

THE LEGAL HISTORY AND ECONOMIC IMPLICATIONS OF OIL PIPELINE REGULATION

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I. INTRODUCTION

The battle now being waged in the regulatory arena over which ratemaking methodology should be adopted for oil pipelines is an epic event not to be missed by any lawyer or economist intrigued with the art, the science, and, more than occasionally, the perversity of government regulation.¹ This struggle is more than just interesting, however, because its outcome will likely spill over into the regulation of other industries—natural gas, electric utilities, and possibly synfuels. Because FERC has assumed the Interstate Commerce Commission's (ICC) previous responsibility for oil pipelines and hence, because of FERC's broader mandate, the potential precedents from the cases examined below transcend the jurisdictional boundaries of oil pipeline regulation.

The two most prominent of the over 80 rate cases now piling up in the dockets of the Federal Regulatory Commission (FERC) are the *Trans-Alaska Pipeline System* (TAPS) and *Williams Brothers Pipeline* (WBPL).² In *TAPS* and *WBPL*, three competing ratemaking methodologies have been proposed; FERC has indicated that its decision on the appropriate methodology will form the basis for developing a generic methodology for all oil pipeline ratemaking.

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¹This article documents the legal history and evolution of oil pipeline regulation. It is a companion piece to *A Critical Comparison of Utility-type Rate-making Methodologies in Oil Pipeline Regulation*, by P. Navarro, B. Petersen, and T. Stauffer, which appears in the Fall 1982 issue of *The Bell Journal of Economics*. The latter article examines the economic implications of oil pipeline regulation. The reader interested in mathematics, formulae, and the mechanics of our results can refer to that paper.

²Trans-Alaska Pipeline System, FERC Docket No. OR78-1; Petroleum Products, Williams Brothers Pipe Line Co., FERC Docket No. OR79-1 [hereinafter referred to as *Williams II*].

The three methodologies being examined are:

1. the "ICC formula," developed by the Interstate Commerce Commission between 1909 and 1978 when ICC had the authority to regulate oil pipeline rates;
2. the "Consent Decree formula," a close cousin of the ICC format, with its origins in a 1941 Department of Justice decision which imposed several constraints on oil pipelines; and
3. the "FERC formula," the conventional utility-type methodology, based upon "original cost," which is championed by the current regulators of oil pipelines.

The purpose of this paper is to review the legal evolution and evaluate the economic performance of these competing ratemaking methodologies, as well as to emphasize that viable, more effective alternatives do exist. These alternatives avoid many of the disabilities of the methodologies now slated for consideration before FERC.

Section II provides a brief summary of the events which precipitated the *TAPS* and *WBPL* cases. Section III reviews the legal history of the three formulae now competing for acceptance. In presenting this rather detailed legal history, we hope to illustrate "how things go wrong," that is, how the regulatory process can gain a momentum and logic of its own, acquiring objectives or posing standards which are unrelated to definable social needs or any accepted economic criteria of efficiency. The results are distortions that generate false or misleading signals to investors, regulators, and consumers alike.

Section IV then compares the mechanics and evaluates the performance of each of the three formulae. In this section, we show how "things went right" in oil pipeline regulation, if only inadvertently—at least until the inflationary "energy crisis" decade of the 1970s. Ironically (and quite accidentally), the ICC formula performed curiously well when tested against economic metrics. Carried blissfully along by an historical and legal process (which had little or no economic or financial logic of its own), the ICC formula actually provided reasonable results during most of the 40-odd years when it was applied. Unfortunately, the happy circumstances which made for that success—low inflation rates and stable energy prices—are gone; our empirical results³ show quite clearly that not only the ICC formula, but also the Consent Decree and FERC methodologies, suffer from a serious inability to cope with inflation.

In Section IV, the structural "errors" intrinsic to the current ratemaking formulae are identified and illustrated. All of these errors—formula bias, inter-temporal bias, and retrospective bias—are exacerbated by inflation.

Section V illustrates that the distortions arising from regulatory failure do make a difference—not only to investors, but to regulators and consumers as well. In particular, to the extent that these flaws generate false signals to investors, there will be a sub-optimal level of investment in a diverse array of energy projects which are vital to U.S. energy development. At the same time, these false signals can fool regulators, who are lulled into thinking that things are going better than

³See Navarro, Petersen, & Stauffer, *supra* n.1.

they are, both prospectively and retrospectively, and who wake up only after the horse has bolted through the barn door. Finally, consumers pay a heavy price for misregulation, both intertemporally and through the unnecessary costs of resource misallocations which raise the prices of many of the goods and services the consumer buys to levels higher than they otherwise would be or need be.⁴

We thus come not to praise any of the three competing formulae but, rather to bury them. In Section VI we present two alternatives which, unlike these artifacts of the regulatory past, are more flexible and better adapted to the new and volatile circumstances of chronic and secular inflation. The first of these approaches is a theoretical norm ("levelized rates") that provides the appropriate signals with economic precision. However, like many economically correct solutions, levelized rates suffer several (though hardly insurmountable) political and mechanical disabilities.⁵ The second is a hybrid ("escalated utility rates") that offers a workable, if not perfect, compromise solution to some of the flaws that plague the three currently competing ratemaking formulae.⁶

II. THE TAPS CASE: HOW IT ALL GOT STARTED

The TAPS case emerged as the byproduct of a dispute over the taxation of Alaskan oil, because the pipeline tariff materially affected the allocation of taxable income among jurisdictions. Thus, the history of the TAPS case is rooted in the history of Alaskan oil. In 1968 huge reservoirs of oil were discovered at Prudhoe Bay on the Arctic-rimmed North Slope of Alaska. Shortly thereafter, plans to build an 800-mile pipeline to the all-weather port of Valdez on Alaska's South Central Coast were drawn up by a pipeline consortium comprised of totally-owned subsidiaries of the Prudhoe Bay oil producers.

Construction began in 1969 but was immediately halted by legal disputes with environmentalists and native Alaskans. After protracted court battles, these disputes were ended by the *Trans-Alaska Pipeline Act*,⁷ a special Act of Congress that paved the way for the resumption of construction in 1974. By 1977, the Trans-Alaska Pipeline System (TAPS) was completed at a cost of over \$9 billion, roughly ten times that of the original estimate of \$900 million. (This high cost can be attributed to ten years of inflation and compulsory design changes.)

In the same year, and in anticipation of the first flow of oil, the eight companies owning undivided joint interest in the pipeline⁸ filed individual tariffs with the ICC, which then had jurisdiction over oil pipeline rates. The proposed tariffs ranged from \$6.04 to \$6.44 per barrel. According to the pipeline companies, these tariffs were computed on the basis of the methodology prescribed by a 1941 Department of Justice (DOJ) consent decree which limited the payment of dividends by oil pipeline subsidiaries to 7% of "valuation," as determined by the ICC.⁹

⁴Examples of such costs include distorted fuel choice, e.g., disincentives to burn cheaper coal or deferred plant investment, which jeopardizes longer-run security.

⁵See Navarro, Petersen, & Stauffer, *supra* n.1 (for discussion of "Levelized Rates" methodology).

⁶Several variations of the Escalated Utility Rates formula have been advanced. See Testimony of Stewart C. Myers ("Trended Original Costs") and Michael Jensen ("Inflation-adjusted Original Costs") in Williams Brothers Pipe Line Co., FERC Docket No. OR79-1, *et al.*

⁷Trans-Alaska Pipeline Authorization Act of 1973, 43 U.S.C. § 1651 *et seq.* (1976).

⁸Sohio Pipe Line Co., ARCO Pipe Line Co., Exxon Pipeline Co., BP Pipelines, Inc., Mobile Alaska Pipeline Co., Philips Alaska Pipeline Corp., Union Alaska Pipeline Co., and Amerad Hess Pipeline Corps.

⁹*United States v. Atlantic Refining Co.*, C.A. No. 14060 (D.D.C. 1941) (consent judgment entered same day as complaint).

The ICC, however, rejected the tariffs filed by the pipeline companies, contending that the consent decree had never "been employed in a Commission proceeding as a test of reasonableness of rates."¹⁰ Instead, the Commission cited the precedents established in several rate cases in the 1940s for a different tariff structure based upon an 8% "return on valuation" for crude oil lines¹¹ and a higher 10% "return on valuation" for refined product lines.¹² Then, upon suspending the pipeline companies' proposed tariffs, the ICC set interim rates of its own. The resulting tariffs were almost one-fourth less than those the pipeline companies had proposed.

To complicate matters, in the ensuing court challenge before the ICC over the determination of final rates, the State of Alaska, the Arctic Slope Regional Corporation, and the Department of Justice (all protestants with their own quite special interests in the case¹³) contended that not only were the pipeline companies' proposed tariffs too high, but so were the ICC's interim rates; they thus argued for even lower figures. The intervenors reasoned that the ICC ratemaking methodology was based on the "ICC valuation," a hybrid of original and replacement cost which resulted in "excessive rates" because of the alleged double counting of inflation.

