *supra* note 17, at 94.

change in wage rates. But since short-term average variable costs . . . are never as large as average total costs . . . , universal adoption of this type of pricing is infeasible if sellers are to cover total costs, including (as always) a minimum required return on investment.³⁶

That is, there is no possibility that average fixed costs will be covered by the price unless a markup over average variable costs is established. This "deficit" explains the common tendency to use a fully allocated cost pricing scheme. In that case, costs which are fixed over a long period of time would be included in the concept of variable cost. The dangers inherent in such practices have been fully documented above. Therefore:

Definition Incremental costs are the total of those items of costs (as taken from each element of direct costs in the chart of accounts) that directly increase (decrease) with a discrete change in output.³⁷

This workable definition of incremental costs once again underscores the necessity for development of a direct cost accounting system. In order to calculate an incremental cost, it is necessary to identify the relevant direct cost accounts,³⁸ and then through statistical or engineering studies determine those portions which are variable (for the given time horizon) with additional units of output.

The time horizon underlying the managerial decision fundamentally influences which direct costs (or portions thereof) will be variable. Therefore, it is critical that an accounting system store and display direct costs in order that varying time horizons can be used in a diversity of analyses. It should be kept in mind that it is not a simple procedure to convert direct costs into variable and fixed components. With maintenance-of-way crew expenses, the foreman can, in fact, make an estimate of those portions which should be capitalized and those portions which should be expensed, although such estimates will be arbitrary. But rigorous studies of these costs are difficult to implement; and furthermore, they require much more sophisticated engineering statistical analyses than may be immediately apparent. For example, the time horizon factor can mean that certain direct cost accounts will be totally fixed in short time horizons but will become increasingly flexible as time horizons lengthen. Also, it is possible that the variable cost relationships are not just simple linear arithmetic functions of output, but may have much more complex factors influencing their incurrence.

36. 1 A. KAHN, *supra* note 10, at 84.

37. Accounting texts rarely use this term; therefore, no authoritative accounting discussion of the subject was found.

38. Economists develop their pricing theory—where marginal revenues and marginal costs are equated—with "normal profit" computed into the cost curve. In this way, when an equilibrium market situation is achieved, the supplier earns a "normal" profit. However, accounting systems do not reach the same solutions since their computations of "costs" do not have an imputed normal profit figure.

C. AVOIDABLE COSTS

1. Economic Definition

It was mentioned above that avoidable cost³⁹ is akin to the notion of incremental cost. The distinction is that the term "avoidable cost" is usually employed with regard to retractions of service (decreases in output). That is, it is usually thought of as a decrement; but the concept and method for deriving avoidable cost are the same as those for incremental cost, and therefore, it is perfectly acceptable to use this term for analysis of positive changes in output. Bear in mind "the difference between costs of expansion and costs of regression. For short periods of time, unit costs of expansion may be quite unrelated to costs of shrinkage."⁴⁰

Definition Avoidable costs are equal to decremental (incremental) costs.

Avoidable costs still include the discounted future cash-outlay costs avoided through a discontinuance. (A more rigorous discussion of avoidable costs is contained in the following section.) The method for calculating incremental and avoidable costs is the same, but the numerical value of each may be different in any given case. The distinction between incremental and avoidable costs can be further clarified in the following example adapted from Baumol.⁴¹ Suppose a railroad has just been faced with the proposition of discontinuing a service which obligates it to spend \$100 next year and \$200 two years from now, but if service were discontinued, its obligation would be \$25 per year. The avoidable cost would then be the present value of \$75 (\$100-\$25) discounted one year plus \$175 (\$200-\$25) discounted for two years. Now, alternatively, assume that the railroad wants to double the service instead of discontinuing it. There is no guarantee that the incremental cost would equal the avoidable cost. That is, if the railroad is not subject to constant costs, the incremental cost could be above or below the avoidable cost of an equal amount of service. The reader may balk at this example on the grounds that a comparison between unlike things is being made. That is, increasing or decreasing service by the same amount results in the firm being on different portions of its production function. That is correct; the example only serves to indicate the proper occasion for the use of the two concepts.

