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The Determination of a Fair Return on Investment for Regulated Industries

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Introduction

Almost all common carrier transportation in the United States is subject to profit control by regulatory commissions. The actual effect of such profit control varies among transportation modes. For the railroads, profits are set by competition, and the public statements of ICC officials indicate that if they could think of an easy way to raise rail profits they would. Motor carriers' rates, and hence profits, are set largely by the level of rail rates. Airline earnings have on occasion, such as the General Passenger Fare Investigation of 1956, been determined by regulatory action. For pipelines, regulatory profit control is of more importance. Finally, regulation is the dominant determinant of earnings in the regulated industries outside transportation, such as the telephone and electric power industries.

Even though regulatory action plays a varying role in determining earnings of the so-called public utility industries, it is obviously of considerable practical importance. The purpose of this paper is to examine various measures of profits which might guide a public agency in determining the existence of inadequate or excess profits in a regulated industry. Although profit standards for regulated industries were a perennial topic for economists prior to the war, the subject has been generally ignored since then.

The indifference of economists to regulatory standards may be influenced in part by an increasingly widespread view that the proper policy is the deregulation of the so-called regulated industries. We think there is much merit in such a view; indeed, we have argued elsewhere the economic case for a substantial degree of deregulation of the transportation industries. Nonetheless, we do not think the public utility concept completely outmoded; there are sectors of the economy where competition does not suffice to protect the public interest.[1] Furthermore, the process of removing regulation is at best a slow one; in the interim, how the regulated sector of the economy is managed is an important question.

Another source of economists' indifference may be the belief that the control of pricing rather than the control of profits should be the focus of regulation. Profit control, after all, not only has a very negative, perhaps anticapitalistic connotation, but also is a subject about which economic theory has had relatively little to say. By contrast, that theory has a great deal to say about a socially efficient set of prices as a mechanism to allocate resources, at least in the short run. But detailed regulatory control of prices in practice tends to be unworkable, especially in achieving efficiency objectives. The record of the ICC suggests that managerial freedom to set prices would produce a closer approximation to the economists' efficiency norm, at least under present circumstances, than regulation.[2]

Economists also may believe that economic analysis has nothing new to contribute to the topic of a "fair" return. We believe, on the contrary, that economic analysis has at least two important points to make. First, concepts in capital theory clearly demonstrate that measures of profits traditionally used in regulation (such as rate-of-return on original or reproduction cost of equipment) contain inherent biases which will understate or overstate true returns, basically because these usual measures do not take explicit account of the timing in the pattern of profits and the economic longevity of equipment. Second, economic analysis can provide a framework for recognizing the impact of both the changing value of the dollar and improvements in the productivity of capital equipment. Inflation deserves an explicit treatment in regulatory decisions in order to protect the adequacy of service by insuring funds for new and replacement equipment, and to recognize

[1] The technology and cost structure of many transportation activities do not preclude competition nor fit the economists' concept of natural monopoly. This is in sharp contrast to the electric power, gas, and water industries, where duplicating service is clearly wasteful. Indeed, a reasonably high level of competition already prevails in the transportation industry and, if not inhibited by government regulations, even more competition would almost unquestionably come into being very quickly.

[2] This leaves untouched a third aspect of regulation, control of costs. Our analysis omits this problem. For a recent and stimulating discussion on certain aspects of this problem, see Harvey Averch and Leland L. Johnson, "Behavior of the Firm under Regulatory Constraint," *American Economic Review*, LII, 2, Dec. 1962, pp. 1052–1069.

the equitable interest of investors in their real income. At the same time, explicit thought should be given to the distribution of the gains of new technology between consumer and investor. The regulatory literature now gives little recognition to the problem.

We take as our starting point for this exploratory investigation the proposition that regulation is a substitute for competition in protecting the public interest. This proposition underlies most of the judicial and legal action as well as most writing on regulation. While competition may not always produce optimum results, and regulation may aim at other goals than simulating competition, the record of regulatory efforts and of competition in numerous sectors of the U.S. economy suggests that competition produces a rough optimum, and the results of competition are, in the long run, the most workable standard for the administration of the regulated sectors of a free enterprise economy. A regulated firm operating in a competitive environment must buy its supplies at prices set by competition; it compensates its employees at wage levels commensurate with those in nonregulated industries, and, however protected its position within the industry, it competes for consumer's dollars against the nonregulated competitive industries. Most importantly, a regulated firm buys its capital at prices set in economy-wide capital markets. Any return to investors persistently below those established in the capital markets for the nonregulated firms will eventually create difficulties in attracting capital to the regulated firms and industries. The process of regulation in a free enterprise economy, therefore, must include recognition of the fact that a regulated firm and industry will follow the trends of prices, wages, and profits in the rest of the economy.

We would stress that our analysis is illustrative and tentative. The concepts used require further development and clarification prior to actual application. Moreover, our concentration upon the measurement of profits does not reflect a belief that any such measurement can substitute in the regulatory process for an examination of the risks and profit needs of an industry in terms of investment requirements and financial acceptability, or for an examination of the equitable claims of consumers against excess profits and the investors for an adequate income. Clearly it is the final impact of regulation in meeting these claims and requirements which is paramount rather than the results in terms of any one measure of profit.[3]

[3] The Supreme Court has stated "It is not the theory but the impact of the rate order which counts." See Federal Power Commission vs. *Hope Natural Gas Co.*, 320 U.S. 591 at 601–602. See also Atchison, *Fair Reward and Just Compensation*, 1954, Chapter II.

Measures of the Rate of Return

RATE OF RETURN ON A RATE BASE

The most widely used approach to a regulatory determination of reasonable profits has been through the measurement of profits as a percentage of a rate base. Two distinct definitions of the rate base are in wide use: reproduction cost—defined as the current cost of reproducing the capital equipment; and original cost—defined as the historical cost of the equipment plus working capital and minus accrued depreciation (roughly equivalent to average historical net investment).[4]

Original cost is primarily an equity concept, based upon the rationale that the investor has made a specific commitment of funds upon which he is entitled to a stipulated rate of return. Original cost also has a concreteness which facilitates administration. Such administrative convenience became a paramount consideration in the thirties when the literal interpretation of reproduction cost threatened the breakdown of effective regulation.

In a period of changing prices, however, neither the investor nor the consumer are likely to be well served by the original cost approach. The equity investor under such circumstances receives essentially a fixed monetary and a declining real return unless the permitted regulatory rate of return is promptly altered with changing price levels. Furthermore, unlike that for the bondholder, the fixed monetary return for equity holders in regulated industries is created by the regulatory process rather than by a clearly understood contract. The consumer, though, realizes at least short-run gains from the reduction in the real value of the investor's return.

However, these short-run gains of the consumer are achieved through earnings insufficient to maintain adequate service in the long run. Once it becomes clear that the equity investor in a regulated industry can receive only a fixed monetary return, equity investments normally will be forthcoming only with extremely high average returns. In the transitional period from the current return to a higher return,

[4] Long-term debt plus net worth represents a variation of the depreciated original cost rate base. It does have the additional advantage of being based directly on accounting records and frees the regulatory process from the necessity of a physical inventory for equipment. It also takes automatic recognition of working capital which is, however, generally included in the other two rate bases. All subsequent comments made about the depreciated, original-cost rate base apply virtually without modification to long-term debt, plus net worth.

the regulated industry is likely to be starved for capital necessary for expansion. The probable final result of such developments for the consumer will be both higher prices to pay a higher average return (to compensate the equity investor for risks which are not offset by any possibility of increased returns) and transitional periods of inadequate service. There is the further danger that the existence of inadequate service and the necessity of a higher rate of return may never be recognized, so that the consumer is perpetually deprived of sufficient capacity and the technologically best equipment.

It was this aspect of inflation that led to the introduction of the reproduction cost concept in the 1920's. Reproduction cost, by increasing profits in an inflationary period, will contribute to the maintenance of long-run adequate service. It provides an "automatic" solution to the problem of earnings dilution caused by the disparity between old and new investment costs in a period of changing price levels. Reproduction cost also treats alike companies with a different timing in their pattern of purchasing equipment. Uniformity can be important here because under conditions of secular inflation, failure to use reproduction cost or some other price correction is likely to inhibit most the earnings of those who most need to raise outside capital, i.e., firms with the oldest equipment.

Profits, however, are a smaller source of funds for purchasing new equipment in most regulated industries than the funds generated by depreciation. The underlying notion of a depreciation allowance is a flow of funds that will enable a firm to maintain its capital stock. If the prices of equipment are unchanged and the life of the equipment is estimated correctly, then depreciation practices based on original or historical cost achieve this objective. Obviously, though, price changes nullify the concept of original cost depreciation just as they eliminate the utility of an original cost rate base in regulating profits. If prices are rising, original cost depreciation may be insufficient to replace equipment, so that reinvestment either from new funds or retained earnings is required merely to maintain capital stocks at present levels.[5] This problem is not peculiar to the regulated industries, but the nonregulated companies can to some extent offset a depreciation deficiency with the higher profits which usually accompany inflation.

[5] Strictly speaking, this will hold true only in declining or stagnant situations because, in expanding industries, price increases will be offset at least partly by depreciation expenses rising more rapidly than replacement needs. The depreciation allowance pertains under expansionary circumstances to a larger capital stock than replacement needs because of the lag between initiating depreciation charges and actual replacement.

Regulated companies do not have this option unless regulatory action is unusually prompt and perceptive.

While the determination of depreciation by reproduction cost faces up to the problems of inflation, the approach has had a dismal history in regulatory practice. During the 1920's, reproduction cost was interpreted so literally by regulatory commissions that existing equipment was assumed to be reproduced even if the equipment was obsolete, and more efficient and lower cost processes were available. This deprived the consumer of all technological gains. Furthermore, the establishment of reproduction cost relied upon the testimony of expert witnesses as to the current costs of reproduction; a cumbersome and subjective procedure that often better served the welfare of expert witnesses than consumers.

THE OPERATING RATIO AS A MEASURE OF PROFITS

The public utility industries in which many regulatory practices were first formulated were, at least historically, relatively risk free. As a result, regulation could ignore the possibility of losses and concentrate on profits. When regulation was extended to the more competitive transport sectors of motor trucking and buses, the economic character of these industries required some explicit recognition of risk. In this context the operating ratio approach was evolved, utilizing as a regulatory standard of reasonable profits the ratio of expenses to gross revenue.[6]

The rationale of the operating ratio primarily insures that short-run, unforeseen developments do not result in costs approaching or exceeding revenues so as to sharply reduce or eliminate profits. This arises in motor trucking and bus transport for two reasons: first, both expenses and revenues show relatively large year-to-year changes; second, the gap between revenues and operating expenses is extremely small. This last arises from the fact that capital is a small part of the total production process.[7]

[6] For example, if an operating ratio of 93 per cent in motor carriers serves to indicate a reasonable profit, when expenses are more than 93 per cent of revenues, a rate increase is indicated, and when expenses are less, a rate decrease is indicated.