As a counterproposal, these intervenors argued for the adoption of an original cost rate base. This alternative method of specifying pipeline rates took on special force once the jurisdiction over oil pipelines was transferred to the FERC in the Department of Energy in 1977. As an intervenor in the case, the FERC—bureaucratic successor to the Federal Power Commission (FPC)—strongly favored the "original cost" approach to ratemaking. Original cost had traditionally been employed in ratemaking for natural gas pipelines, for most public utilities, and—disastrously in the view of some—had even been used by the FPC to specify the wellhead price of natural gas.¹⁴

Thus began the current battle over oil pipeline regulation in the courts. Shortly after the TAPS case had begun, it was joined in the FERC dockets by a second prominent rate case involving the Williams Brothers Pipe Line Company; many of the same issues are at stake here.¹⁵ At this time, there are over 80 other cases awaiting the resolution of those two cases, as FERC has suggested that it

¹⁰Trans Alaska Pipeline System, 355 I.C.C. 80 (1977).

¹¹Reduced Pipe Line Rates and Gathering Charges, 243 I.C.C. 115 (1940).

¹²Petroleum Rail Shippers' Assoc. v. Alton & Southern Railroads, 243 I.C.C. 589 (1941).

¹³The State of Alaska owns a one-eighth royalty interest in Prudhoe Bay oil and collects that royalty as 12.5% of the "wellhead value" of the oil. Because the wellhead value equals the market price less transportation costs, higher tariffs mean a lower wellhead price and lower royalty revenues for the State.

The Arctic Slope Regional Corporation represents the interests of the Inupiat Eskimo who, under the Alaska Native Claims Settlement Act of 1971, 43 U.S.C. § 1601 *et seq.* (1976), have claim to 2% of the wellhead value up to a total of \$500 million as consideration for giving up aboriginal land claims in Prudhoe Bay. The lower the tariff, the more slowly that \$500 million is collected. The Department of Justice is concerned with the effects of excessively high tariffs on competition in the Alaskan oil market and on the rate of exploration and development of Alaskan reserves. This exploration rate is alleged to be retarded by high tariffs.

¹⁴Stauffer, *Liquified and Synthetic Natural Gas—Regulation Chooses the Expensive Solution*, in Caves, Richard E. and Roberts, Marc J., *Regulating the Product: Quality and Variety*, Cambridge, Ballinger (1975). The FPC's effort to use the utility formula for a depletable resource founded upon two incorrect assumptions about the physical world. First, the FPC implicitly assumed that the output of a gas reservoir declines linearly over time. Second, the Commission confounded accounting conventions with technical reality: it assumed, in spite of extensive evidence to the contrary, that exploration was contemporaneous with production, whereas gas must be discovered prior to development and perforce prior to production. The FPC confused quasi-capital outlays with current operating expenses and thereby considerably understated the relevant rate base.

¹⁵Trans-Alaska Pipeline System, FERC Docket No. OR78-1.

may rely on the TAPS and Williams Brothers decisions to develop a generic methodology for oil pipeline ratemaking.

At the heart of these proceedings is the basic issue of what constitutes the “proper” procedure for ratemaking—the ICC formula, the Consent Decree formula, or the original cost FERC formula. It is to the legal history of these alternatives that we now turn in order to understand the intricate controversies underlying the debate over which (if any) to adopt.

III. LEGAL HISTORY OF THE ICC, CONSENT DECREE, AND FERC FORMULAE

A. *The ICC Formula and the ICC “Valuation”*

The ICC formula for calculating oil pipeline rates evolved under the aegis of the Interstate Commerce Commission and is broadly analogous in structure to more general ratemaking formulae employed elsewhere in regulated industries. Its details, however, differ so distinctively that the net financial impact of the ICC formula is radically different from that of the more conventional ratemaking formulae. We now consider the components of that formula.

The “ICC valuation,” which is used as the rate base in both the ICC and Consent Decree formulae, is based on the concept of “fair value.” This concept grew out of early efforts of the ICC, in conjunction with the courts, to develop a compromise between the original and reproduction cost doctrines being debated throughout the early half of the century. Developed within the Commission’s Bureau of Accounts, the ICC valuation began to be used in 1934 and its specification evolved over three decades in which there was little controversy over oil pipeline regulation and very few ratemaking cases.

When the first rate case in over 30 years came before the ICC in 1975,¹⁶ however, interest in the ICC approach was rekindled, precipitating a more general investigation by the ICC to examine the “valuation of common carrier pipelines.”¹⁷ It was in this investigation, through the testimony of Jesse C. Oak, valuation engineer for the ICC, that the valuation formula, so mysteriously conceived, was first systematically displayed. According to Mr. Oak:¹⁸

¹⁶Petroleum Products, Williams Brothers Pipe Line CO., 351 I.C.C. 102 (1975) [hereinafter *Williams I*].

¹⁷Valuation of Common Carrier Pipelines, FERC Docket No. OR78-2 (formerly I.C.C. *Ex Parte* 308).

¹⁸Testimony of Jesse C. Oak in FERC Docket No. OR78-2 (March 25, 1977).

(eq. 1)

$$V_t = 1.06 \left\{ \left[C_o \left(\frac{C_o}{C_o + CRN_t} \right) + CRN_t \left(\frac{CRN_t}{C_o + CRN_t} \right) \right] CP_t \right\} + (L_1 + L_2 + W_1)$$

where:

- V_t = "single sum" valuation in year t
 CRN_t = cost of reproduction new in year t
 $CRND_t$ = cost of reproduction new less depreciation in year t
 C_o = original cost to date
 L_1 = present value of lands
 L_2 = present value of rights of way
 W_1 = working capital
 1.06 = scale factor for a "going concern"
 $CP_t = CRND_t/CRN_t$ = "condition present" in year t .¹⁹

To economists steeped in price and finance theory (but who have little contact with the outside world of courts and regulatory commissions), the formula in Eq. 1 is nothing less than bizarre: it is a mysterious collection of seemingly unrelated components that, through the wonders of jurists' algebra, miraculously distill into a single simple sum. The ICC formula is indeed unique in the annals of rate regulation. It is specific to only one industry and is used by no other agency, except, of course, the FERC which inherited it (apparently reluctantly) along with the responsibility for regulating oil pipelines. However, despite its odd specification and genesis (as we shall discuss below), this formula actually worked. Moreover, it becomes entirely understandable (if perhaps not completely defensible) when viewed within the context of the legal history and economic controversies of its day. It represents the end result of a systematic effort by the ICC to carry out its mandate to regulate oil pipelines within the constraints set by Congress and the guidelines and *obiter dicta* laid down by the courts. This becomes evident as one traces the formula's lineage—its logic proves to be understandable only in an historical context, to which we now turn.

1. Valuation Base

The first term in brackets in Eq. 1 is referred to here as the *valuation base*; it represents a variable weighted average of the original historical cost (C_o) and the notional replacement cost (CRN_t), as estimated annually by the ICC's valuation staff. It reflects the ICC's effort to compromise the controversy between the use of an original versus a replacement cost rate base. This controversy raged outside its doors during the early half of this century,²⁰ with the ICC paying obeisance to the rulings of the courts and the laws of Congress.

¹⁹The ICC never defined a formal procedure for depreciating the replacement cost of the rate base. Instead, the gross reproduction cost new is multiplied by a monotonically declining scale factor, the "condition percent" (CP_t), which purports to reflect the relation between gross and depreciated replacement costs, i.e., $CRND_t = CP_t \cdot CRN_t$.

²⁰See Clemens, E.W., *Economics and Public Utilities*, Appleton-Century-Crofts, Inc. (for an entertaining view of the valuation base and other controversies that dominated public utility regulation during the first half of the century).

The weighting scheme (as well as the basic ICC approach to ratemaking) emerged from the Supreme Court's ruling of 1898 in *Smyth v. Ames*, which required that:

The basis of all calculations as to the reasonableness of rates . . . must be the fair value of the property being used . . . in order to ascertain that value, *the original cost of construction* . . . and . . . *the present as compared with the original cost of construction* . . . are all matters for consideration, and are to be given such weight as may be just and right in each case.²¹ [emphasis added]

The Court explicitly recognized both original and "present" costs. Oblivious to the potential contradiction, it mandated that both be considered but left the specification of their relative weighting singularly vague.