In conclusion, avoidable costs are an empirical measure of marginal costs that will decrease (increase) through a finite and discrete reduction (expansion) in output. They are simply incremental costs for a negative change in output. In sum, avoidable costs are another applied form of marginal costs.

39. Avoidable cost is a "word of art" unique to the railroad industry and is therefore virtually unheard of in economic literature.

40. SYSTEMS ANALYSIS & RESEARCH CORP., *supra* note 12, at 47.

41. Reply Statement of William J. Baumol at 13 n.1, Determination of Compensation under Section 402(a) of the Rail Passenger Service Act of 1970, ICC Finance Docket No. 27353 (Sub-No. 1), 342 I.C.C. 820 (1973) [hereinafter cited as Baumol Reply Statement].

2. *Railroading Definition*

Avoidable costs are an important concept in railroading because of the tremendous amount of resources sunk into fixed plant and structures. As a result, the difference between average total costs and average variable costs will be substantial. Furthermore, if management is to pursue rational policies in pricing and output, then it should fully understand these differences.

In railroading, avoidable costs are precisely equal to incremental costs. In semantic terms, avoidable costs are thought of as negative increments (decrements), but conceptually the two are identical.

Baumol describes this term in the railroading context:

Avoidable cost in our plan serves merely as a benchmark, as an initial point for purposes of calculating compensation level. Its virtue for this purpose is that it is well defined on a firm basis of economic analysis and, since it requires no allocation of unassignable costs, it is not subject to the arbitrary choice of basis for allocation selected to suit the purposes of the user at that particular moment.⁴²

Furthermore, Baumol proceeds to set forth a rigorous definition:

It may be useful at this point to offer a definition of the term "avoidable cost" in the sense it is used by economists. The *avoidable cost* of a service is *the present value of all savings in current and future cash outlays that would be realized by the supplier if he were to discontinue that service*. That is, if continuation of the service obligates him to an outlay of \$100 next year and \$200 the following year, while if he were no longer to provide it he would be left to pay only \$25 a year because of contracted arrangements, the avoidable cost is $\$100 - \$25 = \$75$ discounted for one year, plus $\$200 - \$25 = \$175$ discounted for two years. Note that this figure will normally include at least some portion of common cost; e.g., if at the reduced scale of its overall operations the firm requires only 60 instead of 100 maintenance men (who each in fact now serve several company activities), then . . . 40 maintenance men constitute an avoidable cost [A]voidable costs include appropriate capital outlays. If the service in question requires investment in a new machine next year, then presumably the cost of that investment will be avoided if the service is discontinued.

Avoidable cost is a particular type of the more general category of *incremental cost*. It is the incremental (decremental) cost where the two alternatives whose costs are compared are the continuation of the service on current terms versus elimination of that service.⁴³

Note the use of the term "cash-outlays" above; Baumol relates avoidable as equal to cash-outlays that occur through time. In essence, avoidable costs are analogous to a cash flow statement (present valued) relating the cash (and equivalents) changes attributable to elimination of a particular asset or service.

42. *Id.* at 13.

43. *Id.* at 13 n.1 (emphasis added in part).

Definition Avoidable costs are equal to the savings in resources due to the elimination of a particular activity.

3. Accounting Definition

At this point, an overall view is appropriate. This discussion of definitions of avoidable, incremental, and variable costs have all focused upon the feasibility of collection of and calculation from the proper data base. It is impossible, by definition, to calculate any of these marginal notions for a Class I carrier if the data base is an aggregation of systemwide expenses. Avoidable costs⁴⁴—actual variable inputs—cannot be computed if the direct costs of the service in question are not available. Therefore, for a rate proceeding on a service over a particular route, abandonment of a line, or a separate price for a distinct service, avoidable (incremental and variable) costs can only be determined if carrier data is disaggregated to logical cost centers.

Definition Avoidable costs are the total of those items of costs (as taken from each element of direct costs in the chart of accounts) that directly decrease with a discrete decrease in output.