[7] For example, the operating ratio in electric utilities (the prototype of the traditional utility involving large amounts of capital per sales dollar) in the decade 1946 to 1959 varied from a low of 83.3 to a high of 86.6—a range of 3.3 per cent—whereas buses with a small capital input per unit of sale varied from a low of 88.1 to a high of 96.1 per cent—a range of 8 per cent. In addition to a wider range in the variation of the operating ratio, the same variation in operating ratio causes a larger fluctuation in profits in an industry like buses than in electric utilities. For example, the same absolute change in operating ratio for electric utilities and buses from 1948 to 1949 (2.2 per cent) caused bus profits per unit of sales to decrease 26 per cent, whereas the electric utility profits decreased only 12 per cent.

In the operating ratio approach to regulation, profits provide a margin against financial crisis; that is, an insurance premium against unexpected losses. In the bus and trucking industry, given the breadth of the allowed safety margin, profits usually have remained sufficient to meet the extremely small capital requirements of the industry.

Though often suggested, a wider use of the operating ratio approach to regulation is undesirable for at least two reasons. First, it ignores the important problem of capital requirements which, as stated above, is a minor matter in the bus and trucking industries, but not for most other regulated industries. Second, there is no reason why a safety margin may not be provided by an adjustment in the rate of return. In fact, the historical explanation for the use of the operating ratio approach in the motor carrier industry may have been a reluctance to directly set a rate of return sufficiently large to compensate the investors for the risks involved. Aside from such considerations of administrative hesitancy, there is no reason why regulatory agencies should not recognize that some regulated industries involve very high risks and hence should be allowed to earn a rate of return greatly in excess of other regulated industries with lesser risk.

FINANCIAL RATE OF RETURN

The profit measures just outlined all share a common defect: they include no explicit recognition of the time element in investment. The time element can be explicitely recognized through the use of the discounted present value formula. Assuming that an investment is made at one point in time and is independent of all other relevant investment possibilities, and assuming that interest is compounded at regular intervals, the present value formula can be expressed in simple notational form as:

$$V = \sum_t P_t/(1 + r)^t$$

where V represents the present value of the investment; P_t indicates the annuity or profit or be realized at future time t; r stands for the interest rate; and t indicates the number of interest computation periods that separate the present (or point of investment time) from the time of the profit realization. It should be noted that P represents the *total cash return* (in a given time period) to be realized from the investment so it is *not* net of depreciation expense.

The traditional application of the discounted present value formula has been to determine the profitability of an investment in capital budgeting decisions. In this context, there are alternative procedures.

One procedure (the so-called benefit-cost ratio approach) is to compute present value just as above and then compare this with the cost of the investment; if present value exceeds cost (the benefit-cost ratio exceeds unity), the investment is considered profitable at the accepted or going rate of interest employed in the formula. The second procedure is to use the cost of the investment in place of present value in the left-hand side of the equation and to solve the equation for r which then is considered to be the earnable rate of return rather than the interest rate. If the rate of return computed in this fashion is greater than the interest rate, the investment is considered to be profitable.

Since different results can be obtained by using these alternative approaches to capital budgeting, considerable controversy exists about their relative merits.[8] In general, if maximization of V is the basic objective (which would seem to be quite plausible if consumer sovereignty is accepted), then the benefit-cost ratio will yield the best results in the widest variety of circumstances. Neither approach is infallible, even in pursing narrowly and correctly stipulated objectives, if the simplifying "point of time" and independence assumptions are eliminated; with interdependence between different investments over time, more complex techniques are required.[9]

The rate-of-return approach also suffers from a specific limitation; multiple solutions can exist for the present value formula when solved for r (the usual algorithm being Newton's approximation), specifically when P assumes negative values over some part of the time horizon. This limitation, together with the fact that the benefit-cost approach better serves the more plausible objective function, suggests that the rate-of-return calculation is the less useful of the two possibilities for capital budgeting purposes.

These limitations, however, are not serious objections to the use of the rate-of-return approach in regulatory problems. The multiple solution characteristic of rate-of-return calculations is not a real disability because the established "fair rate of return" is in practice an approximation to the correct answer, thus supplying outside information for choosing between different solutions where more than one exists. In fact, as long as the benefit-cost ratio exceeds unity at a zero rate of interest (i.e., the simple sum of benefits exceeds the simple sum of costs)

[8] Excellent discussions of these problems can be found in Jack Hirschiefer, "On the Theory of Optimal Investment Decision," *Journal of Political Economy*, August 1958, pp. 329–352; and *Management of Corporate Capital*, Ezra Solomon, ed., Glencoe, Ill., 1954.

[9] S. Marglin, *A Linear Programming Approach to Dynamic Capital Budgeting*, Rotterdam, 1962.

the "correct" rate of return will almost invariably be the lowest positive solution rate.

Once this is recognized, it is also obvious that the two capital budgeting approaches are usually identical when applied to regulatory decisions. If the rate-of-return approach is used, the calculation simply reduces to determining whether the lowest positive (or otherwise correct) solution rate is above or below the established "fair rate." Of course, if the benefit-cost approach were employed directly, the procedure would be to determine whether the benefit-cost ratio were above or below unity at the established fair rate.[10]

As long as the two approaches yield the same result, the rate-of-return approach has the advantage of being more in keeping with established regulatory traditions. Like the current practice, it involves computing a rate of return under an established rate structure and then comparing this with what is considered to be a just or equitable rate of return for investors in regulated enterprises. If the computed r is greater than the desired "just" return, the required regulatory action is to adjust tariffs downward, and thereby the P term as well, to make r equal to the established standard. Conversely, a rate of return beneath the target rate calls for regulatory action to increase P, usually by upward rate adjustments, to a point where the computed r equals the standard or accepted r.

Definitional Problems Encountered in Computing Rates of Return and Operating Ratios

Definitional problems have been a major difficulty in the regulatory use of either rate-of-return or operating ratio formulas. Indeed, a good part of the voluminous record in protracted rate hearings is devoted to disputes over definitions.

Two key definitional problems in computing gross returns on profits for regulated industries are, first, whether capital gains on inventories, fixed assets, and other investments should be counted; and second, whether returns realized on nonregulated, by-product operations should be considered in regulatory proceedings.

[10] To put the argument somewhat differently, the distinction between the rate-of-return and the benefit-cost approaches to capital budgeting are the different *rankings* of capital outlays that the two approaches yield, and these rankings are irrelevant in the regulatory context. What counts for regulation is whether the existing set of facts pertaining to only *one* investment situation are consistent with an adequate compensation to capital.

The capital gains problem as it occurs in defining gross return can be divided into two subproblems: (1) capital gains or losses realized in the course of normal operations from price level changes on the capital goods and inventories employed in the regulated production process, and (2) capital gains or losses realized on the basis of speculation in the commodities and capital goods employed by the regulated industries. Normal capital gains or losses of the first type ought to be built into the rate base and regulatory calculations, since such capital changes are as integral a part of furnishing utility services as operating costs.

For the second type of capital gains the obvious test is whether entry into the speculative activity that yields the gain or loss is restricted by grant of public franchise. If entry into speculative activities is open to both regulated and nonregulated firms, the profits and losses from these activities should be considered beyond regulatory purview. To illustrate, the grant of a unique franchise to operate an airline between two urban centers does not bestow on an airline an exclusive right to engage in speculation in plane prices. Not only can airlines operating between other points engage in such speculation but also private firms outside the airline industry can join in the speculation. Excluding speculative capital gains and losses, it might be noted, considerably simplifies the administrative problem facing regulatory agencies.

On the other hand, this simple test only applies to speculative activities sufficiently limited not to jeopardize the financial stability of the regulated firms or industries. The mass speculation that characterized substantial parts of the electric utilities industry in the 1920's must inevitably be passed on to consumers, either through higher rates to bail out the speculators or through inadequate service from bankrupt companies. The better remedy here, however, is direct control of financing or refinancing rather than through adjustments in profit measures.

The by-product or subsidiary activity problem—such as when railroads own hotels, oil wells, and timber lands—is relatively easy to solve analytically. Again, the test is whether the grant of a public utility franchise bestows upon the firm substantial market power in another sector of the economy. Such would be the case where the by-product can be economically manufactured only in conjunction with the supply of the regulated service. Of course, if the revenues of nonregulated activities are excluded from regulatory calculations, so too should be their costs and related productive assets.

While the principle is obvious, there may be substantial difficulties in practice. Often it is necessary to establish meaningful transfer prices between the regulated and nonregulated activities of the firm. Otherwise, a regulated firm might render services to a subsidiary at inordinately low prices, or conversely, purchase at inordinately high prices, thus redistributing profits from the regulated to the non-regulated sector of the firm's activities. Considerations of this kind are central to many regulatory disputes in the telephone industry.

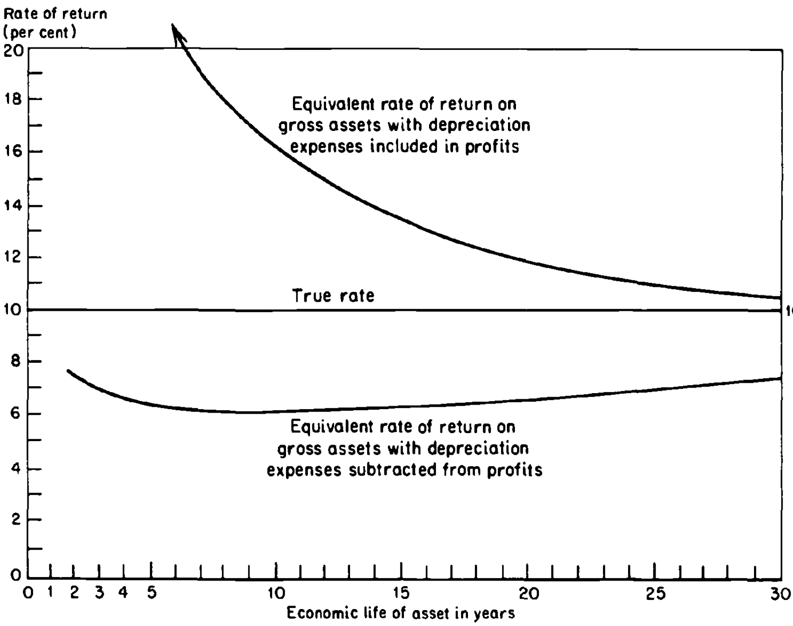
In essence, the problem of defining costs is one of broader significance in regulatory proceedings when there is a less than competitive market for certain of the factors utilized in the production process. Without a competitive market it is, by definition, difficult to establish a going market price to use as the "cost" paid by the regulated firm. In extreme cases, the only recourse is to assume that a "fair price" represents costs of production plus a "fair return," thus placing the industries supplying regulated industries in much the same situation as the regulated industries themselves. In less extreme cases, such as the bilateral oligopoly that characterizes the equipment markets for some utilities and airlines, extending regulation is presumably not worth the effort, and it is better to rely on competition despite its imperfections.