With the passage of the *Valuation Act* in 1913, the obligation to consider both original and reproduction cost was further sanctioned by the Congress which directed that in determining the valuation of common carrier property:

Such investigation . . . shall state in detail . . . the original cost of all lands, rights of way, and terminals . . . and the present value of the same . . .²²

Then again in 1923 in *Bluefield Company v. Public Service Commission*, the Supreme Court reaffirmed its insistence to consider *both* original and replacement cost. However, like the Congress, it declined to specify an exact formula; instead, it left the weighting scheme up to the consideration of the ratemaking commission. It held that in estimating the value of property as a basis for rate regulation, evidence of present reproduction costs, less depreciation must be given consideration.²³

Finally in 1929 in *St. Louis & O'Fallon Railway Company v. United States*, the Court firmly censured an ICC attempt to use only original cost. It annulled a Commission order that would have forced the St. Louis & O'Fallon Railway to place in a reserve fund one-half of its excess net income and to pay the other one-half to the Commission²⁴—where that "excess" resulted from an ICC valuation based solely on original cost. The Court further directed that it is the duty of the Commission to give consideration to present or reproduction costs in estimating the value of a carrier's property.²⁵

Thus, the conceptual stipulation for a weighting scheme involving both original and replacement cost was firmly laid down by the time the ICC began to prepare actual valuations of oil pipelines in 1934. Neither the Congress nor the courts ever prescribed the exact weighting scheme, and the Commission later defended the configuration it had chosen:

²¹*Smyth v. Ames*, 169 U.S. 466, 546-47 (1898).

²²*Valuation Act*, Ch. 92, § 19a, 37 Stat. 701 (1913).

²³262 U.S. 679, 689 (1923).

²⁴279 U.S. 461, 478 (1929).

²⁵*Id.* at 484.

The Commission's position has been that the value of the property before depreciation should lie between these two elements of cost [original and replacement], and it elected to weigh the two together based on each one's percentage relationship to the sum of the two. In other words, during a period of inflation, cost of reproduction new would naturally be given the greater weighting while during a recession original cost would be given the greater weighting. *There are numerous ways in which these two elements could be weighted. However, the Commission considered this to be the most equitable and consequently has used this approach in all of its valuations both for railroads and pipelines.*²⁶ [emphasis added]

We see, then, that the valuation base is a hybrid construct. It was created through decree by the ICC and reflects the regulators' compromise between the conflicting concepts of original and replacement cost as the basis for computing rates.

The valuation base the ICC chose (Eq. 1) is the weighted average of original cost, C_o , and the "cost of reproduction new," CRN. The latter is defined as the original cost escalated by an index of pipeline construction costs which was prepared annually by the ICC staff. The weights are the ratios of the original or replacement costs to their sum, a specification for which no economic rationale has been, or perhaps ever could be, adduced.

This results in a curiously distorted measure of "valuation." Referring to Eq. 1, we note that the weights are variable; indeed, each component is in effect weighted by itself. Since the reproduction cost rises under inflationary conditions, the relative weight of the replacement or reproduction cost rises with time and/or increasing rates of inflation, so that the valuation base understates the replacement cost for low rates of inflation but will asymptotically approach the reproduction cost for very high rates of inflation. The "compromise" is thus time variant. We further note that as a consequence of the weights in the valuation base, the "valuation" cannot be expected to track the true replacement value even if the cost escalation index is otherwise exactly correct. Nor will the valuation base reflect the "valuation" of the assets in current dollars.

2. Going Concern Value

The figure 1.06 reflects a multiplicative correction which escalates the "net valuation" (valuation base times condition percent) to represent the value of a "going concern." This 6% correction, while small, is hotly contested. Depending upon one's view of the ICC formula, one can charitably regard it as a discretionary component or criticize it as mysterious and totally arbitrary.

In fact, the origins of the 6% correction are difficult to trace; the same rate was used not only to value a going concern but also to calculate reproduction cost. It may simply have been the prevailing interest rate of the day—a reflection of the economic conditions of the 1940s which one may perhaps legitimately question as being applicable in the 1980s. As the Commission stated in *Atlantic Pipe Line Company*, the valuation docket in which it first articulated its accounting method,

²⁶351 I.C.C. at 111.

Six percent is the legal rate of interest in a large section of this country where no other rate is specified, and our engineers and working committee have come to an agreement as to the use of 6 percent as a guide.²⁷

Regardless of one's view of the appropriateness of 6%, when judging the rationale for the inclusion of this formula component, it should be noted that the issue of whether to allow any value to "going concern" had a legal history that rivals in richness and length the debate over original versus reproduction cost, and there were both strong proponents and opponents to its use.²⁸ No doubt the ICC was influenced by the court's decision in *Bluefield Co. v. Public Service Commission*. In addition to reinforcing the concept of a weighted average of original and reproduction costs, this decision also explicitly allowed scaling up the rate base by a full 10% for "going value."

3. The Condition Percent

The "condition percent" index, CP_t , is designed to function as a depreciation schedule. It reflects the fraction of the assets still serviceable at the end of each year, so that the condition percent multiplied by the valuation is the counterpart of "net assets" as defined for most regulated utilities.

The "cost of reproduction new" (CRN_t) component of CP_t is calculated through "unit indices" applied separately to each item of property employed by the pipelines. Note that this procedure differs markedly from the more typical use of inflation indices such as the Consumer and Wholesale Price Indices. These are often applied to inflate (or deflate) a sum total as the general price level rises (falls). While the ICC procedure has come under heavy criticism,²⁹ the Commission defended its calculation of CRN, stating:

The principles applied are based on sound engineering techniques recognizing the cost differentials between a predetermined base period and a current period. It recognizes this through a statistical analysis of changing price patterns and construction techniques and converts these patterns to a statistical index series that measures the deflationary power of the dollars invested in common carrier facilities . . . These techniques are also used by appraisers in determining the current market value of land and industrial properties.³⁰

The combining of CRND (CRN less depreciation) into the condition percent has likewise been subjected to criticism and similarly was defended (and explained) by the Commission as a least-cost means of measuring depreciation. In principle, the Commission might have attempted to estimate depreciation charges in some fashion—for example, weighted by the same arbitrary weights used to define the valuation. In practice, the Commission adopted still another approach which introduced yet another inconsistency into its ratemaking format. Specifically, the ICC introduced the notion of probabilistic life expectancy, i.e., a set of "stub" survivor curves as a surrogate for economic depreciation in calculating net

²⁷Atlantic Pipe Line Co., Valuation Docket No. 1203, 47 Val. Rep. I.C.C. 585 (1937).

²⁸See generally Clemens, *supra* n. 20.

²⁹For a detailed explanation and critique of the ICC unit index approach, see the statement of Edward D. Hollander, Senior Vice President, Robert R. Nathan Assoc., Inc., in Valuation of Common Carrier Pipelines Ex Parte 308, May 27, 1977.

³⁰351 I.C.C. at 110.

“depreciated” valuation. In computing rates, however, the ICC allowed only the book depreciation charge, as conventionally determined using original cost. It justified this scheme:

In their criticism of the Commission's use of condition percent in lieu of accrued depreciation, it is apparent that the protestants/complainants do not understand the valuation process and what the Commission [*sic*] is attempting to accomplish. The Commission must find a value of the property due to physical wear and tear. Exact engineering measurements could be done to accomplish this; however, the cost would be prohibitive. Therefore the Commission has elected to measure this physical wear and tear mathematically. This condition percent factor as used . . . is a function of the remaining probable life of an item of property at any attained age and its total probable life at that age. The Commission considers the application of this value to the cost of reproduction new, to produce a reasonable estimate of the cost of the property in its present condition.³¹

Unfortunately, the condition percent does not bear any well-defined relationship to the accounting concept of depreciation. The problem is that the depreciation charge which enters into the calculation of rates (Eq. 1, above) is based upon standard accounting definitions and is derived from the original cost, not from the change in the valuation base. Thus, the depreciation charges which annually enter into the calculation of rates in no way track the year-to-year change in “net” assets.

Nor does the use of the condition percent track the *economic* concept of depreciation: condition percents are derived from physical mortality tables, whereas economic depreciation is defined as the annual decline in economic value. Still worse, the latter tables were based upon observed life expectancies for such items of equipment as railroad ties or telephone poles; the relevance of those statistical distributions for line pipe or large gas-turbine driven oil pumps would need to be demonstrated.

Indeed, the economic concept of depreciation in the context of a regulated industry becomes elusive and proves to be surprisingly difficult to employ. Economic depreciation is defined as the time rate of change of the present value of the cash flow generated by an asset. In a regulated industry the cash flow attributable to an asset is in turn defined as a fixed multiple of its depreciated cost, so that the definition here becomes circular and hence inapplicable. The condition percent thus represents an effort to graft a purely physical concept of “mortality” upon an economic construct in a context in which the economic concept itself is circular.

4. Present Value of Land, Rights of Way, and Working Capital

As a source of yet another anomaly, we have the final three terms in the formula: the “present value” of land (L_1), the “present value” of rights of way (L_2), and “working capital” (W). Specifically, the following question arises: why, after constructing an elaborate formula based on *both* original and reproduction costs, did the ICC choose to value these last three elements on a *current* value basis? While current value is perhaps plausible in the case of working capital, the Commission has offered only the following sketchy explanation of its special

³¹*Id.* at 112.

treatment of land and rights of way:

The ... objection to use of present value of land has no merit since the [Valuation] act specifically requires that the Commission find and give consideration to its value in the determination of a valuation.³²

Note, however, the weakness of this rebuttal: the Commission justified the sole use of “present value” of lands and rights of way by invoking the *Valuation Act*, which it used earlier to validate a weighted average of original and reproduction cost for plants and equipment. Moreover, the ICC then defined the *present* value of land as exactly equal to 50% of its *historical* cost, while the “present value” of rights of way were also opaquely assessed as the original cost multiplied by the condition percent. Fortunately, because of the capital intensiveness of pipelines, these components represent less than 5% of the overall valuation, so that the effect of misspecification is mercifully small. However, the Commission’s argument does provide insight into the type (or lack) of economic analysis which entered into its deliberations.