Note that although this definition is similar to the economic definition, the accounting treatment of avoidable cost will differ significantly from the economic treatment in three respects:

First, any chart of accounts will not directly consider any present value or cash discounting of future-period avoided costs. Accounting systems rely on historical cost since they are a repository of records of the past. As a result, the forward-looking present value methods are outside of today's accounting techniques.

Second, avoidable costs derived from accounting records are generally blind to opportunity costs.⁴⁵ Because accountants try to avoid "creation" of costs, a cost must typically meet the test of having been the result of a transaction. Since opportunity costs are seldom a transaction at all, accounting systems do not recognize them.

Third, in economics, cost measurement is not constrained by discrete time periods, as it is in accounting. As a result, typical accrual expenses (e.g., depreciation) are unnecessary in the economist's world. The economist recognizes this cost at the instant the resources are accrued. Accountants, on the other hand, record these costs when the "transaction" occurs to pay for the expense. An accrual system tries to at least emulate true economic cost behavior by setting up surrogates (e.g., time, output) by which to charge expenses in a systematic way. This transition between cost

44. Avoidable cost is a term unique to railroading and is therefore virtually unmentioned in general accounting literature.

45. An exception is in the public utility field, where an opportunity cost for corporate funds tied up in a construction venture can be capitalized as a cost of that project.

and accrual must be carefully considered when evaluating projects in both the economic and accounting modes.

Despite these distinctions, avoidable cost to the accountant remains that cost which can be avoided by discontinuing or cutting back output. The difference with the economist lies in the scope and measurement of the costs involved.

Because many abandonment and rate change proceedings hinge upon incremental concepts pertaining to a small subcomponent(s) of a firm's total activities, the carrier must compile direct costs for particular line segments. As one can readily imagine, many regulatory proceedings focus on services that are not accurately characterized by total variable costs for a given line segment (much less the entire system).

For instance, an abandonment of a five-mile nodal end of a light density line with only a nominal amount of traffic most certainly has higher switching costs for local freight service than the average variable costs for switching for the entire line segment (as defined by the carrier's accounting system.)

The solution to this sort of problem, which ought to be sanctioned by the Commission, is to permit the carrier, when the carrier so chooses, to perform a special study to collect the actual variable costs associated with the individual service under scrutiny before the Commission. In other words, a study *based upon a direct cost data base* should be prepared to compute the avoidable costs of the activity.⁴⁶ Thus, if the carrier seeking to abandon a short light density line segment cannot demonstrate with line-segment-specific costs that abandonment is warranted, then *the carrier should proceed to keep a record of the actual direct costs of providing service to that line segment*. Such a special study might show that the switching minutes per freight car terminated is much higher than variable costs as averaged over the entire line segment.

These special studies can be conducted by redefining the line segment records in the accounting system to record the direct costs for the five-mile light density line. Alternatively, the carrier might wish to conduct the special study in a different way—a time study of the actual labor and equipment resources required to perform a given service unit of output for the service. This approach manually computes actual variable costs of a subcomponent of a line segment so that those subcomponents with higher costs can receive rates more reflective of true economic marginal costs. If a special study is to be sanctioned as a valid way to calculate avoidable costs, then the following procedural issues must be addressed:

- (1) Under what circumstances is a special study permissible?
- (2) What methodologies for a special study are acceptable?
- (3) How should a special study be audited?

46. Such studies are now conducted at some railroads with location-specific accounting data.

- (4) What other parties should be permitted to conduct independent special studies, and/or audit the carriers?
- (5) Upon whom should the burden of proof be placed with respect to proving the findings shown in the carrier's (other's) special study?

To summarize, the special study probably needs to be used in order to prevent the same misfortune happening in the future as has happened elsewhere with Rail Form A. That is, the litigants in a proceeding would not be constricted to rigid, unyielding reliance upon costs averaged over an operating unit not necessarily reflective of that under scrutiny in a proceeding.