Somewhat more tangible are the problems of defining appropriate depreciation charges for regulated industries. For example, there is considerable reluctance to count depreciation expenses as a cost when gross assets is used as the denominator of the rate-of-return ratio. (It is usually agreed that depreciation should be counted as an expense when net fixed assets is employed as the rate base.)

One approach to solving this definitional problem is to compare the results obtained by including or excluding depreciation with those obtained by using the present value formula. In general, results obtained from the established regulatory measures can be converted into present value equivalents and thus directly compared with each other and with the rate of return found from the present value formula. Such a set of comparisons is shown diagrammatically in Figure 1 for a case in which the rate of return calculated using the present value formula is 10 per cent. The upper hyperbolic-shaped function indicates the gross profit (on gross investment) return that must be earned in order that a 10 per cent financial rate of return on capital be realized. Similarly, the lower function indicates the rate of return that must be earned when using net profit (that is, when depreciation, calculated on a straight-line basis, is included as an expense, and gross investment is still used as the base) to obtain the 10 per cent financial return.

In general, if depreciation is counted as an expense, the rate-of-return ratio, with gross assets as a base, underestimates the true return.

Figure 1



Conversely, if depreciation expense is not subtracted, the reported returns are overestimated. Which of the two functions deviates least from the "true financial rate" depends on the economic life of the equipment involved. Both give reasonably good results if the durability of the equipment is great enough, for the functions converge on the true rate as the length of equipment life increases. For equipment of very low durability, the deduction of depreciation expense yields answers closer to the true rate. At an intermediate range of durability, the retention of depreciation expense in the returns yields better estimates than its subtraction. As a rule, as the expected equipment life increases, the gross profit ratio converges to the true rate more quickly than the net profit ratio.

The preceding propositions have been based on a straight-line computation of depreciation expenses. With a declining-balance computation of depreciation, the analysis is slightly more complicated. Different effects can be achieved by the declining-balance method depending on the age distribution of the equipment stock and the relative productivity of the equipment in different periods of its life span. In the simplest case, declining-balance depreciation might accurately reflect declining productivity of the equipment. Under such circumstances, changes over time in revenue and depreciation expense would roughly cancel, yielding a good approximation of a constant annuity. This, of course, is a special case and could not be expected to hold as a general rule.

It is useful to note that the different results obtained from various regulatory rate-of-return formulas can be readily converted into one another and also into the true financial return. Accordingly, the choice of the particular measure used for regulatory purposes does not matter if it is made with a knowledge of these transformation relationships. For reference, a number of transpositions between measures of profitability on a gross asset base, with and without depreciation counted as an expense, and the financial rate of return have been brought together in Table 1.

Depreciation charges play a quite different role when operating ratios are the basis of regulation. The central consideration is the relationship of depreciation expenses to total costs, since the main economic

TABLE 1

RATES OF RETURN ON GROSS ASSETS, WITH AND WITHOUT DEPRECIATION EXPENSE COUNTED IN PROFITS[a], COMPARED WITH GIVEN FINANCIAL RATES OF RETURN FOR DIFFERENT LIVES (per cent)

Financial Rate of Return[b] (years of economic life)	4 Per Cent		8 Per Cent		10 Per Cent	
	With DE	Without DE	With DE	Without DE	With DE	Without DE
2	53.0	3.0	56.1	6.1	57.6	7.6
4	27.6	2.6	30.2	5.2	31.5	6.5
6	19.1	2.4	21.7	5.0	23.0	6.3
10	12.3	2.3	14.9	4.9	16.3	6.3
15	9.0	2.3	11.7	5.0	13.2	6.5
20	7.4	2.4	10.2	5.2	11.7	6.7
30	5.8	2.5	8.9	5.6	10.6	7.3
40	5.1	2.6	8.4	5.9	10.2	7.7
50	4.7	2.7	8.2	6.2	10.1	8.1

[a] Depreciation expense estimated by straight-line methods.

[b] As estimated by using the present value formula.

rationale for the use of the operating ratio is the provision against bankruptcy and capital exhaustion from short-run fluctuations in profits. If the ratio of depreciation expense (and indeed of other book charges as well) is large relative to total cost, the firm has a cushion against sudden swings in revenue. Relatively large negative accounting profits are not accompanied by a cash drain on company funds unless revenue falls below total cost minus book charges. Thus, a high rate of book charges to total costs reduces the probability of cash drains because of random fluctuations in profit levels.

Another definitional question bedevilling rate-of-return calculations is whether unadjusted gross fixed assets or gross fixed assets minus depreciation reserves (net fixed assets) should be employed as the rate base. When net fixed assets are used as the base, it is usually accepted that depreciation expenses should first be subtracted from profits before computing the ratio and this procedure will be assumed throughout the following discussion. Defined as the ratio of net profits to net fixed assets, the rate of return becomes a good approximation of what is commonly known in capital budgeting procedures as net return on average investment. This is simply the ratio of profits after taxes and depreciation to one half the total investment. Indeed, the two measures should yield roughly identical results in the long run, that is, when averaged over the complete life of the assets involved.

When compared with the time rate of return obtained by using the present value formula, the net return on average investment uniformly overestimates the profitability of an investment (when profits are assumed to be evenly spread over the economic life of the equipment and straight-line depreciation is used). This overestimate is not too serious when economic life is short and when the correct rate of return is low, but it becomes progressively worse as economic life is extended and the true rate of return increases. These results are illustrated in Table 2.

Furthermore (again assuming straight-line depreciation and the even spread of profits over expected economic life), the use of net fixed assets as a rate base underestimates the true return during the early years after a re-equipment period and overestimates the true return toward the end of equipment life or just before a new re-equipment period occurs. When investments in equipment are made only at widely spaced periods in time, and then in very concentrated amounts, the average or long-term rate of return indicated in Table 2 will be realized as an instantaneous (i.e., a particular annual) rate of return only at the mid-point between re-equipment periods. Rates of return computed on net fixed assets under such circumstances will essentially

TABLE 2

RATE OF RETURN[a] ON AVERAGE INVESTMENT OR ON NET FIXED ASSETS WITH A UNIFORM AGE DISTRIBUTION FOR EQUIPMENT WITH GIVEN FINANCIAL RATE OF RETURN AND ECONOMIC LIFE
(per cent)

Economic Life (years)	Financial Rate of Return[b] (per cent)			
	4	8	10	12
2	4.03	8.1	10.2	12.2
4	4.08	8.3	10.5	12.7
6	4.13	8.5	10.8	13.1
10	4.24	8.9	11.4	14.0
15	4.36	9.4	12.2	15.0
20	4.50	9.9	12.8	16.0
30	4.74	10.7	14.1	17.6
40	4.98	11.5	15.1	18.8
50	5.21	12.1	15.9	19.7

[a]Net of depreciation expense estimated on a straight-line basis.
[b]As estimated from the present value formula.

follow a sawtooth pattern; right after re-equipment the rate of return will drop sharply and then rise slowly in a linear fashion until it reaches a peak just before the new re-equipment period. At this point, the instantaneous rate of return will again drop and the process will be repeated. Furthermore, for growth industries, like the telephone industry and many utilities, a net fixed asset base will persistently underestimate the true financial rate.

Other biases, of course, may occur if profits are not uniformly distributed over the life of an asset or if straight-line depreciation is not used. For example, if gross profits decline more rapidly than depreciation allowances accrue, the rate of return computed on net fixed assets would in the long run underestimate the true rate of return. The instantaneous rate-of-return problem also still exists; the ratios of profits to net fixed assets under such circumstances would tend to be too great in the early years and too low in the later years.

Similarly, if net fixed assets decline more rapidly than profits, a rate of return based on net fixed assets will result, on the average, in an even more serious overestimate of true profitability than when profits are spread evenly over economic life; in the early years of the investment the average lifetime return will be very much underestimated while in the late years, just before re-equipment, the converse will hold true. This situation may occur when the introduction of new equipment is associated with learning costs that reduce profits in the early years of an investment.

Another question often raised in defining the rate base is whether working capital should be included. The usual practice has been to include it when the depreciated value of the equipment is employed as the rate base but not when gross original or replacement value is used. As a general rule, it would seem preferable to include working capital as part of the rate base and specifically recognize that it has a different economic life than physical equipment (i.e., it usually has a salvage value of 100 per cent). Working capital is as important a part of the production process as any other kind of investment and to omit it is the same as omitting part of the required investment needed to earn whatever profit is realized.

In addition, separate treatment probably should be given to returns on working capital because such investments are usually relatively liquid and consequently open to substantially less risk exposure than fixed investments in equipment. In other words, everything else equal, a regulatory body could justify a somewhat lower rate of return on total investment, including working capital, for industries with a substantially higher than average proportion of their assets in working capital.

A final class of definitional problems arises if reproduction costs rather than original costs are used as a rate base. Determination of reproduction cost necessitates a definition of the unit of productive capacity to be reproduced, which in turn raises the question of the treatment of technological change.

Regulatory agencies usually have defined reproduction costs in terms of reproducing the specific equipment now in use, thus excluding the effect of technical change. Strictly applied, reproduction cost could mean, for example, asking such irrelevant questions as what it would cost today to manufacture a DC-3, a boxcar without roller bearings, and interstate buses without diesel engines. It would be better to frame the reproduction cost question directly in terms of what it costs to create equipment capable of producing a specific unit of output. This would avoid a host of irrelevancies in rate cases, as well as a strong tendency toward reserving most of the gains of technological change for producers.

Of course, defining the appropriate unit of output is not always easy. First, a number of dimensions are usually needed to properly or fully define output in a service industry like transportation; e.g., in passenger services some distinction usually must be made between seat-miles of capacity for different trip lengths, since equipment efficient at one trip length may be very different in many important respects from that efficient at other lengths. Second, changes in technology alter the inherent properties of individual "capacity units" over time. For instance, faster plane speeds clearly make a passenger seat-mile of capacity in a jet worth more than a passenger seat-mile of capacity in a DC-3. This raises the question of how these gains should be distributed.