5. Allowable Rate of Return

In order to calculate rates using the ICC formula, a rate of return must be applied to the ICC valuation. The evolution of the ICC-allowed rate of return provides an interesting example of how the legal precedents of other eras are often brought kicking and screaming (and sometimes totally inappropriately) into more modern times.

Although the *Hepburn Act* of 1906 placed oil pipelines under the jurisdiction of the ICC and the 1913 *Valuation Act* required the Commission to establish a valuation for every pipeline, only two rate cases came before the Commission between 1914 and 1934. The task of establishing “valuations” for the pipelines was not even begun until 1934 because of the ICC’s preoccupation with the railroads. The slow-paced response led one economist in the early 1940s to note with remarkable understatement that: “... the Commission did not pursue an aggressive policy of regulation.”³³

Explaining, in what would prove to be a prophetic statement given the fact that there would be no further rate cases in the 30 years from 1945 to 1974, he said:

... the Commission depends to a great extent upon the conflicting interests of shippers, on the one hand, and carriers on the other, to bring before it matters requiring its attention. Since this procedure had been followed in dealing with the railroads, the Commission, with its limited control, could see no reason why a different procedure should be adopted in regard to pipelines. It has been shown, however, that there are very few shippers who use the pipelines other than the owners, and this, in part, accounts for the small number of complaints that have been made to the Commission.³⁴

³²*Id.*

³³Prewitt, *The Operation and Regulation of Crude Oil and Gasoline Pipe Lines*, Feb. 1942 *Quarterly Journal of Economics* 203.

³⁴*Id.*

Beginning in 1940, the ICC laid down a ratemaking standard in a series of four Commission rulings that would not be challenged for the next 30 years. In 1940, a rare instance where it did not wait for an outside protestant, the Commission initiated the *Reduced Pipeline Rates and Gathering Charges* proceeding. Using the final valuations prepared by its Bureau of Accounts, the Commission determined that 21 of 35 crude oil pipelines were earning returns in excess of 8% on valuation and ordered those 21 companies to reduce their rates.³⁵

In 1941 the ICC declared in *Petroleum Rail Shippers' Association v. Alton & Southern Railroad, et al.* that a 10% return on valuation was appropriate for the transport of refined products; the 2% differential over the crude oil rate reflected an additional "risk premium" associated with the fact that at that time, shipping refined products was an infant industry subject to greater risks than the more established crude oil system.³⁶

Then in 1944, in *Minnelusa Oil Corporation v. Continental Pipe Line Company, et al.*, the Commission reaffirmed the nominal ROI for crude oil pipelines, stating:

We are of the opinion and find, under all the circumstances, that for the purpose of testing the reasonableness of rates assailed, an annual return of 8% is fair.³⁷

Several features of these precedent-setting cases are worth highlighting. First, the Commission's specification of the "fair" rate of return on valuation was discretionary and, in its judgment, reflected the industry-specific risks and economic conditions of the time—a feature worth noting since after 1944 the ICC would not rule in another rate case until the 1970s. Then, in *Williams Brothers* and shortly afterwards in *TAPS*, the Commission blindly reiterated these standards as if they had been fixed in stone and reflected some absolute, time-invariant economic law.

Second, despite the fact that these precedents were explicitly laid down, they were not challenged, tested, or, according to the pipelines, even implemented for the next 30 years. Indeed, this "dearth of precedent," as it is referred to in *Williams Brothers*, explains much of the difficulty faced by the Commission and courts in settling *TAPS*: after 30 years of benign, malign, or oblivious neglect of pipeline rate regulation, the ICC suddenly was confronted with a case involving billions of dollars and was forced to resurrect a methodology that had been gathering dust for three decades.

In sum, the ICC formula appears to be the joint creation of the Courts, the Congress, and the ICC, reflecting an interpretation of the legal and legislative events of the times. The formula was an evolving stepchild, a creature that was first conceived consonant with the "fair value" doctrine of *Smyth v. Ames*, as enunciated in 1898. Moreover, the formula was totally crystallized before *Smyth v. Ames* was (allegedly) eclipsed by the "end result doctrine" in 1944, enunciated in *FPC v. Hope Natural Gas*. This latter decision, as we shall see below, was construed by many to endorse the use of an original cost rate base. Sprinkled

³⁵243 I.C.C. 115, 142-44 (1940).

³⁶243 I.C.C. 589 (1941).

³⁷258 I.C.C. 41, 54 (1944).

liberally with rules of thumb, in part reflecting the economic conditions of the 1930s and 1940s, in part undeniably the product of judicial compromises, and by now bereft of internal logic and legitimized at best only by history, the formula has come under strong attack.

Ironically, while its genesis must be suspect, we shall see later that it functioned unexpectedly well. Its analog is the camel—cruelly designated as a “horse designed by committee”; like the camel, the ICC formula actually proves reasonably efficient under a broad set of conditions. However, just as the camel, so suited to the Sahara, is out of place at Hialeah, the ICC formula transplants poorly into the modern period. We must defer this assessment, however, until we complete the legal histories of our other two major candidates for oil pipeline ratemaking.

B. The Consent Decree Formula

While the ICC was establishing its precedents for oil pipeline rate regulation in the 1940s cases, the courts interjected their own constraint upon pipeline rates in the case which led to the 1941 Consent Decree.³⁸ The Consent Decree gave birth to a double standard of rate regulation, and it was this decree that the owners of TAPS invoked in designing their initial rate schedules, claiming that it was the prevailing industry practice.³⁹

The 1941 Consent Decree represented another effort by the government to restrain the alleged monopoly power of oil pipelines. Then, as indeed now, most of the oil pipelines were subsidiaries of oil producing companies. In the eyes of the Antitrust Division of the DOJ, this vertical integration was an impediment to effective competition, creating barriers to entry for independent or unintegrated oil producers.

The *Hepburn Act* of 1906 first challenged the ostensible competitive advantages of the integrated oil companies by declaring the oil pipelines as “common carriers” and placing them under the jurisdiction of the ICC. If the pipeline companies were common carriers, they “could be forced to carry oil for independent producers or refiners”⁴⁰ and thus reduce any potential barriers to entry created by the ownership and operation of a crude oil pipeline.

The pipelines, however, soon found a way to circumvent the intent of the *Hepburn Act* by levying high tariffs for use of the pipeline and then rebating the resultant large profits back to the parent oil producers in the form of dividends. The effects of this rebate scheme were to: 1) depress the price of oil at the wellhead; 2) exclude independent producers and refiners from the market because they found the rates and/or the capital costs of vertically integrating themselves prohibitively high; and thereby, 3) slow the rate of exploration and development of oil reserves—charges that would be made in TAPS years later. As symptomatic evidence that such a mechanism was in fact operating, critics pointed to the egregiously high returns on total capitalization, 20% or more, that the pipelines earned

³⁸United States v. Atlantic Refining Co., C.A. No. 14060 (D.D.C. 1941).

³⁹Testimony of Rodney Harrill in Trans-Alaska Pipeline System Rate Case, FERC Docket No. OR78-1, November 30, 1978.

⁴⁰See generally 49 U.S.C. § 10101 *et seq.* (Supp. III 1979).

in the 20-year period prior to 1941.⁴¹ (See below for the limitations of such "evidence.")

The DOJ interpreted these implicit rebates as a clear violation of the *Elkins Act*, under which it was unlawful to:

... offer, grant, or give or to solicit, accept or receive any rebate, concession, or discrimination in respect of the transportation of any property in interstate or foreign commerce by any common carrier ...⁴²

The result of the DOJ court challenge was the 1941 Consent Decree which expressly prohibited pipelines from paying out dividends in excess of 7% on the ICC valuation base. Additionally, while the Decree did not prevent pipelines from *earning* more than 7%, it required that any "excess earnings" be placed in a special account and restricted their use to the retirement of debt or new construction which, however, could not be added to the valuation base.⁴³ This last proviso thereby acted as a compelling disincentive to exceed the 7% ceiling, since any such proceeds were financially sterilized in non-earning accounts and hence quite unprofitable.

Thus, while the Consent Decree formula parallels the ICC formula in its use of the same "ICC valuation" rate base, the Consent Decree otherwise differs in two quite important respects: it allows a 7% rate of return, rather than the 8% or 10% permitted by the ICC, *and* interest charges are included in the rates, over and above the 7% allowed on the total valuation base.⁴⁴

The effective result of the 1941 Consent Decree was to give birth to a double standard for oil pipeline regulation: one set by the ICC and one set by the DOJ. Both coexisted for some 35 years, with the Consent Decree formula setting a clear upper bound to tariffs because of a liability for treble damages in the event of violation. That is, the ICC formula was used within the constraints of and subject to the test of consistency with the Consent Decree's rates.

