# How Arbitrary Is "Arbitrary"? — or, Toward the Deserved Demise of Full Cost Allocation

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The authors of this article observe that an effort to deregulate some of the activities of a regulated company while continuing to subject other activities to a rate of return ceiling may lead utility regulators back to a full allocation of cost approach to regulation which has been discredited by marginal and incremental cost analysis. In a series of hypothetical and actual examples they demonstrate the futility of efforts to allocate joint and common costs or investments between various services or products of the same firm. They conclude that if a firm is to be partially regulated and partially unregulated, rate base and rate of return as the basis of regulation must be abandoned.

Recent moves toward deregulation of a number of industries have, paradoxically, brought with them a resurgence in regulatory reliance upon the discredited accounting device referred to as "full allocation" or "full distribution" of the fixed and common costs of the regulated firm. Despite a number of reasoned moves in Congress and the courts in the direction of a marginal and incremental analysis that economics so clearly suggests, regulators seem vulnerable to entrapment into readoption of the full allocation approach by their attempt to deregulate some of the firm's activities while continuing to subject the remaining activities of the enterprise to a rate of return ceiling. Whenever there are costs and investments common to the regulated and the unregulated activities only some sort of arbitrary apportionment (allocation) of these between the two sets of activities can permit the calculation of a number that *pretends* to approximate the "true" rate of return on the regulated outputs.

This article briefly reviews the burdens upon consumers and the public generally that are likely to result. However, its major purpose is to puncture the legend that a fully allocated cost calculation produces numbers approximating any substantive economic magnitudes. We will show that different and equally plausible allocation criteria yield shockingly different numerical results, so that by judicious choice of allocation criterion, the partisan calculator can make the process yield virtually any numbers he chooses (in advance) to obtain.

### Full Allocation and Sequential Deregulation

If a rate base and rate of return standard is used to

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govern the regulatory process, there is really no alternative to full allocation of costs and investments, given a decision to divide products of a firm which are closely related in their production into an unregulated portion and a regulated one. Where the activities of a firm benefit from substantial common investments or substantial common outlays (or both), there is no way to calculate a rate of return for any or all of the company's individual activities, one by one. Indeed, the difficulty is not that we cannot determine these numbers, but that such numbers themselves are necessarily figments of the imagination. An example will make this clear.

Imagine two processes, each of which requires its own machine, each costing $1 million, and that both processes require a superclean atmosphere which a $3 million item of equipment can simultaneously provide for the two activities. The bulk of the firm's investment is obviously devoted to the air purifier, and its cost is therefore the key component in a calculation of the company's overall rate of return. But who other than a medieval theologian can pretend really to know what portion of the firm's air purifier investment is truly to be ascribed to each of the firm's products? The truth of the matter is that the $3 million investment is ascribable totally to the two products together, and that no *particular* percentage of the investment may be ascribable more defensibly than some other percentage figure to either of the products by itself. But without knowing what portion of the firm's total investment is properly attributable to either product it is impossible to calculate a rate of return on either product by itself. Indeed, no meaning can really be given to the concept.[1]

If regulatory rules nevertheless require the undefinable to be defined, the only option open to those who must comply with the rules is to adopt some arbitrary device, usually dressed up to give it an appearance of reasonableness — an arbitrary rule that divides up indivisible investments and costs. This, of course, is what full allocation means.

But an arbitrary division criterion produces just the sort of results the term "arbitrary" implies. Depending upon the conventional criterion chosen for the division of investments and costs, one will obtain widely differing results from the calculation. It is generally acknowledged that the result will be affected by this choice. But there seems to be an impression that any such calculation, if carried out with sufficient care, will yield a reasonable approximation to some underlying true figure. That impression is totally unfounded. We have already shown here that where the common component of cost and investment is substantial, there is no such thing as the "true" rate of return on a portion of the firm's activities. But, in addition, although it is not generally realized, changes in the basis of allocation can make an enormous difference to the results that emerge, as will be demonstrated presently. In other words, one can have

absolutely no confidence in the results obtained from any such calculation. Moreover, the numbers that emerge readily lend themselves to manipulation by any interested party through selective choice of basis of allocation.