In general, administrative convenience and equity are usually both well served by adopting some conventional and simple measure of output and adhering to it with reasonable consistency. If reproduction costs are controlled in terms of producing equipment capable of a certain output of services, the usual consequence will be to split technological gains between producers and consumers in, admittedly, some rough and ready fashion. This occurs because most (though certainly not all) technological improvements result in producing a better product at lower cost. For example, jets produce a faster service for consumers and lower operating costs for airlines; similarly, roller bearings in boxcars result in a more dependable service for shippers and lower operating costs for railroads; and heavy diesel buses usually have superior riding and other comforts as well as lower operating costs.

At a minimum, defining reproduction cost in terms of a constantly improving service unit rather than in terms of actually reproducing a specific piece of equipment is a way of increasing the probability of transmitting to the consumer some share of the technological gains. Since reasonable profits and prices could be computed on the most efficient and newest equipment, a service-unit approach to computing reproduction cost also would provide a built-in incentive for managements to adapt to technological change. Furthermore, the administrative difficulties in the strict reproduction-cost approach are largely eliminated.

The use of a simple index of the production cost of an ever-improving unit of output is not, however, an automatic cure-all. Depending on the particular character of technological advance in an industry and the type of price index employed, the gains will be shared differently by the different participants. It remains a central problem to decide whether the results are equitable.

Despite the difficulties in computing capital reproduction costs, the effort would seem well worthwhile as long as it is accepted as a regulatory objective that the capital stock of a regulated industry should be maintained. At the very minimum, reference should be made to some sort of general price index for capital goods even if a specific index for the regulated industry appears impossible to construct. The only alternative to making a determination of capital costs is to adjust the rate of return upward when price increases occur; but these will provide only rough approximations of actual requirements unless the adjustments are based on cost and price indexes.

Some Empirical Applications

On the basis of the preceding analysis, the simplest way to construct somewhat improved estimates of rates of return from normally available balance sheets and income statements would be to: (a) use as a rate base the sum of stockholders' equity (paid-in capital and surplus, retained earnings, etc.), long-term debt, and accrued depreciation reserves; (b) define profits (for the numerator of the rate-of-return ratio) as normal accounting profits realized on activities under or closely associated with regulation, plus interest charges and depreciation expenses; (c) take explicit cognizance of the role and influence of capital longevity by making corrections in rate-of-return ratios (as defined by (a) and (b) above) so as to convert them to closer approximations of the internal rate of return that would be obtained by solving the present value formula; (d) take into account the particular differences in the durability of working capital and physical investments; and (e) correct the rate base for price, or at least take cognizance of the possibility of price inflation by attempting to measure any changes that occur in the cost of capital needed to produce specified units of output.

We will present, first, various bits and pieces of information pertinent to the price correction problem and, second, rough comparisons of rates of return realized in several transportation industries with those realized in several regulated and unregulated sectors of American industry in recent years. While these estimates will be crude in several respects, the most serious omission is the lack of appropriate price corrections for the rate bases. Accordingly, the number reported are directly comparable only to the extent that different sectors of industry have approximately the same historical age composition of their capital asset structures and have experienced similar price histories or price stability in their capital equipment acquisition markets over recent or relevant years.[11] We excuse ourselves from applying price deflation to accounting values on capital assets because it is an empirical task beyond our resources. It requires unpublished data on the historical distribution of capital asset acquisitions in order to determine the appropriate weights to assign to the index for all relevant preceding years.

These illustrations are, therefore, necessarily incomplete and are intended primarily to indicate what is possible rather than as sources for drawing substantive conclusions. The usefulness of these figures, however, might be easily underestimated. With all their imperfections and inadequacies, they are probably superior to most existing profit measures used by regulatory agencies. Furthermore, in many instances the differences between series compared are so large that no possible bias could alter significantly the more obvious conclusions or inferences. Still, care is required in their interpretation and it is hoped that their imperfections will be a challenge to others to undertake needed improvements.

PRICE INFORMATION AND INDEXES FOR TRANSPORTATION

The preceding discussion of reproduction cost developed two conclusions. First, that an adjustment in the rate base to recognize the possible impact of inflation was essential, and second, that such an adjustment could be best achieved by a price index (preferably based on a unit of service whose quality is continually improving) rather than the administratively cumbersome application of the concept of reproduction cost.

There are three types of price index which might be used in the adjustment of the rate base and hence profits: (1) a consumer or cost of living index, (2) a general producers' durable equipment index, and (3) specific indexes of equipment prices. The personal consumption index adjusts the rate base to stabilize the real income or purchasing power returns realized by investors. The other two indexes, in contrast, adjust the rate base to maintain the purchasing power of reinvested earnings. Since retained earnings as a source of reinvestment funds have become increasingly important, the maintenance of the purchasing power of profits in terms of reinvestment deserves at least equal priority with the maintenance of investors' real income.

If the particular prices paid for capital by a given industry follow the general pattern, the price index of producers' durable equipment

[11] Of course, there might be other fortuitous combinations of circumstances in which relative price movements and historical capital acquisition patterns would make the numbers directly comparable even without price correction.

used in national income accounts will, of course, more or less maintain the purchasing power of profits in terms of reinvestment. This index represents the price changes in a wide cross section of capital equipment (machinery, tools, vehicles), and investments in regulated industries generally fall within the categories included. Furthermore, since the typical division of profits is roughly equal between reinvestment (retained earnings) and dividends, and depreciation expense is usually about equal to retained earnings, the consumer price index and the producers' durable equipment index might be given, as a first rough approximation, weights of one and two, respectively, in the construction of a general composite index of price changes for the adjustment of rate bases. Such an index is shown in Table 3, with 1946 selected as the base year. The figures suggest a steady erosion in the value of profit dollars, though at a slow pace since 1957.

The index of prices of all producers' durable equipment, however, may often be an inadequate representation of the price changes in the equipment bought in a particular industry, especially since the general index does not reflect technological change in a particular industry (or, for that matter, in industry in general). For example, as shown in Table 4, unit of productive capacity costs for airplanes, as measured

TABLE 3

A GENERAL PRICE INDEX FOR RATE BASE ADJUSTMENT

Year (1)	Personal Consumption Expenditures (2)	Producers' Durable Equipment (3)	Composite Index: 33.3% of (2) + 66.7% of (3) (4)
1946	100.0	100.0	100.0
1947	119.3	114.1	115.5
1948	126.1	123.3	124.0
1949	125.0	129.3	127.7
1950	126.7	132.0	130.2
1951	135.4	143.4	140.6
1952	137.5	144.2	141.7
1953	139.3	145.8	143.3
1954	140.5	146.3	144.6
1955	140.8	150.5	146.3
1956	142.1	160.0	154.0
1957	147.8	169.5	162.3
1958	150.5	174.0	166.2
1959	152.5	177.8	169.4
1960	155.0	178.0	170.3

Source: U.S. Department of Commerce, *Survey of Current Business*, July 1956, p. 6, and July 1962, p. 8.

for 1947–55 by prices paid for the DC-6 and DC-6B which represent efficient equipment in medium-range service, have increased less than the producers' capital equipment price index. Indeed, as can be seen by looking at column 8 of Table 4, the costs of this type of medium-range, four-engine plane capacity were remarkably stable over those years and, if anything, actually declined. The indexes reported in Table 4, it should be noted, reflect changes in the utilization patterns of the equipment as well as price changes.

A decline in the actual price of medium-range plane capacity is even more evident in more current data. In 1960, the equipment with the lowest operating costs in medium range operations would appear to be the Lockheed Electra. This plane in a conventional First-Tourist configuration has approximately 40 to 50 per cent more seating capacity than the DC-6B and, except for the period when its operating speeds were reduced for safety reasons, operated at about a 33 per cent higher over-all cruising speed. Such figures imply that one Electra is the equal in units of seats of available capacity to two DC-6B's, as long as the Electra can achieve the same number of hours of daily utilization as the DC-6B. Except for the safety problems in 1959 and 1960, the Electra, with its simple turbo-prop propulsion, should achieve a higher rate of utilization than its reciprocating engine predecessors; it should be remembered, moreover, that the DC-6 also had substantial safety problems in its early years. The Electra when new (in 1958) cost between $2.3 and $2.4 million, so that an approximate 100 per cent increase in capacity was bought at a 50–60 per cent increase in price. In 1962, a used Electra in good condition cost about $1.3 million, partially reflecting the fact that even more efficient and lower cost medium- and short-range capacity was shortly expected in pure jets.

The advent of jets into long-range service also has kept unit costs of this type of capacity more or less constant. Both the Boeing 707 and the DC-8 represent 50 per cent more seating capacity than their predecessors, the DC-7 and the Constellation, and are at least 60 per cent faster. Again, given only equal hours of utilization, this makes each DC-8 or 707 at least equal to 2.5 DC-7's in terms of available capacity. Since DC-7's cost about $2.5 million when new and the DC-8 and 707 have averaged about $6 million in price, the price ratio is also about 2.5.

In short, it would be difficult to argue that the capital costs of airline capacity have risen markedly in recent years since, if anything, they have probably declined. Given the difficulties mentioned earlier of gaining acceptance of downward price corrections and, more importantly, the fact that airline returns have not been high by any standards

TABLE 4

CAPITAL COSTS OF MEDIUM-RANGE FOUR-ENGINE PLANE CAPACITY, 1946-55
(based on DC-6 and DC-6B prices)

Year (1)	Price[a] (thousand dollars) (2)	Available Seat Miles (3)	No. of Planes of the Relevant Types in Fleet (4)	Available Seat Miles per Plane (col. 3 ÷ col. 4) (5)	Capital Costs per ASM (col. 2 ÷ col. 5) (6)	Index Based on Col. 6 (7)	New Composite Index[b] (8)
1946	587.6						
1947	658.8	549,427	83	6,655	$98.60	262.5	206.5
1948	681.8	1,857,475	102	18,210	37.50	100.0	100.0
1949	751.4	3,127,426	104	30,007	25.05	66.8	77.6
1950	857.6	3,586,964	111	32,315	26.55	71.0	80.7
1951	874.0	4,320,953	106	40,763	21.80	58.2	74.5
1952	1,016.9	1,466,068	43	34,095	29.70	79.2	89.0
1953		2,550,428	60	42,507			
1954	1,105.5	2,706,572	64	42,290	26.20	69.8	83.8
1955	1,494.4	3,223,962	70	46,057	32.30	86.2	94.7

Source: Computed from data furnished by the ATA and compiled by them in connection with the General Passenger Fare Hearings before the CAB in 1956-57.

[a]Highest price in each case.

[b]Col. 7 plus col. 2 of Table 3, weighted at .67 and .33 respectively.

in recent years, rates of return uncorrected for capacity price changes are probably reasonably legitimate and acceptable for evaluating airline operations at the moment.