C. The FERC Formula

The basic ratemaking formula traditionally used for most regulated utilities—the "FERC" formula in the new argot of the pipeline ratemaking cases—uses an original cost less depreciation rate base to which some prescribed rate of return is applied to calculate rates. The allowed nominal return on investment (ROI) is interpreted to include adjustments for risk and inflation. This formula differs from the ICC and Consent Decree formulae in several important respects:

⁴¹It can be shown that the accounting rates of return of firms whose rates are calculated using either the ICC or Consent Decree formulae will be overstated, i.e., the accounting ROR exceeds the underlying def-equivalent ROR. This effect is exacerbated by high rates of inflation or low rates of real growth. Simulations reveal sizeable biases (3 to 5 points), so the historical profitabilities of pipelines cannot be taken at face value and the DOJ's allegations have yet to be tested properly.

(See Solomon, E., *Alternative Rate of Return Concepts and Their Implication for Utility Regulation*, 1 *Bell Journal of Economics and Management Sciences* 65 (Spring 1970) and Stauffer, *The Measurement of Corporate Rates of Return: A Generalized Formulation* 2 *Bell Journal of Economics and Management Sciences* 434 (Autumn 1971).

⁴²49 U.S.C. § 1 (1976).

⁴³*United States v. Atlantic Refining Co.*, C.A. No. 14060 (D.D.C. 1941).

⁴⁴By way of contrast, we note that any interest on outstanding debt under the ICC formula must be paid "below the line," i.e., out of the total allowed return.

1. It relies solely on an original cost rate base.
2. Depreciation is straight-line, where the depreciation charges included in the rates track the year-to-year reductions in the historical net book assets used in the rate base.
3. The nominal rate of return which is allowed on the original cost rate base is a weighted average of the rates of return upon equity and debt capital, which reflects the relative capital structure of the firm.⁴⁵

The FERC formula has a long history, is widely used for gas pipelines and electric utilities, and has broad acceptance in the economics profession, at least as a theoretically defensible approach. The legal precedents for the FERC formula began in 1944 when the Supreme Court, in an apparent departure from its previous stance on ratemaking, as articulated in *Smyth v. Ames*, ushered in the "end result" doctrine in the famous *Hope Natural Gas v. the Federal Power Commission* case. In his attack on fair value, Justice Douglas wrote:

Rates which enable the company to operate successfully, to maintain financial integrity, to attract capital, and to compensate its investors for the risks assumed certainly cannot be condemned as invalid, even though they might produce a meager return on the so-called "fair value" rate base.⁴⁶

The FPC, along with most other regulatory bodies, interpreted the *Hope* decision as a mandate to use an original cost rate base; upon close reading, however, it is clear that the *Hope* decision was not so much an endorsement of original cost as it was a condemnation of the ground rules that had developed out of *Smyth v. Ames*. Specifically, under the "fair value" doctrine, the Hope Natural Gas Company—by Justice Douglas' noneconomic calculus—was earning exorbitant rates of return on its investment. The Court's disapproval of that "end result" was picturequely and clearly expressed in its characterization: "... the stockholders of natural gas companies hav[ing] a feast so that producing states may receive crumbs from the table."⁴⁷ Despite any explicit endorsement of original cost, the precedent in the *Hope* case nonetheless resulted in a dramatic and immediate switch to its use, and today some variant of original cost is used by most regulatory agencies—from public utilities to natural gas pipelines.

⁴⁵This familiar formula, from which rates and after-tax returns may be easily derived, is simply:

$$\text{Rate}_i = \frac{C_o}{V_o} \left\{ \frac{D_i^{bk}}{1-T} - \left(\frac{T}{1-T} \right) D_i^{ca} + \bar{R} \left(1 - \frac{1}{N} \right) \right\} + \frac{VOC_i}{V_o}$$

where: T = rate of income tax; and

$$\bar{R} = BR^d + \frac{(1-B)}{(1-T)} R^{ca} = \text{utility capital charge.}$$

⁴⁶320 U.S. 591, 605 (1944). Justice Douglas erred, however, in interpreting Hope's rate of return as "high," since he failed to recognize the bias in the accounting rate of return due to Hope's expensing of intangible drilling costs, etc. See Solomon, *supra* n.41 and Stauffer, *supra* n.41.

⁴⁷320 U.S. at 605.

That precedent did not, however, affect the ICC, which had crystallized its ratemaking procedure prior to *Hope*, and which, after 1944, would not hold another rate case for over 30 years. When the *Hope* doctrine was finally tested in the *Williams I* case, the Commission emphatically repudiated the traditional interpretation of *Hope* as an endorsement of original cost and defended its own approach:

Many have read into the Supreme Court decision in *Hope* ... that the only proper base from which to measure rate of return is a net original cost base ... However, section 19a of the [Valuation] act has had no material amendments since its enactment on March 1, 1913. Until such time as it is amended, the Commission, in administering the act, must consider all the elements of value detailed in section 19a.⁴⁸

The ICC further claimed that, "The fair value rate base here meets the end result doctrine of the *Hope Natural Gas* case."⁴⁹ Indeed, as our empirical results have suggested,⁵⁰ that assessment may actually be correct—the ICC formula could not have produced excessive rates of return and actually did not, if only by coincidence rather than through careful construction.

IV. COMPARATIVE MECHANICS AND PERFORMANCE

Having traced the genesis of the three different ratemaking formulae, we now turn to an assessment of their impacts. The three formulae, their legislative histories notwithstanding, do exhibit common structural components, and each is ostensibly designed to achieve the same end—"a just and reasonable" pipeline tariff or utility rate. However, we shall show that their commonality is most misleading, and that the three formulae are dramatically different in their impacts upon the several economic or political actors involved in the regulated industries.

Specifically, in this and the next section, we shall examine separately the effect of each formula upon the regulated firms, upon consumers, and upon the regulators themselves. The tests or metrics applicable to each protagonist differ, reflecting their different concerns:

Firms and Investors

Does the formula provide incentives or create disincentives to invest in capacity or provide services? In particular, is the actual, realizable rate of return under regulation equal to, lower than, or higher than the allowed rate of return?

We shall find that the formulae usually yield *lower* real rates of return than are built into the calculations by the regulators, so that in general, they are *disincentives* to otherwise desirable investments. This intrinsic structural error is termed "*formula bias*."

⁴⁸351 I.C.C. at 114.

⁴⁹*Id.*

⁵⁰See Navarro, Petersen, & Stauffer, *supra* n.1.

Consumers or Users

Do the rates or tariffs represent a reasonable measure of the real cost of providing the services to users? In particular, do the formulae disproportionately shift the costs forward to early users or defer the costs to future users?

We shall find that all three formulae involve serious temporal shifts in rates, a second intrinsic distortion termed “*intertemporal bias*,” and that the FERC formula is the worst of the three in this respect.

Regulators

Do the formulae provide proper signals to the regulatory authorities by accurately indicating the relative performance of the regulated firms?

We shall show that all of the formulae fail both prospectively and retrospectively in this area. That is, the rate of return to be earned will usually be less than that specified (“formula bias,” as discussed above) *and* that the past profitability of the regulated firms, as measured from their corporate records, is higher than the actual rate of return. This latter error is termed “*retrospective bias*.”

A. Mechanics of the Three Formulae

The common structural elements of the three formulae are:

- Asset or rate base
- Depreciation schedule
- Allowable rate of return
- Projection of operating costs, including fuel
- Forecast of output (demand)

These structural ingredients are combined sequentially to compute a unit charge for the service to be supplied by the regulated utility as follows:

1. The return to capital equals the rate base multiplied by the allowable rate of return.
2. An allowance for applicable income taxes is added, based upon established conventions.
3. The depreciation charges are added, using some statutory schedule, to yield the total payments (pre-tax) to invested capital.
4. Variable costs—fuel, wages, etc.—are added to yield the “revenue requirements,” i.e., the annual stream of revenues which notionally will cover the firm’s costs and leave it, net of taxes, with the prescribed rate of return.
5. The “revenue requirements” are divided by the forecasted level of output or throughput, to yield the allowed unit rate or tariff.

The quantitative specification of the several components, however, belies the common terminology, and each of the formulae implies distinctly different numerical values for each of the key components in the rate calculation. The essential differences are displayed in Table One.