### Social Costs of Regulatory Reliance on Full Cost Allocation

As a result of the arbitrariness of full cost allocation, only increased problems for rational regulation, for the regulated firm, and for the public, can follow from any attempt at partial or sequential deregulation while continuing to control what purports to be the rate of return of the portion of the company that remains under regulation. As we have seen, such a course of action makes arbitrary allocation of investments and costs inescapable. Because of the arbitrariness of such a process and the extreme volatility of its results when the basis of allocation is changed, one can be confident that it will lead to a profusion of protracted disputes over the figures and the shares of the joint and common costs that are to be recovered from different groups of ratepaying customers of the firm.

In addition, as deregulation proceeds, increasingly fine definitions of services will undoubtedly have to be employed, and the demands upon the allocation processes will grow correspondingly. Such developments are likely to make the very process of allocation of joint and common outlays all but unmanageable by the firm or by the regulator.

But administrative difficulties are not the central issue. Rather, a number of other consequences of the full allocation process that are clearly detrimental to the public interest should be the main concern here. This is not the place to review the many unfortunate results of use of full allocation to regulate rates and earnings, since these have many times been described at length (and perhaps ad nauseum). We will only note that because the numbers that emerge from the process are indeed arbitrary, any prices determined by the regulator with their aid can only have a random relation to the prices that would emerge in competitive markets; i.e., the prices required if economic efficiency is not to be undermined.

In addition, the full allocation approach to price setting tends to foreclose any opportunity for the regulated firm to obtain adequate earnings. It is true that regulators who set rates on the basis of fully allocated costs (FAC) attempt to select a set of rates which, if realized in practice, will yield a viable return to the enterprise. But no regulator can force consumers to pay more than they are willing to pay, given the alternatives competition offers to them. As a result, in any regulated market (however defined) customers will end up paying the lower of two pertinent prices: that dictated by market forces, and that decreed by the regulator on the basis of a cost allocation.

If in some markets (as is normally the case) the FAC price is below the free market level, while in other markets the relationship is reversed, the regulated firm will be unable to charge the free market price in the former, and will be precluded from charging the FAC price in the latter. The net result tends to be a shortfall in overall revenues from the regulated services that the firm cannot make up for by high prices in the deregulated arenas, which will all presumably have been selected to be sufficiently competitive to prevent such overpricing automatically.

## Arbitrariness of the Fully Allocated Cost Figures

As has been said, the obvious (but specious) way to go about the calculation of the profitability of a subset of the products of a firm is the adoption of some allocation procedure for the purpose. It is all too easy to concoct defenses for the approach. It is said to be "practical" and have a long period of usage behind it. But here, to paraphrase Disraeli, practicality consists in practicing the blunders of our predecessors. It is said that by careful and rational choice of an allocation criterion, taking account of the use to which the figures will be put, one can arrive at defensible calculations. Two examples making absolutely no extreme assumptions will demonstrate the error of this conclusion. The first example is hypothetical and is intended to make clear the source of the problem. The second example uses actual data from a very real enterprise.

Railroad regulation has been an arena in which many metaphysical disputes over the proper method of allocation have long been under way. Faced with the industry's heavy investment in track, which is a cost incurred in common on behalf of every type of traffic, a variety of allocation criteria have been advocated over the years, each criterion having been selected carefully to comport with the interests of its advocate. To minimize the appearance of arbitrariness "relative use" has usually been agreed to as the proper allocative criterion. But how should relative use be measured? By volume of shipments (number of cars)? By their relative weight (ton-miles)? By their relative value?

Clearly, when the shippers of lead try to prove they are being overcharged, they will advocate the use of bulk or value rather than weight as the proper standard on which to allocate investment, so that lead shipment will be assigned a small share of the responsibility for the railroad's track investment, and the calculated rate of return on lead shipments will be comparatively high. Similarly, precious metal shippers on a comparable mission can be relied on to find arguments against the use of value of shipment as the proper basis of allocation, while shippers of balsa wood will dependably argue that volume is a defective allocative criterion.