Rather similar price stability for equipment purchases is observable in railroading. In that industry, however, it is more difficult to arrive at over-all impressions of equipment price behavior since so many more types of equipment are involved in a railroad operation than in an airline operation. However, there has been remarkable price stability in the last five years in several important categories of railroad equipment. For example, using actual purchase prices for specific pieces of equipment, since 1957 there has been at most a 5 per cent upward revision in the price of diesel switch and road engines, steel rail, boxcars, and specialized freight rolling stock. Since there have been improvements, in some cases of quite great significance, in the productivity of some of these categories of equipment, this relative price stability strongly suggests that the price per unit of railroad productive capacity may have declined slightly in recent years.

Some relevant figures on equipment utilization and operating efficiency of railroads are given in Table 5 along with some highly aggregate indexes relating to railroad equipment prices for the years 1953 through 1962. The price indexes reflect both price increases and some change, usually a quality upgrading, in the mix of equipment used. The year 1953 is a good base year for efficiency and price comparisons because it essentially eliminates most Korean War effects. The figures in Table 5 suggest that there has been a minimum 10 per cent increase in the efficiency of utilizing railroad equipment and probably substantially more. These figures are to be contrasted with approximate percentage increases in prices for the major types of railroad equipment during the same period: 11 per cent for diesel engines; 15 per cent for steel rail; and 43.5 per cent for freight cars. In large measure, the greater increase in freight car prices represents a substantial upgrading in the quality of cars obtained. In particular, railroad interchange rules were modified several years ago to substitute solid bearings for waste packings in freight car journals; these rules become fully effective only on May 1, 1962 (with the dramatic result, as shown in Table 5, that freight car miles per hotbox rose sharply in 1962) but have been anticipated in equipment procurement practices and prices for several years. Modern freight cars also have several other loading and maintenance cost advantages over those available a decade ago and very often provide a much higher quality of service to the shipper. The net impression is that if there has been an increase in the cost per productive unit of

TABLE 5

INDICATORS OF RAILWAY EQUIPMENT UTILIZATION, OPERATING EFFICIENCY AND PRICES: 1953-62

Year	Net Ton Miles Per Loaded Car Mile	Car Miles Per Freight Train Mile	Freight Car Miles Per Hotbox (Monthly Due in June of each year)	Freight Train Miles Per Train Hour	Gross Ton Miles Per Freight Train Hour	Price Index for Diesel Electric Locomotives	Price Index for Freight Train Cars
1953	32.1	63.2	n.a.	18.2	51,750	191	443
1954	31.4	65.0	n.a.	18.7	53,897	191	450
1955	32.1	66.2	n.a.	18.6	55,770	191	468
1956	33.0	67.2	n.a.	18.6	57,071	200	516
1957	33.4	69.3	n.a.	18.8	59,218	210	562
1958	33.0	70.7	n.a.	19.2	60,807	210	594
1959	33.3	69.6	n.a.	19.5	61,924	210	612
1960	34.0	70.2	159,354	19.5	63,096	210	619
1961	34.7	71.0	293,338	19.9	65,621	211	625
1962 (9 months)	35.7	71.5	938,576	20.0	67,491	211	635
Percentage Change 1953-62	11.2	11.4		10.0	31.0	11.0	43.5

Source: Operating efficiency data are from J. Elmer Monroe, "1962 Review of Railway Operations," *Railway Age*, January 7/14 1963, pp. 87-93. Price indices for the years 1953 through 1960 are from the American Association of Railroads Joint Equipment Committee Report, *Costs of Railroad Equipment and Machinery*, July 1, 1961. The 1961 and 1962 indexes for freight train cars are estimates made by the New York, New Haven and Hartford Railroad; the 1961-62 values for Diesel-Electric locomotives are estimates made by the present authors and are probably the most dubious numbers reported in the Table.

railroad equipment prices, it has been very slight during the last ten years.

Very much the same picture seems to hold true in trucking. In fact, the price of aluminum-van dry-storage trailers seems to have declined slightly, if anything, during the last ten years. It is a bit difficult, though, to assess the productive characteristics of these trailers since, to a certain extent, it would appear that durability has been sacrificed for heavier revenue loadings and a reduction of operation costs through less weight. On the other hand, the relative stability over the last decade in the price of trailer-pulling tractors, in the face of some quite obvious improvements in quality, strongly suggests that the cost of productive capacity in tractor units has declined. Again, the over-all impression is one of rough price stability in terms of costs per unit of productive capacity.

Obviously, it would be useful to know whether technological gains have offset capital goods price increases for other transportation industries. Data are not readily available to answer this question; although, if the point were raised in regulatory proceedings, the data, of course, soon would become available.

RATES OF RETURN IN SOME REGULATED INDUSTRIES

The procedures suggested in previous paragraphs for developing improved estimates of rates of return in regulated industries can be applied both to individual firm and to aggregate industry data. The results obtained by these different procedures will differ, though, and the simple average of rates of return for individual firms generally will not be the same as that obtained by analyzing the aggregate figures for an entire industry. In the aggregate figures the large firms in an industry will enter in heavily, with weights more or less proportional to their asset values. The simple average of the individual firm ratios, on the other hand, weights all firms equally. Which measure is the more appropriate for general regulatory purposes is largely a matter of opinion, being dependent upon such diverse factors as viewpoints about the desirability of competition and its strength in maintaining good managerial practices, the worth of maintaining small business in the economy, and the essentiality of services in a regulated industry.

To illustrate the procedures, a fairly detailed analysis has been made of the 1960 experiences of ten American trunk airlines (all except Northeast) and nine of the larger international air carriers, using data reported to the International Commercial Airlines Organization. The results are reported in Tables 6, 7, and 8. To facilitate the computations, the somewhat arbitrary assumption was made that the airlines conducted no activities other than those that were reasonably pertinent to or an obvious adjunct of their flight operations. All profits and costs, whether realized from flight operations or from nonoperating items, were considered relevant for the rate-of-return calculations. In the case of the U.S. carriers, this means that profits and costs from such adjunct services as supplying meals and beverages for airline passengers and from the sale of surplus property or equipment were included and considered to be an indistinguishable part of the regulated airline operation. In essence, this procedure was followed not because it was considered defensible, but rather because it greatly simplified the calculations from published data. Furthermore, with a few exceptions, like American and United Airlines, the numbers involved were so small as to be of relatively minor importance in determining the final results.

TABLE 6

AIRLINE RATE BASE CALCULATIONS
(in millions of U.S. dollars at end of 1960)

Airline	Long-Term Debt (1)	Capital Stock (2)	Capital Surplus (3)	Unappropriated Balance of Profit and Loss (4)	Flight Equipment Reserves for Depreciation (5)	Grd. Prop. and Equipment Reserves for Depreciation (6)	Total (7)
American	228.8	15.2	39.8	98.2	144.2	30.3	556.5
Braniff	40.0	7.4	18.3	10.9	34.0	5.1	115.7
Delta	55.0	3.4	15.9	19.1	53.4	6.9	153.7
Eastern	165.0	3.2	27.2	80.1	180.9	21.0	477.4
National	33.8	1.8	21.2	5.9	34.5	3.8	101.0
Northwest	68.5	25.1	6.6	20.5	34.5	10.5	165.7
Pan American	317.3	5.3	72.4	60.7	183.5	24.1	663.3
TWA	123.2	33.4	48.9	43.6	185.4	22.9	457.4
United	242.0	42.2	54.1	51.8	158.1	35.5	583.7
Western	23.0	1.4	19.4	11.8	23.1	4.4	83.1
Sabena	91.5	15.0	--	--	30.1	12.5	149.1
TCA	209.9	5.0	--	--	63.0	9.8	287.7
Avianca	2.2	2.1	3.7	.6	6.7	1.7	17.0
Air France	213.3	20.4	8.7	.5	112.1	25.6	380.6
KLM	101.6	38.6	.4	.3	93.1	16.7	250.7
SAS	108.0	30.4	--	16.2	46.7	8.4	209.7
Swissair	42.1	24.4	--	.1	24.8	7.4	98.8
BEA	122.9	44.8	--	.1	38.9	11.7	218.4
BOAC	-	422.6	6.6	48.3	66.9	15.5	559.9

TABLE 7

AIRLINE PROFIT CALCULATIONS
(millions of U.S. dollars in 1960)

Airline	Net Profit After Income Taxes (1)	Interest (2)	Total Depreciation Expense (3)	Total (4)
American	11.8	9.6	38.1	59.5
Braniff	.7	1.9	7.8	10.4
Delta	3.1	2.7	13.9	19.7
Eastern	-3.6	6.0	39.4	41.8
National	-5.1	2.2	9.8	6.9
Northwest	1.6	3.2	14.4	19.2
Pan American	7.1	12.4	50.2	69.7
TWA	6.5	4.1	37.3	47.9
United	11.2	8.8	46.3	66.3
Western	2.4	1.1	9.3	12.8
Sabena	2.5	.6	7.0	10.1
TCA	--	4.2	13.7	17.9
Avianca	.6	.5	1.3	2.4
Air France	.2	8.6	32.4	41.2
KLM	2.7	2.4	21.6	26.7
SAS	-16.2	2.8	15.1	1.7
Swissair	1.1	1.3	6.0	8.4
BEA	4.0	3.6	13.5	21.1
BOAC	-7.1	13.3	29.8	36.0

As shown in Table 7, with these simplifications, the calculation of the rate-of-return numerator reduces to adding interest and total depreciation expenses to final net profits after income taxes.

The calculation of the rate base or denominator of the ratio is only slightly more complicated, given the simplified procedures assumed here. It involves adding long-term debt, capital stock, capital surplus, unappropriated balances of profit and loss, and all reserves for depreciation. The rate base calculations for the 19 airlines under analysis are reported in Table 6.

The final step in the analysis was to divide the total profit return as shown in the last column of Table 7 by the rate base estimate shown in the final column of Table 6 and these quotients are recorded in Table 8. These estimates, of course, might be converted into more refined approximations of the "true" rate of return by using the present value formula and taking into account the fact that airline equipment is now estimated, at least by the U.S. Internal Revenue Service, to have an average life of six years. In the present case, it is quite clear that performing this correction, i.e., assuming that the new Internal Revenue Service "guideline life" is correct, would mean that none of the

TABLE 8

CRUDE AIRLINE RATES OF RETURN, 1960

Airline	Rate of Return (unadjusted)
American	10.7
Braniff	9.1
Delta	12.8
Eastern	8.7
National	6.8
Northwest	11.6
Pan American	10.4
TWA	10.5
United	11.4
Western	15.4
Sabena	6.8
TCA	6.8
Avianca	14.1
Air France	10.7
KLM	10.7
SAS	8.2
Swissair	8.5
BEA	9.7
BOAC	6.4

Source: Col. 4 of Table 7 divided by col. 7 of Table 6.

domestic or international carriers earned a positive rate of return on their investments in the year 1960. (A break-even or zero rate of return would require a 16.6 per cent crude rate of return on the assumption that airline investments have a six-year useful life.) A somewhat more reasonable procedure might be to proceed on the old Civil Aeronautics Board determination that the economic longevity of flight equipment is seven years with a scrap value of 15 per cent. A seven-year life, in addition, would not appear too out of line for airline ground equipment as well. It would be even more legitimate and necessary to take into account the fact that approximately 10 to 15 per cent of every dollar invested in commercial airline operations is net working capital.