D. CASH-OUTLAY COSTS

1. Economic Definition

The phrase "cash-outlay" is not part of the typical parlance of economists. "Cash" is thought of as a resource in the assets of the enterprise, but it is not typically referred to as a surrogate measure in the identification of costs. Of course, when one discusses the idea of cash-outlay, the rational approach is to take those items of cost which are directly incurred in response to incremental output. In other words, cash-outlay is another term connoting marginal costs.

With respect to establishing a time frame in which costs are able to vary, the decision horizon becomes the determining factor. Cash-outlay can be interpreted to mean those short-term variable costs which are typically paid for by cash or cash equivalents. In this case, fixed costs are decidedly excluded from the measure. A broader notion of cash-outlay (and that favored by us) would include an opportunity cost and would require discounting future cash-outlays to their present value.

Baumol ties the avoidable and the cash notions together in his definition of avoidable costs, from which the following statement is an excerpt: "The *avoidable cost* of a service is the present value of all savings in current and future *cash outlays* that would be realized by the supplier if he were to discontinue that service."⁴⁷ Essentially, cash-outlay is a short-term cost phenomenon measured directly from variable costs. (We recommend the adoption of the short-term marginal cost approach in which the opportunity costs of equipment are unequivocally defined as relevant cost to be included in the computation.)

Definition Cash-outlay costs are the value of costs (including the present value of all directly traceable future costs) incurred by the firm due to discrete changes in output.

47. Baumol Reply Statement, *supra* note 41, at 13 n.1.

2. *Railroading Definition*

The notion of cash-outlay is not yet part of the parlance of railroad economics. It is likely that many people will confuse this concept with out-of-pocket costs. However, there are several important clarifications which should be made with regard to establishing an operative definition of cash-outlay. First, the context of using the term in the 4-R Act is sufficiently vague so that the concept could be interpreted to mean short-run marginal costs or long-run marginal costs. Either way, it is an incremental concept but the identification of the appropriate time horizon is at issue.⁴⁸

We recommend that cash-outlay be defined as short-run marginal cost explicitly *including* the opportunity cost (if any) of equipment involved in the service.⁴⁹

We further recommend that any definition of this motion which is eventually implemented in a rulemaking should contain the flexibility to include capital costs *which can be identified as being variable* with the institution of the distinct service for which the costs are being computed. Therefore, if the distinct service entails the addition to, deletion from, or modification of the capital assets of the railroad, then this resource expenditure should be incorporated into the calculation.⁵⁰ Strictly speaking, this definition is not identical to short-run marginal costs or variable costs.

Definition Cash-outlay costs are those additional resources directly required to facilitate a finite and discrete change in output.

3. *Accounting Definition*

The defining of this term for accounting purposes should be done carefully if the regulator expects to receive accounting data useful for regulatory decision making. The word "cash" should not be rigorously interpreted to mean only items of expense against which cash expenditures are traced. Rather, the concept should encompass all direct items of ex-

48. This issue is definitely not insignificant, because the arithmetic of calculating surrogates for long-run and short-run incremental costs brings about decidedly different results. The lengthening of the time horizon from short- to long-run converts many "fixed" or "common" costs into the direct cost category; i.e., they are variable with shifts in output.

49. The installation of the notion of opportunity costs of equipment must be coordinated with the rulemaking on peak and seasonal period pricing. If the ICC opts for a policy of peak period pricing based upon opportunity costs for equipment, then the information systems required to collect the relevant data to administer the peak period pricing will be compatible with the information required herein. However, if the ICC decides not to pursue this policy, then a revision of the opportunity cost provision should be performed.

50. The measurement of capital costs which vary with the provision of the distinct service may develop in to a controversial issue subject to litigation. For example, other carriers protesting the "low rates" of a carrier seeking to set up a separate tariff for a distinct service could counter the proposed rate by contending the measurement of cash-outlay has failed to take into account certain "identifiable" capital costs. In order to grant the railroads the maximum flexibility in pricing policy, the burden of proof should be placed upon the protestant to demonstrate that the carrier's computation of incremental capital expenses is in error—provided, however, that the carrier seeking to include certain capital expenses as varying with provision of the distance service must fully document the computations by including an explanation as to what use these capital items will be employed.

pense against which cash or cash equivalent resources have to be allocated for their replacement. In terms of the location-specific direct cost responsibility accounting system, cash-outlays—a marginal cost concept—are very simply identical to incremental costs.