The consequences of the choice among such allocative

criteria are not minor. This will first be shown with the aid of the following hypothetical example:

Suppose (i) that a railroad's traffic from origin A to destination B is composed exclusively of shipments of lead, precious metals, and balsa wood; (ii) that its investment in track, signals, tunnels, et cetera along the way is $100 million, with another $10 million of specialized investment on behalf of individual products; (iii) that the railroad derives annual net revenues (revenues minus direct costs) from each product equal to $3.2/3 million. Then its overall rate of return on investment will be 10 per cent; i.e., [3 × 3.2/3]/110.

Table 1 shows the hypothetical bulk (boxcar loads), weight, and values of the three products' annual shipments as well as their direct investments, on the assumption that these investments are proportionate to number of boxcars used.

Next, Table 2 shows the investment assigned to each product if the $100 million of track is allocated proportionately to carloads, weight, or value. The arithmetic is straightforward.

Table 3 shows the investment assigned to each product when the $10 million of specialized investment is included in the allocation.

Finally, Table 4 shows rates of return, calculated by dividing each product's $3-2/3 million revenue contribution by its assigned investment figures in Table 3.

### Table 1

#### Basic Data for Hypothetical Railroad

| Commodity | Carloads (000) | Weight (000 Tons) | Value (Millions) | Direct Investment |
|---|---|---|---|---|
| Lead | 10.0 | 90 | 5 | 2.0 |
| Balsa Wood | 39.5 | 1 | 5 | 7.9 |
| Precious Metals | 0.5 | 9 | 90 | 0.1 |

### Table 2

#### Allocated Investments
#### ($ Millions)

| Commodity | Allocation Basis | | |
|---|---|---|---|
| | Carloads | Weight | Value |
| Lead | 20 | 90 | 5 |
| Balsa Wood | 79 | 1 | 5 |
| Precious Metals | 1 | 9 | 90 |
| Total | 100 | 100 | 100 |

## Table 3

**Total Assigned Investments**
*($ Millions)*

| Commodity | | Allocation Basis | |
| | Carloads | Weight | Value |
|---|---|---|---|
| Lead | 22.0 | 92.0 | 7.0 |
| Balsa Wood | 86.9 | 8.9 | 12.9 |
| Precious Metals | 1.1 | 9.1 | 90.1 |
| Total | 110.0 | 110.0 | 110.0 |

## Table 4

**Attributed Rates of Return on Investment**
*(Per Cent)*

| Commodity | | Allocation Basis | |
| | Carloads | Weight | Value |
|---|---|---|---|
| Lead | 16.7 | 4.0 | 52.4 |
| Balsa Wood | 4.2 | 41.2 | 28.4 |
| Precious Metals | 333.6 | 40.3 | 4.1 |

It is clear from Table 4 that the figures for balsa wood span the narrowest of the ranges for the three commodities. Yet, it is seen that by judicious choice of the allocation criterion its rate of return can be changed from a clearly inadequate 4.2 per cent (Column 1) to an excessive 41 per cent (Column 2). The precious metals figure is even more sensitive, being transformable from a low of 4.1 per cent to a high well in excess of 300 per cent. This, surely, is a most curious way to calculate *the* rate of return for a product line.

Such maleability of fully allocated costs and rates of return is not a mere artifact of our hypothetical example. Tables 5 and 6 represent numbers for T. Rowe Price Associates, a large mutual fund manager, and one of its money market mutual funds, with which the authors of this article recently had occasion to work.[2] Table 5 shows for the entire firm and for Prime Reserve Fund four sets of data which were used as the bases for our five allocations of those costs of the firm which were not directly attributable to any one or another of its mutual funds. These costs were, in turn, allocated by us on the basis

of (1) relative mutual fund revenues, (2) relative number of labor hours utilized, (3) relative amounts spent on wages, and (4) relative number of customers served. (Because costs increase sharply with number of customers served in the mutual fund industry, in contradistinction to the size of their transactions, number of customers is not an unpersuasive allocation criterion.) Finally, since each of the preceding allocation criteria is to some degree persuasive, we have provided a fifth hybrid criterion (5), the balanced factors allocation, which uses a judiciously selected weighted average of criteria (1) to (4). The method of selection of the weights and its purpose will soon be clear.