Working on the basis of these assumptions, the profit picture for 1960 airline operations is improved, but only slightly. Specifically, the break-even rate of return is lowered to 10.7 per cent. As can be seen in Table 8, this means that Delta, Western, Avianca, United, and Northwest do a little better than break even, and American, KLM, and Air France are on the margin of doing so. What these figures confirm, of course, is something that is well known: 1960 was not a very good year for either domestic or international airlines.

TABLE 9

RATE OF RETURN AND NET INCOME ON RAILWAY OPERATIONS: 1953-62

Year	Net Railway Operating Income Before Fixed Charges But After Depreciation (million dollars)	Rate of Return on Net Investment (per cent)	Net Income After Fixed Charges (million dollars)
1953	1,109	4.19	903
1954	874	3.28	682
1955	1,128	4.22	927
1956	1,068	3.95	876
1957	922	3.36	737
1958	762	2.76	602
1959	748	2.72	578
1960	584	2.13	445
1961	538	1.97	382
1962[a]	652	2.39	494

Source: J. Elmer Monroe, "1962 Review of Railway Operations", *Railway Age*, January 7/14, 1963.

[a]Twelve months ended September 30, 1962.

Some insight into the rates of return in aggregate on U.S. railway operations over the last decade can be obtained from Table 9, which reports net railway operating income, net income after fixed charges, and the rate of return on net investment computed on the basis of the net railway operating income (that is, exclusive of fixed charges) for the years 1953 through 1962. As can be seen from Table 9, these rates of return fluctuated between approximately 2 and 4.25 per cent. Conceptually, these rates resemble the return on average investment or net fixed assets discussed previously and shown in Table 2. As can be seen from that table, when the average rate of return on net fixed assets is at such a low level, it does not depart markedly from the true financial rate of return. Thus, the financial rate of return on railway operations in recent years has apparently fluctuated between approximately 1.90 and 4.00 per cent. These figures, however, are undoubtedly high because railroad assets during the period were approximately 55 per cent written off, so that a net fixed asset base results in an overstatement of the financial return. (For further information see Table 10 where the 1960 railroad return calculated by the more accurate gross asset method is presented.) Again, the figures document a well-known fact: railroading has not been a prosperous business in the United States in recent years.

Aggregate rate-of-return calculations for 1960 for both Class I railroads and other U.S. regulated industries are reported in Table 10,

TABLE 10

AGGREGATE 1960 RATE OF RETURN ESTIMATES FOR SOME REGULATED INDUSTRIES (million dollars)

Industry	Rate Base				Return							
	Long-Term Debt (1)	Capital Stock, Surplus and Unappropriated Balances and Losses (2)	Depreciation Reserves (3)	Estimated Rate Base (1+2+3) (4)	Net Income After Taxes (5)	Long-Term Interest Payments (6)	Total Depreciation Expense (7)	Total Return (5+6+7) (8)	Net Current Assets (9)	Crude Rate of Return (8 ÷ 4) (10)	Estim. Useful Life (years) (11)	Est. Financial Rate of Return (per cent)[a] (12)
Transport:												
1. Class I railroads	9,919	16,338	8,214	34,471	445	244	629	1,318	1,110	3.8	25	0
2. Motor carriers of property	667	751	1,003	2,421	37	37	202	276	221	11.3	8	0
3. Motor carriers of passengers	175	71	258	514	28	4	29	61	10	11.8	8	-.5[b]
4. Pipelines	1,056	1,085	1,331	3,472	169	43	118	330	206	9.5	22	8.0
Public Utilities:												
5. Natural gas	6,114	4,384	2,946	13,444	458	265	360	1,083	113	8.1	28	7.2
6. Electric utilities	21,057	18,897	9,863	49,817	1,783	727	1,183	3,693	47	7.4	30	6.2
7. Telephone	730	13,517	5,577	19,814	1,250	279	1,076	2,605	86	13.0	25	11.5

NOTES TO TABLE 10

Coverage and Sources

Line

1. Includes all U.S. Class I line haul carriers. Class I railroads have about 99 per cent of intercity rail traffic. Data from ICC, *Transport Statistics*, 1960, pp. 114-118, Part 1.
2. Includes carriers subject to ICC regulation engaged in intercity operations and reporting financial data. These are predominantly Class I carriers, i.e., those with annual revenues in excess of $1,000,000. They receive about 70 per cent of the total revenue of ICC regulated carriers. Source as above, Part I, pp. 6-10.
3. Includes all Class I intercity carriers, i.e., with annual revenue of more than $300,000. These carriers receive 88 per cent of all revenues of ICC regulated carriers of passengers. Source, as above, Part I, p. 132.
4. Includes all pipelines reporting to the ICC, source as above, Part 6, pp. 2-3.
5. All Class A and B natural gas companies, i.e., companies with more than $750,000 annual revenue. These companies account for virtually all interstate natural gas business. Source: Federal Power Commission, *Statistics of Natural Gas Companies*, 1960, Tables 1 and 4.
6. All privately owned Class A and B electric utilities, i.e., companies with annual revenues of more than $250,000. These companies receive 98 per cent of the revenue of privately owned electric utilities. Source: Federal Power Commission, *Statistics of Electric Utilities in the United States*, 1960, Tables 17 and 18.
7. All Class A carriers, defined as companies with more than $250,000 revenue. Class A carriers account for 99 per cent of industry revenues. Source: Federal Communications Commission, *Statistics of Communications Common Carriers*, 1960, pp. 28-30.

   Figures on useful lives were obtained from U.S. Treasury Department Internal Revenue Service, *Depreciation Guidelines and Rules*, September 1962 (except for telephones).

[a] In computing these figures an allowance has been made for both working capital needs and longevity of assets.

[b] Estimated financial rate of return here is negative.

TABLE 11

ESTIMATED AVERAGE TRUE RETURNS IN SOME REPRESENTATIVE MANUFACTURING INDUSTRIES, 1948-54

Industry	Average Net Profit to Gross Fixed Asset Ratios[a] (per cent)			Estim. of Needs Net Working Capital as Per Cent of GFA	Estim. of Net Profit to GFA After WC Corrections (per cent)			Approximate Average Economic Life of Equipment[b]		Approximate Financial Rates of Return[c] (per cent)		
	1946-50	1951-54	1946-50		1946-50	1951-54	1946-54	Bulletin F	Sept. 1962, *Guidelines*	1946-54, Bulletin F Lives	1951-54, Bulletin F Lives	1951-54, *Guidelines* Correction[d]
Pulp and paper	18	12	15	25	14	10	12	19	16	16	13	13
Light chemicals	34	17	25	40	24	12	18	20	11	23	16	15
Heavy chemicals	22	10	16	25	18	08	13	18	11	17	12	10
Rubber	18	12	15	20	15	10	13	17	14	17	15	13
Basic iron and steel	16	14	15	25	13	11	12	25	18	15	14	13
Fabricated metal products	25	24	25	30	19	19	19	22	12	25	24	20
Other machinery	28	28	28	40	20	20	20	24	12	25	26	22
Light electrical machinery	34	18	26	40	24	13	19	19	12	22	17	16
Automotive	34	19	26	30	26	15	20	17	12	25	19	18
Household appliances and furnishing	45	30	37	35	33	22	27	18	12	33	28	23
Machine tools	23	24	24	40	16	17	17	18	12	24	24	21
Heavy electrical machinery	33	25	29	40	24	18	21	22	12	25	23	21
Basic textiles	34	08	21	15	30	07	18	25	14	22	10	08
Other textiles	24	06	15	20	20	05	13	16	11	18	08	07

using the gross asset method previously used with the airlines. As can be seen, the domestic regulated industries had widely varying experiences in the year 1960. The public utilities on the whole did well; in fact, the telephone industry did very well. An intriguing feature of the figures presented in Table 10 is the degree to which the public utilities have relatively low depreciation reserves, usually under 30 per cent of the gross rate base; this means that any rate of return using net assets as the base for these industries probably will understate the true average return.

On the other hand, all the transport industries, with the lone exception of pipelines did miserably, more or less matching the airline experience in the same year. We have, however, several reservations about our findings with respect to intercity trucking and, to a lesser extent, intercity buses. First, our calculations are based on 1960 data which, from industry accounts, appears to have been a year of atypically low profits. Second, the accounting data for trucking, an industry with a large number of small firms, may be less accurate than for other regulated industries. Finally, the economic age in the guidelines may understate the economic life of trucking equipment. Hence, we are not sure that our findings refute the widely held notion that trucking is a generally profitable industry.

The recent profit situation of the transportation industries (again with the exception of pipelines, and possibly trucking and buses) appears at least as bad when measured against the standards of unregulated manufacturing industries as when measured against other regulated industries. This is brought out by the figures shown in Tables 11, 12, and 13. In these tables, rates of return for manufacturing

NOTES TO TABLE 11

[a]Based on data for approximately 750 publicly listed corporations in these industries. Moody's *Manual of Industrials* and individual company reports were the principal sources.

[b]Based on Bulletin F, *Income Tax Depreciation and Obsolescence, Estimated Useful Lives and Depreciation Rates*, U.S. Treasury Department, Bureau of Internal Revenue (Washington, 1948) and *Depreciation Guidelines and Rules*, U.S. Treasury Department, Internal Revenue Service Publication No. 456 (9-62), Washington, 1962.

[c]Estimated by dividing the ratios of reported net profits to gross fixed assets by one, plus the estimated percentage needs of net working capital, and using Table 1 above (in an extended version) to convert the resulting figures into financial rates of return.

[d]These corrections were made on the presumption that Bulletin F lives had to be used by corporation accountants when recording depreciation, but that the "1962 Guidelines" were correct estimates of actual economic lives. The undepreciated portions of gross fixed asset values left at the end of the "Guidelines lives" were regarded as capital losses and considered to be 50 per cent recouped by a reduction in corporate taxes.

have been estimated both for averages of individual firms and industry aggregates.