Table One. *Comparison of ICC, Consent Decree, and FERC Formulae*

	ICC Formula	Consent Decree Formula	FERC Formula
Gross "Valuation"	Escalated historic costs	Escalated historic costs	Historic costs
Escalator	ICC Index	ICC Index	None
"Net" Rate Base	Escalated historic costs <i>multiplied</i> times a composite stub survivor curve		Historic cost <i>minus</i> depreciation
Depreciation Charges (for rates)	Schedule	Schedule	Schedule
Allowed Rate of Return	89% (Crude lines) 10% (Product lines)	7% (<i>Plus</i> interest)	Weighted average of actual returns on debt and equity
Interest	Implicit in return on <i>total</i> capital	Actual charges included	Included in weighted return to capital

1. Rate Base

The “gross” rate base for the ICC and Consent Decree formulae is the historical acquisition cost. This cost is escalated for both formulae by the ICC’s own in-house cost index which purports to carry vintaged costs forward and measure the replacement cost of the same capital goods as if they were acquired currently. First, it would be the purest happenstance if the rate of escalation for pipeline construction were identical to the deflator used to correct vintage dollars for inflation. Thus, the escalated “base” cannot reflect purchasing power shifts. Second, even if the index were correct, the effect of the weights would bias the correction downwards.

In practice, the rate of cost escalation, as computed by the ICC for pipeline industry inputs, has exceeded the rate of inflation by some 1.5 percentage points since 1947. The escalator thus overcompensates for monetary inflation, while the mechanics of the ICC’s valuation formula lead to an under-compensation, so that the net effect cannot be predicted *a priori*. The relationship between the ICC valuation and the conventional adjustment for inflation, as related to general indices of purchasing power, is thus not knowable in general and the error is specific to the exact circumstances of each case. The FERC formula, on the other hand, starts from the simple arithmetic accumulation of the historical acquisition costs of capital items, irrespective of when they were acquired and unadjusted in any way for inflationary trends. The two measures therefore diverge increasingly over time and as inflation rates accelerate.

2. Net Valuation

The mechanics of the computation of the net, “depreciated” rate base differ in all three formulae as well, over and above the fact that the calculations are referenced to different measures of undepreciated “cost.” Under the FERC formula, the depreciation charges are accumulated, paralleling the accumulation of investment expenditures, and the accumulated depreciation is *subtracted* from the accumulated capital outlays.

As discussed in Section III, under the ICC and Consent Decree formulae, the escalated cost figure is *multiplied* by the “condition percent,” a factor purporting to reflect the proportionate decline in “value” or “serviceability” of physical assets. The condition percent does not decline to zero. Hence, the contribution to the net valuation base associated with any given asset under the ICC and Consent Decree formulae does not necessarily fall off towards zero, even in the absence of inflation. In fact, under current inflation levels, the net valuation can actually rise secularly. In contrast, using the specification under the FERC formula, the net assets are constrained to decline linearly to zero over the depreciation lifetime of the asset.⁵¹

The two “values” of the firm’s assets, for purposes of ratemaking, thus differ quite markedly over time, depending upon the relative severity of inflation, as depicted in Figure One. We note again that the cost escalation formula employed

⁵¹When assets are retired prior to their standard depreciation lifetime, this description requires minor modification.

by the ICC will always *undercorrect* for inflation if the ICC's own inflation index is specified correctly, so that the ICC valuation will always be *less* than the replacement or current cost even when the process works properly. However, if the regulators choose an escalation index which exceeds the rate of monetary inflation, the index then tends to overcompensate for inflation, and the error becomes less insofar as the two structural errors in opposite directions might fortuitously offset each other. In general, however, the relationships among the ICC valuation, the FERC depreciated rate base, the replacement cost, and the economic value are capricious and must be determined in each case.

3. Depreciation

In principle, the depreciation charges are the same for all three formulae in the very special sense that some form of statutory, straightline depreciation is used to calculate the annual charge for capital recovery. However, in the case of the FERC formula, the same depreciation charge which enters into the computation of annual rates is also debited against the accumulated investment in the calculation of net depreciable assets. The net valuation base for the ICC and Consent Decree formulae, however, does not use the depreciation charges. Rather it is derived using an exogenously specified multiplicative factor (the condition percent) and the internal symmetry is lost.

4. Allowable ROR

The final difference lies in the numerical specification of the allowed rate of return. Under the FERC formula the allowed rate of return exhibits two distinctive characteristics:

- a. It is weighted, reflecting the actual capital structure (debt/equity ratio) of the firm.
- b. It is firm-specific, derived from the actual costs of debt and equity capital to the firm.

By way of contrast, the rates under the ICC and Consent Decree formulae were generically specified. Only in the special case of the Consent Decree formula did the ROR include an implicit weighting of actual interest costs.

More precisely, the FERC formula defines a weighted cost of capital which is equal to the actual costs of debt and equity capital, weighted by their respective fractions in the firm's total capitalization. The ICC procedure stipulated rates of 8% or 10% (for crude oil and product pipelines, respectively). The rates were applied to the escalated valuation bases without distinguishing between debt or equity capital and specifying a common allowable ROR for all firms, irrespective of their actual costs of capital. The firm received a total amount of revenue under the ICC formula, and then could apportion that revenue between interest on debt and returns to equity as it saw fit.

The Consent Decree formula, on the other hand, implicitly included actual interest charges related to the actual debt of the firm as part of the allowable rate of return, in the sense that interest charges were a recoverable cost. The allowed 7%

return on *total* net valuation, not just upon equity, was to be collected over and above the actual interest payments. The returns to capital, therefore, comprised two components: 1) the allowed rate of return (7%) on the escalated valuation base, *plus* 2) the actual interest charges on unamortized debt balances.

Finally, we must emphasize that it is futile to compare the individual components of the several formulae with each other, because the different pieces interact in a non-linear manner in the final calculations. This is the source of the “fallacy of decomposition”—the effort to adjudicate components of an integrated formula individually—because the impact of each component can be assessed only in the context where all components are specified.

B. Formula Bias

One immediate consequence of the process of ratemaking by decomposition (the independent specification of each component) is that each of the three formulae exhibits an intrinsic source of error in terms of yielding to the regulated firm a rate of return which is often seriously different from the ostensibly allowed rate of return fed into the formulae by the regulators. This “formula bias,” the first major distortion of the formulae, reflects the fact that the camel, however competent the committee guiding it, neither looks nor runs like a horse.

In the case of the ICC and Consent Decree formulae, the “formula bias” is potentially quite large. It is intrinsic to the design of these two formulae, and results in actual rates of return to the firm which are less than the allowed rate of return if inflation rates are greater than 1-2%. At current levels of inflation, both formulae result in serious rate of return errors. This error arises even if all parameters—costs, inflation rates, future demand, etc.—are known with perfect certainty.

The magnitude of this bias is illustrated in Figure Two. The “allowed” rate of return displayed here is that which must be used in order that the firm actually earns a *real* rate of return of precisely 8%. This plot highlights the capriciousness of the two formulae under different rates of inflation or different debt-equity ratios.⁵²

The pattern is simplest for the ICC formula. If rates of inflation are very low—less than, say about 2% per annum—the allowable rate of return can be less than 8% and still yield a real return equal to 8%. However, for higher rates of inflation (which are more comparable to recent experience), the rate of return must be increased substantially in order that the firm actually earns 8%. For example, if the rate of inflation is 12%—no longer an outlandish value—the allowed rate of return would have to be 12.5% in order that the firm earn only 8%, in spite of the fact that the adjusted valuation base has been escalated with inflation. The compensation for inflation is thus quite imperfect and, where the “allowed” rate is given, the real, realized rate of return falls increasingly below the allowed value when inflation rates are high.

The behavior of the Consent Decree formula is more complex and is sensitive to the debt-equity ratio assumed by the regulated firm. This is because actual

⁵²See Navarro, Petersen, & Stauffer, *supra* n.1.

interest charges are added to the allowed returns to capital. If the ratio is low, 20/80 in the example, this formula performs rather like the ICC formula: it results in a higher real rate of return for low inflation rates, but requires an ever-increasing "allowed" rate of return for higher rates of inflation. Here, too, high inflation results in lower real rates of return to the firm.

However, if the debt-equity ratio is very high, as was proposed by the respondents in the *TAPS* case, the behavior is quite the opposite. As the rate of inflation goes up, the required rate of return actually begins to decline. At low inflation rates, an "allowed" rate of return of about 6.5% would have yielded a real ROR of 8%. Thus, the nominal 7% on valuation allowed under the Consent Decree would have yielded a *real* rate of return on total capital employed which would have been significantly higher (close to 9% or more) for current inflation rates. In that case, "formula bias" worked clearly to the benefit of the regulated firm, yielding a rate of return *higher* than the ostensible allowed value, which itself may or may not have been "reasonable."⁵³

The preceding illustration points to a further complication which is not reflected in the formula design. We have assumed that inflation is fully expected and therefore is embodied in the nominal interest rates. But, if inflation rates increase subsequent to incurring the debt so that interest rates remain frozen while the escalation formulae still function, it is possible for equity investors to be partly compensated for subsequent, higher rates of inflation—but only at the expense of the unprotected debtholders. The real rate of return on *total* capital employed, however, will still decline in general.

It is not possible to attribute the bias to any single component in the two formulae—"decomposition" is neither possible nor appropriate retrospectively. However, we can indicate the conflicting forces at work. Depreciation charges themselves are not escalated; so, that component of the firm's cash flow declines in real value over time in the face of inflation, thereby—*ceteris paribus*—reducing the real rates of return. The condition percent falls less rapidly than do straight line depreciation schedules, while the valuation base rises less rapidly than inflation. Thus, the two effects are directionally offsetting. The higher the inflation rate, however, the more seriously does the net valuation base lag behind.