As with avoidable costs, although the accounting and economic definitions of cash-outlay costs are quite similar, their differences involve recognition of present and future costs (as opposed to accounting's need to identify a transaction) and accounting's accrual methods, which may recognize an expense at a time different from the actual economic consumption of resources. As with incremental and avoidable costs, an accountant's measurement of this concept is usually exactly equal to variable costs for the service. In sum, a marginal cost concept turns out to be equal—when measured—to variable costs.

Definition Cash-outlay costs are the total of those items of costs (as taken from each element of direct costs in the chart of accounts) that directly increase (decrease) with a discrete change in output.

E. CONTRIBUTION TO GOING CONCERN VALUE

1. Economic Definition

Economists do not regularly use the term "contribution to going concern value," but the concept has a solid rooting in economics. These roots are best understood by looking at how this term has been used in a management context, especially with regard to the railroad industry. (Specifically, refer below to the railroading definition of this term.)

For an activity to contribute to the going concern value (GCV) of a firm, it must generate total revenues exceeding total variable costs, as shown on the graphs in Exhibit 2. In short, any contribution to fixed costs by the service is construed to enhance the viability of a firm and thereby satisfy this definition. Friedlander explains why contribution to going concern value is applicable to railroads: "So long as the demand is sufficient to cover short run average variable costs, it will pay the railroad to carry the traffic and thus earn some return on its overhead."⁵¹ This view, of course, is equally applicable to all industries which face the necessity of covering fixed expenses.

Contribution to going concern value is usually calculated over the duration of an accounting period. In other words, purely marginal relationships are not applicable. It is acceptable to calculate the difference between revenues and costs for incremental periods; i.e., a discrete interval may be set and then the costs and revenues which occurred would be measured.

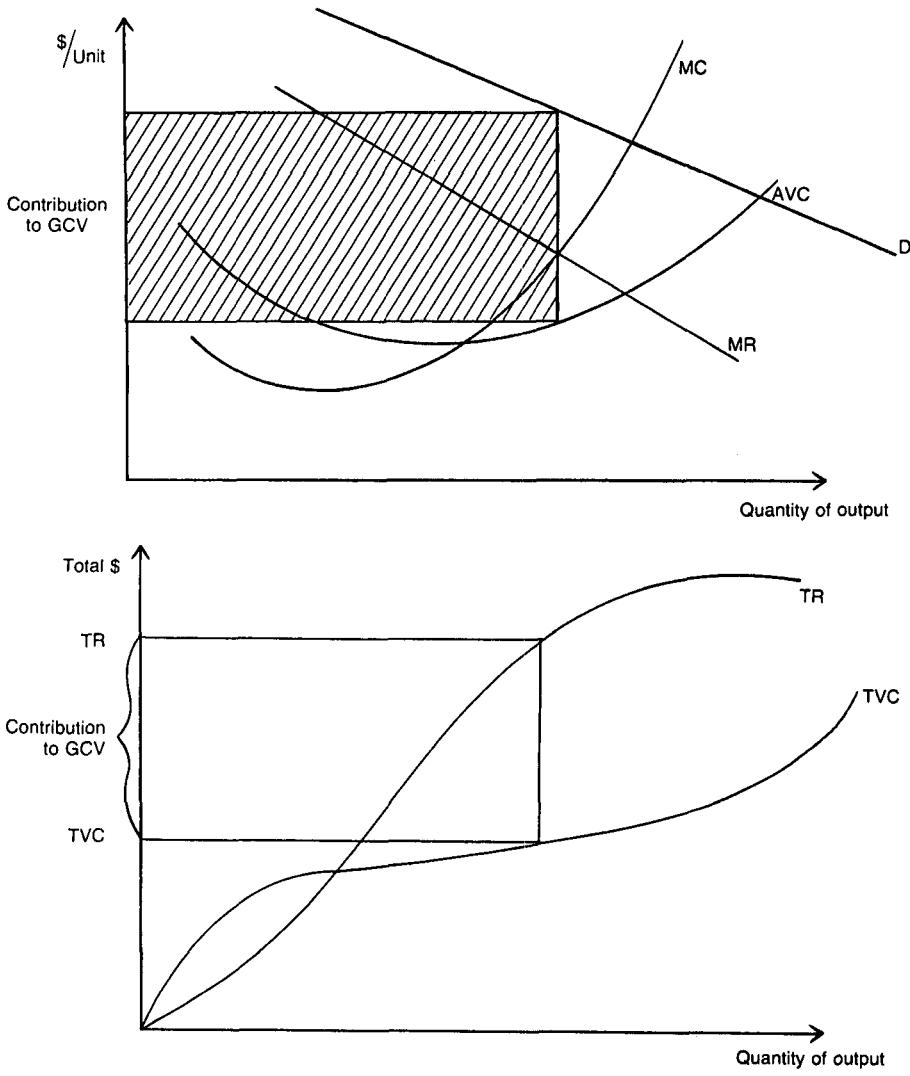
Baumol elaborates on this point by defining the benchmark at which noncompensatory pricing takes place. When prices are compensatory, as defined by Baumol, then a positive contribution to going concern value occurs:

51. A. FRIEDLANDER, *supra* note 33, at 134.

The bench mark that is appropriate for the prevention of such non-compensatory pricing follows by straightforward reasoning from the logic of the issue. If revenues are to make it more profitable to continue to supply the service than to abandon it, then they must *at least* be equal to avoidable costs. Thus avoidable costs serve logically as *the* standard of base payment level necessary to avoid noncompensatory pricing.⁵²

Based upon these principles, the contribution is the excess of total revenues over total variable costs, as the bottom graph in Exhibit 2 demonstrates.

Exhibit 2
Contribution to Going Concern Value



52. Baumol Statement, *supra* note 22, at 7.

Definition Contribution to going concern value is the amount by which the revenues attributable to a service exceed its total variable costs.

An important note should be set forth with regard to policies using this concept: A contribution to going concern value exists whenever total revenues exceed total variable costs. However, one must be very careful in analyzing *changes* in contribution to going concern value between past and future policies. For instance, if a railroad is faced with loss of traffic due to emergence of a new competitive force, the carrier, in order to earn at least some contribution, may be rationally compelled to reduce its rates so long as it still earns a positive contribution to GCV. Since the alternative would be lose the movement altogether—a condition with zero contribution—the carrier will accept a negative change in its position in order to avoid an even worse situation.

In other words, the marginal contribution to GCV due to the defensive rate change is positive when the new contribution is properly compared to the contribution to GCV (zero) which occurs without the rate reduction. Therefore, the comparison of former contributions against the contribution after a defensive rate change would show a negative shift, but such a comparison is fundamentally irrelevant since the choice faced by management is either preserving the rates and losing the haul or cutting rates and making some positive, but reduced, contribution. Finally, it should be pointed out that implicit in an economist's view of cost is an allowance for a normal profit (opportunity cost). Therefore, in equilibrium, where total cost equals total revenue, profit is being earned. Under this condition, then, the economist's view of contribution margins will differ from the accountant's because normal profits are included in the economist's cost definitions, while they are excluded from the accountant's definition.

2. *Railroading Definition*

A substantial amount of case law in railroading has been written that establishes a meaning for contribution to going concern value.⁵³ This notion is a benchmark concept in the valuation of railroad properties during reorganization proceedings pursuant to section 77 of the Bankruptcy Act.⁵⁴ Furthermore, the bankruptcy judge in a section 77 reorganization is typically called upon to make findings with respect to the "going concern value" of the equity securities to be issued in a reorganization plan to the claimants of the estate.