Table 6 shows the results. For example, for 1980 the calculations allege that the rate of return on investment earned by Prime Reserve Fund was a horrendously unprofitable − 125 per cent if number of customers was used as the allocation criterion, while that same mutual fund was found from an allocation based on wage costs to be earning a shockingly excessive 247 per cent on its capital.

Of course, if Prime Reserve were seeking to justify its rate of return none of the preceding methods would

### TABLE 5

Derivation of Alternate Cost Allocations for Prime Reserve Fund

| Allocation Method | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|
| a) Revenues | | | | |
| Entire Firm (T. Rowe Price Associates) | $19,975 | $23,044 | $29,609 | $38,731 |
| Division A (Prime Reserve Fund) | 270 | 1,735 | 4,212 | 8,145 |
| Division A as a Percentage of Total Firm | 1.4% | 7.5% | 14.2% | 21.0% |
| Allocated Expenses | $242 | $1,492 | $3,274 | $6,725 |
| b) Direct Labor Hours | | | | |
| Entire Firm | NA | NA | 550,290 | 695,966 |
| Division A | NA | NA | 75,922 | 166,491 |
| Division A as a Percentage of Total Firm | NA | NA | 13.8% | 23.9% |
| Expenses Allocated to A | NA | NA | $3,175 | $7,650 |

*Table continued on next page.*

## TABLE 5 (Continued)

### Derivation of Alternate Cost Allocations for Prime Reserve Fund

| Allocation Method | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|
| c) Direct Labor Dollars | | | | |
| Entire Firm | NA | NA | $11,696 | $15,830 |
| Division A | NA | NA | 1,146 | 2,199 |
| Division A as a | | | | |
| Percentage of Total Firm | NA | NA | 9.8% | 13.9% |
| Expenses Allocated to A | NA | NA | $2,255 | $4,442 |
| | | | | |
| d) Number of Customers | | | | |
| Entire Firm | 248,490 | 281,210 | 350,957 | 460,993 |
| Division A | 8,338 | 57,343 | 114,607 | 217,027 |
| Division A as a | | | | |
| Percentage of Total Firm | 3.4% | 20.4% | 32.7% | 47.1% |
| Expenses Allocated to A | $602 | $4,041 | $7,515 | $15,054 |
| | | | | |
| e) Balanced Factors Allocation* | | | | |
| Entire Firm | NA | NA | NA | NA |
| Division A | NA | NA | NA | NA |
| Division A as a | | | | |
| Percentage of Total Firm | NA | NA | 17.7% | 25.9% |
| Expenses Allocated to A | NA | NA | $3,991 | $7,916 |

*This allocation of costs is based on a judicious assessment of the relative roles of number of customers, revenues, direct labor hours, and direct labor dollars, assigning these the respective weights in 1980 of 46.4 per cent, 20.1 per cent, 19.6 per cent, and 13.9 per cent; and in 1981 of 44.5 per cent, 19.8 per cent, 22.6 per cent, and 13.1 per cent. These weights relate to the relative size of each activity — operations, research, sales promotion, and portfolio management — as measured by direct costs and the use of an allocation rule, revenue, number of customers, et cetera, thought "best" to reflect the activity of each department.

SOURCE: "Statement of Product Line Revenues and Expenses," annual company reports and internal company documents.