The individual firm averages pertain to the years 1946 through 1954 and were developed from data collected for investment studies.[12] Reported in Table 11 are simple industry averages of individual firm net profit (after tax) returns on gross fixed assets; these averages, in turn, have been corrected for interindustry differences in working capital by using estimates of the average working capital needs of firms in each individual industry.[13] The samples used in constructing these averages covered virtually every firm in the designated industries that is registered with the Securities and Exchange Commission.[14] Gross fixed assets were used as the rate base in these industries mainly because of convenience: the investment studies for which the data were originally collected used gross fixed assets as a deflator when making certain cross-section statistical analyses. However, a gross fixed-asset base has the additional advantage of being less sensitive to differences in the ages of equipment used in different industries, thus avoiding the saw-tooth bias problem discussed previously.

Several different estimates of the rates of return have been presented by using different combinations of estimated useful economic lives, and by averaging the data over different sets of years. Probably the most pertinent figures from the standpoint of the present study are those shown in the last two columns of Table 11 for the 1951–54 period. While not up-to-date, they are the most recent available from the investment studies. One notable aspect of the numbers shown in the table is the way in which progressive refinements of the analyses tend to reduce the differences in the estimated rates of return in different industries, a fact which should at least be reassuring to market economists. It should be noted, moreover, that the rates of return reported in the table are, if anything, too low, since the most important single remaining bias is the omission of interest payments as a return on capital.[15]

[12] J. R. Meyer and E. Kuh, *The Investment Decision*, Cambridge, Mass., 1957; and J. R. Meyer and R. Glauber, *Investment Decisions, Economic Forecasting and Public Policy*, Boston, 1963.

[13] The estimates of working capital needs are quite crude and were based primarily on the average industry ratios of net working capital to gross fixed assets for the individual firms in the samples for the year 1954, rounded to the next lowest quinary.

[14] More detailed information on these samples can be found in Meyer and Kuh, *Investment*, Chapter 3; and Meyer and Glauber, *Investment Decisions*, Chapter 3.

[15] Another potential source of bias working in the opposite direction, however, is the fact that the actual depreciation practices followed by the manufacturing corporations included in the sample probably were slightly more conservative than

Some 1960 financial rates of return for individual manufacturing industries, based upon aggregate data, are reported in Table 12 and were estimated from figures reported in the Securities and Exchange Commission-Federal Trade Commission *Quarterly Financial Report of Manufacturing Industries.* This document presents estimates of the aggregated balance sheets and income statements for several manufacturing industries. In constructing the rates of return reported in this table, essentially the same procedures were used as were used previously when reporting estimates of financial rates of return in the regulated industries. That is, the rate base was estimated by adding together stockholder equity, long-term debt, and depreciation reserves; and the profit returns were taken as the sum of net income after taxes, depreciation expenses, and interest payments (which, however, had to be estimated because they are not available in the FTC-SEC reports). The numbers reported in Table 12 are not always directly comparable with those reported in Table 11 because of slight differences in the industry classifications employed. However, a number of direct comparisons are possible and, in general, it is clear that the numbers are not too dissimilar.[16] One point that is evident from such comparisons, though, is that rates of return, even when depreciation expense is included as a return, apparently have declined in manufacturing in the last ten years. However, some of the differences in the figures reported in the two tables may also be attributable to differences in the samples covered; the SEC-FTC *Quarterly Financial Report* includes returns for many small manufacturing corporations that are not publicly listed and may not attain as high profit levels as larger corporations. In addition, the SEC-FTC figures covered all manufacturing industries, including many of the less profitable industries not included in the investment analyses and therefore not reported in Table 11.

Somewhat more direct evidence on the behavior of rates of return in manufacturing since the end of World War II is presented in Table 13. There, crude estimates are presented of the rates of return realized in

those implied by the "Bulletin F" estimates reported in Table 9. Specifically, the average ratio of depreciation expense to gross fixed assets in these industries indicated in a few instances that the useful lives actually being used for depreciation were one to two years longer than the "Bulletin F" lives shown in the table. If this factor were taken into account, it would tend to further depress the rate of return very slightly; the type of adjustment involved would be essentially like that made when moving from the "Bulletin F" to the Guideline depreciation figures as shown in the last two columns of Table 9.

[16] The relationships between the industrial groupings used in the investment studies and the standard industrial classifications are explained in Meyer and Kuh, *Investment*; and Meyer and Glauber, *Investment Decisions.*

TABLE 12

AGGREGATE 1960 RATES OF RETURN IN MANUFACTURING INDUSTRIES[a]
(billion dollars)

Industry	Rate Base: Long-Term Debt (1)	Rate Base: Stock Holders Equity (2)	Rate Base: Depreciation Reserves (3)	Rate Base: Estim. Base (1+2+3) (4)	Return: Net Profit After Taxes (5)	Return: Estim. Interest (6)	Return: Depreciation Expense (7)	Return: Total Returns (5+6+7) (8)	Net Current Assets (9)	Crude Rate of Return (8 ÷ 4), Per Cent (10)	Estim. Useful Life[b] (11)	Estim. Financial Rate of Return[c] (per cent) (12)
All manufacturing	33.3	164.5	89.9	187.7	15.2	2.3	10.9	28.4	80.3	9.8	12	6
Trans. equip. (incl. motor vehicles)	2.5	16.3	8.0	26.8	1.9	.2	1.1	2.3	8.6	8.6	12	4
Motor vehicle	1.6	12.5	6.2	20.3	1.7	.1	.8	2.6	6.0	12.8	12	10
Elec. mach.	2.5	10.6	3.9	17.0	1.1	.2	.6	1.9	7.0	11.2	12	9
Other mach.	2.6	13.2	5.5	21.3	1.0	.2	.9	2.1	8.4	9.9	12	8
Fab. metal prod.	1.1	7.1	3.0	11.2	.4	.1	.4	.9	4.2	8.0	12	5
Primary metals	4.8	20.0	14.4	39.2	1.4	.3	1.2	2.9	8.4	7.4	17	5
Stone, clay, and glass	.8	5.7	3.1	9.6	.6	.05	.4	1.05	2.3	10.9	15	8
Furn. and fix.	.2	1.4	.5	2.1	.1	.02	.07	.19	1.0	9.1	10	6
Lumber and wood	.7	2.9	1.4	5.0	.1	.06	.3	.46	1.3	9.2	10	5
Instruments	.3	2.7	1.0	4.0	.3	.02	.15	.47	1.8	11.8	12	9
Misc. manufs.	.4	2.0	.7	3.1	.2	.02	.1	.32	1.2	10.3	12	8
Food and kindred	2.8	13.9	6.6	23.3	1.2	.2	.8	2.2	7.6	9.5	15	7
Tobacco	.5	2.1	.3	2.9	.25	.05	.04	.34	2.2	11.7	15	10
Textiles	.9	5.6	2.7	9.2	.3	.09	.3	.69	3.4	7.5	13	4
Apparel	.3	1.9	.5	2.7	.15	.04	.08	.27	1.5	10.0	9	6
Paper	1.6	6.9	3.9	12.4	.6	.1	.5	1.2	2.5	9.7	16	7
Printing and publishing	.7	2.9	1.2	4.8	.3	.03	.2	.53	1.7	11.0	11	8
Chemicals	3.6	16.4	9.4	29.4	2.0	.2	1.2	3.4	7.3	11.5	11	8
Petroleum	3.5	28.7	21.5	55.7	2.8	.3	2.3	5.4	7.0	9.7	15	6
Rubber	.8	3.3	1.9	6.0	.3	.05	.25	.6	2.3	10.0	14	7
Leather	.2	1.1	.3	1.6	.07	.01	.05	.13	.7	8.1	11	5

all of manufacturing, again using aggregate data obtained from the SEC-FTC *Quarterly Financial Reports.* Because of a number of changes that have been made in reporting procedures and the samples used by the SEC and the FTC, consistent series for the entire period are difficult to construct. It is necessary to make a number of assumptions and to "splice" in order to join the reported numbers into a consistent set. Furthermore, because the spliced series were created for a different purpose than the measurements of rates of return (specifically by Professor Locke Anderson of the University of Michigan for conducting some investigations of financial behavior in manufacturing), no spliced series were created for depreciation reserves or gross fixed assets, series which would have been obviously useful for present purposes. As before, moreover, no interest series was available. Accordingly, the estimates developed in the table are based upon net fixed-asset rate bases and are correspondingly somewhat cruder than those reported previously, except for the railroad rates of return reported in Table 10 which are of the same type. In places where direct comparisons are available between the spliced and the original series, however, spot checks indicate that the results obtained by using the net-profit-to-net-fixed-asset approach in estimating the rate of return are not very different from those that would have been obtained if the net worth or gross fixed-asset method had been used instead.

As previously pointed out, a major difficulty with the net-profit-to-net-fixed-asset approach is that it is based on the assumption that approximately one-half of assets are written off. Therefore, the rates of return are accurate only to the extent that this assumption is approximated. Furthermore, the degree of approximation to this assumption can and usually does vary over time. Some biases are probably

NOTES TO TABLE 12

[a]The flow data (net profits after taxes and depreciation expense) are totals for all four quarters of the designated years; the stock data (long-term debt, depreciation reserves, stockholders equity, and net current assets) pertain to mid-year or end-of-second-quarter levels. Net current assets were estimated by subtracting total current liabilities from the total of current assets. Because no series on interest payments was available, interest expenditures were estimated by totalling all forms of long- and short-term debt and applying to them a factor of .06, assumed to be the average rate of interest paid.

[b]Based on *Depreciation Guidelines and Rules*, U.S. Treasury Department, Internal Revenue Service Publication No. 456 (9-62), Washington, D. C., September 1962.

[c]These financial rates of return were estimated on the basis of the useful lives shown in Column 11, and by taking into account differences in net working capital needs. Specifically, it was assumed that net working capital was realized in one lump sum at the end of the number of designated years of useful life.