In these proceedings, it must be demonstrated that an enterprise generates enough cash from operations to satisfy senior debt obligations and still leave an adequate prospect for payment of dividends on capital stock. In other words, the asset under scrutiny by the court—the reorganized railroad—must have revenues exceeding expenses adequate enough to

53. See *New Haven Inclusion Cases*, 399 U.S. 392, 482 (1970).

54. 11 U.S.C. § 205 (1970).

ensure a reasonable prospect for tangible value for the equity in the new company. Therefore, in this particular calculation, dividends are the definition of "overhead."

The court looks to this concept because section 77(e) of the Bankruptcy Act states:

The value of any property used in railroad operation shall be determined on a basis which will give due consideration to the *earning power* of the property, past, present, and prospective, and all other relevant facts. In determining such value only such effect shall be given to the present cost of reproduction new and less depreciation and original cost of the property, and the actual investment therein, as may be required under the law of the land, in light of its *earning power* and all other relevant facts.⁵⁵

The "earning power" concept is the root of much of the law in this area.

With respect to valuation of a particular individual asset component of a railroad, "contribution to going concern value" measures the present value of the net operating cash flows generated by the asset. These operating revenues are first applied against the variable expenses of the asset. All cash flows in excess of these variable costs contribute to the defraying of fixed expenses and then to profits of the rest of the enterprise.

There are two basic methodologies, based upon different principles, that could be used to calculate these "contributions:"

Segregation Studies

In such studies segregated earnings are determined by partitioning the transportation entity into selected units, or in many cases mortgage districts, and then allocating revenues and expenses to such units on a formula basis. Such studies develop the earning power of each segment as part of the transportation entity of which it is a part and include its share of costs for overhead and existing inefficiencies. The total of the earnings for all of the segments equals the earnings of the entire entity. Segregation studies have been used in Section 77 reorganizations, as an allocation method involving securities between various lines of equal rank.

Severance Studies

Severance studies develop the earning power of an operable segment on the assumption that it has been severed from the remainder of the property. Severance earnings may support a higher value than would be found by a segregation study if the unit were to remain a part of the transportation entity of which it is a part. A severance study is a means of calculating the loss of earnings to the remainder of the transportation entity if the unit under study is severed. The results of such studies may also be used to measure potential value to an acquiring carrier.⁵⁶

Though no completely steadfast statement can be made, severance studies indicate the contribution to going concern value based upon incremental or avoidable costs. Segregation studies measure the term based upon the averaging of system-wide expenses and the assignment of certain fixed costs.

55. *Id.* § 205(e).

56. Shannon, *Methodology of Valuation*, CORPORATE REORGANIZATION REPORTER (PENN CENTRAL) 16:1450 (1975).

A severance approach to computation of contribution to going concern value is consistent with definitions in this paper. Furthermore, any capital costs directly incurred in order to produce the output should be classified as a relevant expense to be netted⁵⁷ in the cash flow calculation before the present valuing step. We suggest that the notion of contribution to going concern value should be promoted as a purely short-run concept whereby financing should not be netted out of the contribution. This interpretation lowers the threshold at which the rate qualifies as satisfying the contribution criteria. Encompassing all these notions:

Definition The contribution to going concern value is equal to the excess of revenues attributable to a service over the total variable costs that were incurred to provide that service.

3. Accounting Definition

Contribution analysis has long been a valuable tool of managerial accountants. Although a discussion of its merits can be found in many sources, Wilson's was the best encountered. He explains why contribution analysis is essential:

The contribution concept is of vital importance . . . and represents the difference between the selling price and the variable cost of an item. It is, in fact, the contribution that the sale of a product makes to fixed costs and profits after having covered the avoidable costs of making that product. This point indicates the realistic perspective of [contribution] analysis in not attempting to allocate common costs to units of output, since the possibility of volume variations renders a unit total cost, with its associated gross profit margin, meaningless.⁵⁸

In addition to pointing out the need for an unbiased data base for decision making, Wilson elaborates on the advantages of contribution analysis:

[It is a] background information device for important decisions, such as selecting distribution channels, make or buy, and pricing decisions. In this role it offers an overall view of costs and sales in relation to profit planning, and also provides pointers to possible changes in the firm's strategy.