## TABLE 6

### Ostensible Profitability of T. Rowe Prime Reserve Fund
### As Calculated by Various Cost Allocation Methods

| | | | Cost Allocation Criterion | | |
|---|---|---|---|---|---|
| 1979 Pretax Return | No. of Customers | Revenues | Direct Labor Hours | Direct Labor Dollars | Balanced Factors Allocation |
| Return on Sales | − 132.9% | 14.0% | NA | NA | NA |
| Return on Capital | − 191.7% | 54.9% | NA | NA | NA |
| Return on Assets | − 113.9% | 32.6% | NA | NA | NA |
| | | | | | |
| 1980 Pretax Return | | | | | |
| Return on Sales | − 78.4% | 22.3% | 24.6% | 46.5% | 5.2% |
| Return on Capital | − 124.9% | 81.7% | 93.0% | 247.0% | 15.4% |
| Return on Assets | − 71.1% | 46.5% | 52.9% | 140.6% | 8.8% |
| | | | | | |
| 1981 Pretax Return | | | | | |
| Return on Sales | − 84.8% | 17.4% | 6.1% | 45.5% | 2.8% |
| Return on Capital | − 110.7% | 51.0% | 15.6% | 201.1% | 6.7% |
| Return on Assets | − 72.9% | 33.6% | 10.3% | 132.3% | 4.4% |

SOURCE: Table 5 and annual company reports, various years.

really serve the purpose, since some indicate that its earnings were far too low while others seem to imply the opposite. However, any clever advocate defending Prime Reserve position has a better choice — the balanced factors method, whose weights have indeed been selected judiciously — to show that the fund earned a most reasonable return on capital, 15.4 per cent in 1980 and 6.7 per cent in 1981. Such are the wonders of cost allocation.

## Concluding Comment

The implications of the preceding data are clear. Fully

allocated cost figures and the corresponding rate of return numbers simply have zero economic content. They cannot pretend to constitute approximations to *anything*. The "reasonableness" of the basis of allocation selected makes absolutely no difference except to the success of the advocates of the figures in deluding others (and perhaps themselves) about the defensibility of the numbers. There just can be no excuse for continued use of such an essentially random or, rather, fully manipulable calculation process as a basis for vital economic decisions by regulators.

### Endnotes

[1] Of course, it is possible to calculate each product's incremental investment, incremental cost, and incremental return, but there is no rational ground on which to regulate the *earnings* of a particular company activity on the basis of any or all of those figures. There is no reason, for example, to claim that it is desirable

for all services to yield equal *incremental* rates of return.

[2] The following analysis was prepared on behalf of T. Rowe Price Associates in Schuyt N. Rowe Price Reserve Fund, Inc., United States District Court, Southern District of New York. The data and analyses are a matter of public record.

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## Reviewing the Market Value of Assets

The chief financial officers of 200 of this country's largest corporations acknowledged in a recent survey that they are now paying a great deal of attention to the highest-value use of their companies' assets. Nearly three-quarters of the officers polled by Temple, Barker & Sloane, Inc., at the end of last year indicated that their firms have adopted the practice of scrutinizing the market value of assets. Of those firms that perform market value studies, some 57 per cent do them annually, while another 14 per cent review asset value every few years. The remainder (29 per cent) focus attention on the issue "when needed."

"Unfortunately," said Dr. Michael Tennican, a senior vice president of the Lexington, Massachusetts-based general management consulting firm, "for some firms in the latter category, 'when needed' might be better stated as 'too late.' We are aware of a number of situations," he said, "where companies have seriously begun thinking about restructuring only *after* receiving a call from an outsider who has a desire to take over the task from incumbent management — and who has the shares and the financing required to press the point."

According to Dr. Tennican, pressures for improvement from boards of directors and threats of takeover from corporate raiders will continue to motivate large U. S. corporations to look for opportunities to reinvigorate profitability through restructuring. A key first step to improving profitability, he argues, is for the firm to examine expected returns on the market value of assets dedicated to each identifiable line of business.

"Since traditional accounting systems provide data primarily on historic asset costs rather than market values, corporations need to undertake separate periodic market value studies in order to create maximum value for their shareholders," Dr. Tennican explained. The TBS survey found that when asset value studies are performed, they are typically done (in 90 per cent of the cases reported) by line of business. Approximately 40 per cent of the companies that had performed such studies engaged in some form of restructuring following their reviews.