TABLE 13

RATE OF RETURN CALCULATIONS FOR MANUFACTURING CORPORATIONS, 1947-59[a]

Year	Net Profits After Taxes	Depreciation Expense	Net Fixed Assets	Net Working Capital[b]	Other Non-current Assets	Crude Net Profit to Asset Ratios (per cent)[c]	Approximate Financial Rates of Return (per cent)[d] Without an Interest Allowance	With an Interest Allowance[e]
1947	10.2	2.7	30.0	35.6	6.6	14.1	12.5	13.0
1948	11.8	3.4	36.5	38.7	7.5	14.2	12.5	13.0
1949	9.3	3.7	41.4	41.5	8.6	10.2	9.3	9.8
1950	13.4	4.1	44.2	45.7	8.8	13.6	11.5	12.0
1951	11.8	4.8	49.5	50.9	9.7	10.6	9.5	10.0
1952	10.8	5.3	55.8	53.0	10.3	9.1	8.0	9.0
1953	11.5	6.2	60.2	55.4	10.6	9.1	8.0	9.0
1954	11.4	6.8	64.3	56.7	10.7	8.7	7.5	8.0
1955	15.5	7.7	67.9	60.6	11.8	11.1	10.0	11.0
1956	16.2	8.4	73.8	65.4	13.9	10.6	9.5	10.0
1957	15.4	9.3	82.8	67.8	15.0	9.4	8.5	9.5
1958	12.6	9.6	88.7	68.4	16.5	7.6	7.0	7.5
1959	16.3	10.4	90.7	73.5	17.5	9.0	8.0	9.5

[a]The basic sources of data for this table were *Quarterly Financial Reports for Manufacturing Corporations* published by the Federal Trade Commission and the Securities and Exchange Commission. Because of a number of changes in the sample and sampling procedures used by the SEC and FTC, it was necessary to perform splicing operations to create series that were uniform over the entire time period. The splicing was performed by Professor Locke Anderson of the University of Michigan and it is through his generosity that these data have been made available for use here. The flow data (net profits after taxes and depreciation expense) are totals for all four quarters of the designated years; the stock data (net fixed assets, net working capital, and other noncurrent assets) pertain to mid-year or end-of-second-quarter levels.

introduced here; e.g., a tendency toward a systematic underestimation of the true rate of return throughout the period and particularly during the earliest years reported. In addition, a systematic tendency toward underestimation in the early 1950's may account for some of the observed differences between the estimates presented in Table 13 and those in Table 11 (although the previously reported fact that the SEC-FTC Reports cover a much larger sector of manufacturing and many more smaller firms are probably also at least partially responsible for these observed differences).

However, no matter how returns in the manufacturing industry have declined or are measured, they are still considerably larger than those realized in transportation. Indeed, even the least prosperous of all the manufacturing industries, the textile industries, do better than break even—the recent fate of most transportation industries. The

NOTES TO TABLE 13 (concluded)

[c]The crude net-profit-to-asset ratio was estimated by dividing net profits after taxes by the sum of net fixed assets plus net working capital plus other noncurrent assets.

[d]The approximate financial rates of return were estimated from the crude net-profit-to-asset ratios by using a table of conversions like those shown in Table 2 above. The simple conversions shown in Table 2 were modified, however, to take account of the fact that approximately one-third of the total investment in manufacturing is accounted for by net working capital which is not subject to depreciation and has a 100 per cent salvage value. Furthermore, because the depreciation-to-net-fixed-asset ratios range between approximately .09 in the late 1940's to .11 in the late 1950's, it was assumed that the net fixed assets invested in all manufacturing had an approximate life of twenty years; such an estimate of useful life follows almost automatically from the fact that the conversion from the crude net profit rate to the financial rate of return estimate is based on the assumption that gross fixed assets are approximately one-half depreciated at all times. While this assumption of a one-to-two ratio between net fixed assets and gross fixed assets (or, alternatively, of depreciation reserves to gross fixed assets) is not strictly true throughout the period, spot checks would indicate that it is not too gross a violation of the facts. A direct calculation of the rate of return using gross fixed assets or depreciation reserves was impossible because these two series have not been spliced to create a consistent set of numbers for the entire twelve-year period.

[e]Because no consistent spliced series on interest payments was available, interest expenditures were estimated by totalling all forms of long-term and short-term debt, for which spliced series were available, and applying to them a factor of .06, assumed to be the average rate of interest paid. Clearly, some distortion is introduced by assuming that the average level of interest payments were the same throughout the twelve-year period, since they were almost surely higher during the tight monetary periods of 1954 and 1957 than during the other years, and were probably higher at the end of the twelve years than at the beginning. However, because such a very high percentage of total corporate debt is in the form of long-term debt, the effective movement in the actual rate of interest paid by the corporations was probably not too great over time.

substantial differences existing between returns in the unregulated manufacturing industries and transportation cannot be explained, moreover, simply on the basis of "greater risk" being faced by manufacturers. Indeed, in industries of such marked concentration and reputed prevalence of "oligopolistic price leadership" as basic steel, heavy chemicals, and pulp and paper, there is perhaps less competition and investment risk than in transportation.

Some Final Comments and Observations

The disparity of returns between transportation and other regulated and unregulated industries poses some interesting questions for economic theory and policy. Above all is the question, why investments and services in transportation continue to be forthcoming when resources allocated to these activities realize so much lower rates of return than in other activities.

There are, of course, indications that returns on rail operations are really *not* adequate to keep many of the assets presently employed in these activities in the industry. (This, though, may not be an economically undesirable objective.) The fact that the dependability of rail returns has been further jeopardized in recent years by the rise of new competition from trucks, buses, and airplanes only increases this probability. Some investments in railroading, of course, may be justified at the margin even if average returns are quite low.

In the airline industry, the continued presence of productive facilities apparently is due to the simple fact that very large commitments were made to this industry in recent years on the basis of highly optimistic expectations. While these expectations have not been borne out to any great extent (1961 was about as bad a year as 1960 for domestic and international airlines and 1962 was only slightly improved), there are indications that this industry may be on its way to solving most of its problems. Four domestic carriers, Delta, Northwest, National, and Western, reported quite handsome profits for 1962, particularly for the second half of the year. Circumstances were even improved for the U.S. international air carriers in the second half of 1962.

Disparities in the fortunes of different firms also may help explain why investments continue to be forthcoming in many transportation activities. There is always a hope, sometimes even a well-based belief, that if one is lucky, prudent, or an intelligent manager, one can make a reasonable return on investments in regulated industries. Optimistic hopes of beliefs are only strengthened, of course, if there is a tendency for regulation to gear itself to perpetuating in business the least efficient members of an industry.

Finally, it must be recognized that elimination of fixed investments in any industry requires time. In industries like railroading, involving assets of very long economic life, this transition period may be quite lengthy. Even in the airlines, recent experience suggests that the transition may be long and difficult enough to be both quite painful and not readily obvious. A regulatory agency, or even private managements, may not recognize capital consumption and the full adversity of a industry situation until the processes of deterioration are well, perhaps irreversibly, in progress. Needless to say, oversimplified, crude measures of rates of return do not increase the likelihood of early perception.

COMMENT

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Almost everyone must agree, by now, that the proper objective of regulation is to simulate the competitive process, with the appropriate incentives for service, efficiency, and technological improvement being provided at the cost of no more than transitional, abnormal profits. My difficulty with the Peck-Meyer paper (and perhaps its authors might even agree) is that I really think regulatory simulation of the competitive process is quite impossible. If profit is regulated in an attempt to keep it within competitive norms, there are not only insurmountable measurement problems, but the danger that the incentives for efficiency and technological progress will be lost. If incentive retention of profits arising out of cost improvements is permitted, how much retention should be permitted? A little more incentive for cost reduction can always be provided by increasing the share of such profits that can be retained. The competitive process requires neither measurement nor the objective formal statement of criteria, but regulatory simulation does, and that is why Peck and Meyer have set themselves a difficult task.

Despite these problems, I think their recommendations would improve matters materially; they have gone about as far as one can go with technical refinements, such as the use of present value calculations and the careful analytical definition of capital, in specifying the appropriate rate base. I say "I think," because I really do not know. When the authors come to grips with applying these principles, we find, inevitably, statements like (p. 218), ". . . the consumer price index and the producers' durable equipment index might be given, as a first rough approximation, weights of one and two, respectively, in the construction of a general composite index of price changes for the adjustment of rate bases." We also find wise qualifications like (p. 215), "The use of a simple index of the production cost of an ever-improving unit of output is not, however, an automatic cure-all. Depending on the particular character of technological advance . . . the gains will be shared differently by the different participants."

What I am trying to say is that the attempt to simulate the competitive process requires somebody to make judgements about what is a fair return, how capital should be measured, how this or that number should be weighted, and so on. Such judgements, however rationally and objectively made, tend to become institutionalized and inflexible.

But if regulatory simulation of the competitive process is impossible, except in the roughest way, what then is the solution to the problem of regulation? I think the key to the answer is made plain in the Peck-Meyer paper, as well as in the papers by James C. Nelson and Robert A. Nelson. Peck and Meyer find that no matter how one proposes to measure the rates of return in manufacturing industries, such rates are considerably higher than those realized in the regulated transportation industries, with the lone exception of pipelines. The gas and electric utilities do about as well as manufacturing generally, with only the telephone utilities doing better. These results provide little support for the image of the American transportation system as a vast profit hungry monopoly, that would quickly bleed the country to ruin were it not for the protections provided by regulation.

With regard to transportation, the answer to the problem of regulation is not, in my opinion, the development of more refined measures of capital, rates of return, and so on. The answer is to be found in a very substantial amount of deregulation. In time, preferably soon, I would visualize the entire transportation industry subject only to regulation under the anti-trust laws, and regulations pertaining to safety. I would permit mergers between East-West and North-South air carriers; I would favor railroad and truck mergers designed to produce fully integrated, alternative-route, competitive transportation systems, provided such mergers were not in violation of ordinary anti-trust considerations. I would free most if not all classes of commodities, including passengers, from rate regulation. If there are not now enough alternative, closely competing transport facilities to permit reliance upon free competition in American transportation, then it is abundantly clear that we should be regulating most of American industry.

But I would go further than transportation, and suggest that we seriously consider deregulating the gas utilities and perhaps, in time, the electric utilities. Close substitutes for natural gas in the form of propane, heating oil, and electricity, are now sufficiently numerous, as to suggest that the regulation of the gas industry may be superfluous. I can't imagine the gas companies getting away with rates much in excess of the going equivalent prices of propane and heating oil. If this conjecture should be wrong, I could only conclude that consumers are indifferent at the higher price, and if they really are indifferent then why waste all those administrative resources trying to regulate the industry?

As for the electric utilities, it is evident that close competitive alternatives are not now commercially available. But there is a reasonably good possibility that self-contained home generating plants, employing solar conversion devices, fuel cell, or gas turbine units will in the future become economically competitive with centralized generating systems. Such a development could introduce competitive pressures on the electric utilities that would eliminate, or drastically alter, the necessity for regulation. We should be alert to the possibility of such trends, and guard against the long institutional lag that continues to characterize transport regulation.

Only the telephone utilities seem to be substantially insulated from any impending prospect of competitive substitute service. So perhaps in this industry, and for the time being in the electric utilities, we should struggle along with the Peck-Meyer improvements and a frankly imperfect attempt to simulate the competitive process.