Its other values include:

- (a) furnishing a simple means of evaluating current profit levels by showing the profit performance adjusted for volume;
- (b) providing a useful tool for calculating rapidly effects on costs and profits of changes in volume, and other analyses that are highlighted by such points as:
 - (i) a change in the selling price or the variable cost rate alters the break-even point as well as the contribution margin ratio,
 - (ii) other factors being equal, a change in total fixed costs alters the break-even point by the same percentage, and the net profit by the same amount,
 - (iii) the larger the margin of safety, the greater can be the fall in sales before losses are incurred, and so forth;

57. Charged against revenues generated by the asset or service.

58. H. WILSON, *supra* note 17, at 135.

- (c) demonstrating graphically the approximate sales volumes at which the company will lose money, and at which it will achieve its profit objectives;
- (d) planning and controlling profits and costs; and
- (e) providing cost and revenue estimates and comparisons that help to answer various managerial problems.⁵⁹

We recommend the furtherance of the contribution to overhead concept calculated on the basis of the severance methodology (both of which are set forth above in the economic and railroading definitions respectively).

The accounting profession has two sides with respect to the reporting of contribution to overhead; Hawkins discusses them:

Under below-capacity conditions, it is debatable whether or not a fair portion of general manufacturing overhead should be charged to the cost of assets constructed for a company's own use. The arguments for charging a portion of general manufacturing overhead include: (a) the current loss from idle capacity will be overstated unless a cost for the idle capacity used for construction is capitalized; (b) the construction will have future benefits, so all costs related to acquiring these benefits should be deferred; and (c) the construction project should be treated the same as regular products, which are charged with general overhead.

The principal arguments opposing this point of view are: (a) the cost of the asset should not include general overhead costs that would still have been incurred in the absence of the construction; (b) the general overhead was probably not considered as a relevant cost in making the decision to construct the asset for the company's own use, since the costs would be incurred irrespective of whether or not the asset was constructed; (c) by capitalizing part of the general overhead, current income will increase due to construction rather than the production of salable goods; and (d) it is more conservative not to capitalize general overhead.

Increasingly, the practice of charging fixed assets constructed for a company's own use with general overhead on the same basis and at the same rate as regular goods produced for sale is being adopted, irrespective of the prevailing capacity conditions. This trend reflects a movement away from conservatism for its own sake and a growing concern for the proper allocation of costs to reduce distortions of periodic income due to undervaluation of assets or overcosting of inventory.⁶⁰

For useful regulatory assessments, it is almost imperative that the Commission rely upon the variable-cost-only philosophy for computing contributions to going concern value, since allocated overhead is seldom incremental or avoidable. Hawkins' recommendations are fine for financial reporting purposes, but as he recognizes, managerial decisions do not apportion overhead to any contribution decision. Therefore:

Definition The contribution to going concern value of a service is the excess of revenues attributable to the service over the total variable costs that were incurred to provide the service.

59. *Id.* at 139.

60. D. HAWKINS, FINANCIAL REPORTING PRACTICES OF CORPORATIONS 216-17 (1972).

IV. CONCLUSION

When we originally embarked on this research, we were not aware of the tremendous importance of nuance in technical language when it is applied to law. As economists, we felt we had a thorough understanding of these terms and that we were "right." However, the more involved we became, the more obvious it was that we had to be extremely careful in establishing definitions that were also satisfactory to an accountant or a railroader, yet at the same time maintained a consistent meaning between the three disciplines. The research program, as a result, consisted of many hours of arguments over how one would interpret a particular term, and whether a given principle was conveyed to each discipline.

These key terms of the 4-R Act are now understandable on a common ground by all of the interested parties. This process should assist the Commission in developing definitions that are based on sound theoretical grounds. Hopefully, our efforts advanced the communication between these specialized disciplines.

Finally, many of the lessons derived from this process are readily translatable into the words of art used in other transportation modes. The principles are the same, the economic phenomena are similar, and the need to establish understandable economic regulation must be satisfied.