The net effect of the components cannot be easily predicted *a priori*, and it is always necessary to carry out simulation studies in order to determine the real rate of return equivalent to any set of regulators' compromises. This emphasizes the seriousness of the "fallacy of decomposition," namely, that it is not the plausibility of the component, but the impact of the package, that ultimately should be adjudicated.

⁵³Rates of return are calculated here with reference to total capital employed; i.e., interest plus cash flow related to the sum of debt and equity capital. We do not address the issue of *pro forma* versus *de facto* capital structure except to note that the nominal debt-equity ratios of subsidiary companies must also always be tested against the structure of the parent firm with due regard to any inter-corporate guarantees on subsidiary borrowing or related, financially equivalent throughput agreements.

C. Intertemporal Bias

The second major distortion in the formulae involves the shifting of rates over time, transferring the burden intertemporally and across different groups of consumers. This effect arises entirely from the different trends exhibited by the rate bases over time and under the FERC versus the ICC and Consent Decree formulae. Unlike "formula bias," where the interaction of all components contributed inextricably to the error, the distortion here is uniquely attributable to the specification of the rate or valuation bases.

Intertemporal bias, in turn, manifests itself in two distinctly different forms. First, with respect to any given project, even if the different formulae were otherwise financially equivalent, they imply dramatically different time patterns for the rate charges. Second, with respect to the choice among projects—say a coal conversion scheme versus continuing to burn oil—the FERC formula in particular generates very high rates in the short run which camouflage real savings in costs. Both aspects of intertemporal bias arise from a common source (the different rate bases under the several systems) but it is nonetheless useful to distinguish these two sub-effects separately since the attendant policy issues are different, as will be developed in Section V.

1. Pure Time Shifting of Rates

The shifting of rates over time arises directly from the different rate or valuation bases used in each formula. The marked difference between the valuation base used with the ICC and Consent Decree formulae and the linearly-declining rate base used in the FERC formula has already been displayed in Figure One. Referring again to this figure, we note that the FERC rate base falls linearly while, under most circumstances, the ICC valuation base will actually rise steadily over time. Hence, under contemporary inflationary conditions, the ICC valuation base could be five or more times larger than the FERC base in later years.

The actual rates or tariffs are the sum of the capital charges (which are directly proportional to the valuation base or the rate base), the depreciation charges which remain constant over time, and the fuel and operating charges which probably also rise steadily when measured in current dollars. The net effect of different valuation or rate bases upon the rates thus depends upon the mix of capital-related costs and the fuel charges. The less fuel-intensive or the more capital-intensive the project, the more closely the rates will track the time pattern of the rate base.

Let us focus on the capital-intensive options—nuclear or coal-fired power stations, pipelines, or synfuel plants—which are the most important current cases for consideration and also the ones where these effects are the largest. For these options, the different time patterns for the regulated rates, under the FERC versus the ICC or Consent Decree formulae, are essentially the same as those in Figure One.

The FERC and ICC rate structures are absolutely incompatible in terms of their impact upon consumers over time. As long as inflation rates exceed 2-3%, it will generally be true that the ICC rates will rise for some period of time, or at least will not fall off significantly. The FERC rates, however, will decline inexorably

with time, and the disparity between the two time patterns will increase for significant periods, *reaching a factor of ten or more if inflation rates are above 5-6%*. Further, if the two rate systems are constructed to yield the same rate of return, then the FERC formula will necessarily involve a high nominal or allowed rate of return, so that the rates under it will always be significantly higher in the early years of the project's lifetime.

The fundamental distinction is even more clearly illustrated if we examine the time trends in the *real* tariffs under the two ratemaking schemes, as illustrated in Figure Three. Measured in real, as distinct from nominal dollars, the FERC rates are seen to fall off even more rapidly, emphasizing the marked extent to which the costs of the regulated product or service are shifted disproportionately upon the early users by the FERC formula. We note also that the ICC and Consent Decree formulae distribute the charges more evenly over time, but that there still is a tendency to shift some of the costs upon the early users. However, this effect is very much less marked than in the case of the FERC formula.

The difference in the inflationary response of the two formulae is fundamental. Under the FERC formula, the inflationary compensation to the firm is loaded onto the charge for capital, thus scaling up the charges for all years. Since the rate base itself is "front-end loaded" (see Figure One), this form of inflationary adjustment perforce loads most of the correction and thus most of the rates onto the early users. The effect becomes even more pronounced as inflation rates become higher, because the FERC rates are tilted even more. This "front-end loading" effect arising from the FERC formula is therefore even more serious under current conditions, as illustrated by the dashed curve in Figure Three.

2. Deferral of Cost Savings

A second effect, which is especially true for the FERC formula, is that real savings in costs are "disguised by deferral" when rates are calculated. We have already examined the different ratemaking formulae applied to the same investment. Let us now consider the case where two options are being reviewed by a utility, one fuel-intensive and the other capital-intensive, and let us further assume that the two are economically equivalent. The rates, however, can be radically different and therefore seriously distort both consumers' and regulators' perceptions.

The rates for the two choices as calculated under the FERC formula are illustrated in Figure Four for the case where the economic costs for the capital-intensive, fuel-saving option are *less* i.e., where the consumer should prefer the fuel-saving investment. Yet we see in Figure Four that the rates in the early years are *higher* for this cheaper option, and that the rates only cross after a few years. Thus, a still longer period elapses before the consumer perceives net, accumulated savings.

Even in this case, where one must choose among different technologies, we see a serious distortion emerging, once again because of the "front-end loading" which is inherent in the FERC formula due to the time-skewed rate base. As in the earlier discussion, this effect too, increases for higher inflation rates and thus is even more marked under today's conditions. The effect also exists for the ICC and Consent Decree formulae, but the magnitude is significantly less and therefore of much less practical relevance.

By way of summary, it is to be noted that “intertemporal bias” distorts the perceived costs of a regulated good when rates are set under the FERC, ICC, or Consent Decree formulae in several respects:

- For a given project, different formulae, otherwise equivalent, shift rates forward or backwards in time.
- Where projects are compared under any given formula, costs are shifted forward, potentially camouflaging real savings.
- The FERC formula is significantly worse in this respect than the ICC or Consent Decree formulae.

D. Retrospective Profitability Analysis

The third major distortion of the formulae involves the misstatement of rates of return. We have shown in the sections dealing with the ICC and Consent Decree formulae that the realized rates of return were at best modest, usually well below 8%. Only in the case of a very highly leveraged firm operating under the Consent Decree, might the real rate of return even theoretically go as high as circa 9.5-10.5%. Yet we must reconcile these normative calculations with the arguments advanced by the Department of Justice that oil pipelines have consistently realized very high rates of return. Indeed, a major reason for the intervention of the DOJ is the allegation that monopoly profits are being collected.⁵⁴

This argument, as advanced by the DOJ, is quite misleading; indeed, it is erroneous because the reported accounting rates of return for the pipelines are seriously biased upwards and consistently and significantly overstate the real rates of return for those firms. Biased accounting measures of profitability are not uncommon, and good reasons exist why one should suspect, *a priori*, that such a bias would arise in the case of the regulated oil pipelines.⁵⁵

Generally speaking, biased accounting rates of return are the mirror images of the types of problems discussed above where the ratemaking formula yields real dcf rates of return which differ from those specified with respect to the rate base. Since we have shown here that it is fortuitous if the two rates of return for a single pipeline investment agree, one should also suspect that the observed and actual rates of return for pipelines as going concerns might also diverge.

In the case of firms using straight-line depreciation, it is true in general that the ratio of income to net assets will increasingly overstate the real or dcf rate of return in such measure as the firm's cash flow is shifted towards the future. More precisely, this phenomenon arises if the time shape of that cash flow is convex, i.e., falls off more slowly than linearly declining downwards. The bias is especially likely if the cash flow rises before ultimately declining.⁵⁶

This is precisely the case for a pipeline regulated under either the ICC or Consent Decree formulae. The cash flow is defined as the depreciation charge,

⁵⁴Spavins, Thomas, *The Regulation of Oil Pipelines*, in Mitchell, E.J., ed., *Oil Pipelines and Public Policy*, American Enterprise Institute, Washington, D.C. (1979).

⁵⁵See Solomon, *supra* n.41 or Stauffer, *supra* n.41.

⁵⁶Stauffer, T.R., *Measurement of Corporate Rates of Return and the Marginal Efficiency of Capital*, Garland Publishing Co., New York (1980).

which is constant, plus the product of two time-dependent terms, the condition percent and the valuation base. After the first few years the condition percent falls off less rapidly than a straight line; indeed, it does not go to zero at the end of the depreciation lifetime. The valuation base actually rises with time, the slope depending upon the rates of inflation. The joint effect of the two terms is to produce a cash flow pattern which rises for significant periods and which may or may not decline before the asset is retired.

In order to estimate this bias, let us model a hypothetical pipeline firm under the following assumptions:

1. Only fixed assets, working capital ignored.
2. Asset lifetime is 35 years, economic and depreciation lifetimes are identical.
3. One year construction lag, no AFUDC.
4. Construction cost index escalates at the same rate as monetary inflation.
5. No investment tax credit, and flow-through accounting for accelerated tax depreciation.
6. Steady growth rate.
7. Tariffs set under the ICC formula.

It may be shown that the equation for the accounting rate of return is:⁵⁷

(eq. 2)

$$R^{acc} = \frac{\frac{k(g)}{k(r)} - \frac{S(N,g)}{N}}{\frac{1}{g} - 1 - \frac{S(N,g)}{N}}$$

where: $k(x)$ = present value of the after-tax cash flow to the firm,
discounted at "x"
 R^{acc} = book rate of return
 g = average growth rate of fixed assets
 r = dcf rate of return

The bias in the accounting ROI depends upon both the rate of inflation and the historical growth rate of the pipeline; it also depends, albeit less strongly, upon the rate of depreciation. Simulation results are tabulated in Table Two for the case where the real rate of return is exactly 8%. The table shows the *error* in the resulting accounting rate of return for the case of a pipeline firm subject to ICC rate regulation.

⁵⁷See Navarro, Petersen, & Stauffer, *supra* n.l.

Table Two. *Bias in Book Profitability of Regulated Oil Pipelines*
(ICC Rate Formula)

Real Growth Rate of Pipeline	Rate of Inflation			
	0.5%	2%	5%	12%
Zero	0.0	+2.6	+8.5	+24.4
2%	+0.3	+2.5	+7.6	+20.3
6%	+0.7	+2.5	+6.3	+15.3

Several patterns are clear in this example. It is broadly true that:

- The overstatement of pipeline profitability is greater than the rate of inflation.
- The bias increases more rapidly than the rate of inflation.
- The bias decreases for higher rates of growth of the pipeline (except for cases of very low rates of growth).

It is particularly important to note that the error in the accounting rate of return increases with higher rates of inflation and that the error usually is significantly greater than the rate of inflation. The accounting profitability signal is therefore perverse—the worse the inflation, the more profitable the firm appears; whereas, in reality, the opposite will be true, since inflation erodes the firm's real profitability.

For a zero-growth case with very low inflation, the bias is negligible and the accounting rate of return is an excellent proxy for the real economic rate of return. However, if the inflation rate is higher, say 5% per annum, the firm will show an accounting rate of return of 16.5%—a full 8.5 percentage points *above* its real ROR of 8%. At inflation rates of 12%—close to recent experience—the firm's nominal rate of return would exceed 30%, more than 20 points higher than its real ROR. This signal is dramatically misleading.

The error also depends upon the pipeline's *real* growth rate. For rates of inflation above about 2%, the magnitude of the bias decreases as a function of the pipeline's growth rate. For very low inflation rates, however, the bias is either weakly dependent upon the growth rate or may actually increase slightly.

The "retrospective probability bias" effect has been material for most regulated pipelines in the U.S. during the post-war period. This distortion clearly led the DOJ analysts into their presumption of monopoly power. For the relevant period, and until very recently, the compound inflation rate averaged about 2%, and most pipelines exhibited nominal growth rates in their fixed assets of about 2-4%. Thus, their real rates of growth ranged between zero and 2%. Hence the simulation calculations suggest that book rates of return for that period probably overstate the real, dcf-equivalent rates of return. In particular, the higher accounting rates of return of ca. 13%, cited by the Department of Justice⁵⁸ as evidence of

⁵⁸Spavins, *supra* n.54 at 92 *et seq.*

monopoly profits, correspond to real ROIs in the range of 9 to 12% (or lower), which are much closer to prevailing rates of return in other industries, thereby significantly undercutting the thrust of the Department of Justice's argument.

The previous discussion demonstrated that the mechanics of the Consent Decree formula could not yield rates of return much above 10%. This analysis of the observed profitability data suggests that the observed performance, once one corrects for the structural bias in the accounting profitability series, is consistent with the upper bound inherent in the formula itself. We thus conclude that this evidence for monopoly profits in the pipelines is incorrect and that regulatory concern for pipeline ratemaking, insofar as it purports to focus on "high" profitability in the past, is misdirected.

It is noteworthy that the Department of Justice actually developed several special cases which illustrate this effect in its own presentations alleging untoward rates of return.⁵⁹ In computing year-by-year rates of return, it recorded how the accounting ROR increased very rapidly for older assets as the asset base was steadily written off. The DOJ, however, failed to recognize the empirical fact that real firms are the sum of such vintaged assets and that the accounting RORs could or should exhibit the same trends. The Department of Justice's own calculations, therefore, clearly exhibit this rate of return error, which can be theoretically demonstrated to be quite general and which effectively vitiates its own argument. The Department, however, apparently failed to recognize the consequences of its own analysis.

Finally, the upward bias in reported rates of return for pipelines is further exacerbated by two additional effects which were not included in the simplified analysis here. This bias is increased considerably insofar as there are lags in income resulting from any investment outlays. The analysis had assumed a one-year lag, which is too low, especially for major construction or expansion projects. This effect can contribute another 1-3 percentage points to the bias in the observed *accounting* rate of return.⁶⁰ The additional rate of return bias caused by investment/income lags is also quite general, but is here somewhat larger because of the fact that the income stream is skewed into the future by the workings of the ratemaking formulae, which compound the impact.

This bias is also increased when the growth rates are very low, or especially, if the firm has been disinvesting—the case for some pipelines which had ceased to expand so that depreciation charges exceeded the replacement of capital. In those cases, the older, vintaged assets loom larger relative to the newer assets in the firm's mix. It is precisely for the older assets that the contribution to rate of return bias is largest. Thus, if the set of pipelines includes firms with low or negative rates of asset growth, the real rate of return will be still lower than indicated by the above formula.

⁵⁹*Id.* at 87-82. The author tabulates book or accounting rates of return for a hypothetical pipeline under both the ICC and Consent Decree formulae, using one set of financial assumptions over the 25-year operating lifetime of the pipeline.

⁶⁰Stauffer, *supra* n.56 at III-28—34.

V. POLICY IMPLICATIONS

We now turn to the implications for energy policy of the three fundamental imperfections in the regulatory ratemaking formula, and to the consequences of having a camel designed by committee rather than a thoroughbred regulatory race horse.

A. Impacts Upon Regulated Firms

The overriding drawback to all three formulae, but especially to the FERC formula, is that they create barriers to efficient investment. While these barriers are artificial because they are purely legal, they are nonetheless formidable. When investors believe that inflation is chronic and that there is a reasonable probability of even higher levels of inflation in the future, these barriers become increasingly important. Unless we can hope for a return to a more halcyon period of low inflation, we must therefore conclude that the structural defects of the ratemaking formulae are serious.

Formula bias is the most important drawback for the regulated firm because it simultaneously reduces the firm's own incentives to invest while impairing the flow of investment capital into the regulated industry. Regulated firms test investment decisions by calculating the revenue which will be yielded under the applicable ratemaking formula. They then determine their own rates of return net of interest costs and debt amortization.⁶¹ The regulators may be deceived by the "allowable" rate of return, but the firm may well not be, so that investment outlays which otherwise would be economical simply are not made or the firm restricts its investments to "protective" or "maintenance" levels.

Further, lower "real" rates of return will be directly reflected in lower earnings and lower coverage of fixed charges, a key ratio closely watched by analysts in the bond rating services and in the investment banking houses. Formula bias thus results in lower bond ratings, higher debt cost, and directionally, less access to capital, all of which compound the disincentives for making requisite investments. While this concern is of less relevance (few investments in new pipelines are contemplated), it is critical for the electric, gas, and synfuels industries.

Finally, a very specific consequence of formula bias is that it discriminates against an investment or technology which substitutes capital for fuel—more specifically, against a broad class of technologies which substitute coal plus capital goods for high-cost oil. Formula bias deepens the asymmetry between the cost-benefit calculi of the utility and the consumer, and regulators thereby systematically and effectively discourage the utilities from investments which would benefit consumers through lower, longer-run rates. The reaction to formula bias has been institutionalized, in part, by utilities. Many utilities try to offset formula bias through such devices as assessing fuel-saving investments over shorter periods of time or using *ad hoc*, higher target rates of return in their decision analysis in order to build a more comfortable margin into the investment choice.

⁶¹Corey, G., in Lind, Robert C., ed., *Discount for Time and Risk in Energy Policy*, Resources for the Future Johns Hopkins University Press (Fall 1981).

One consequence, therefore, of formula bias is a reversal of the conventionally-argued "Averch-Johnson Effect," i.e., a systematic bias in utility investment choices *against* capital-intensive options and *towards* fuel-intensive technologies. In particular, formula bias results in marked disincentives for such oil conservation strategies as coal conversions.⁶²

This perverse policy signal is reenforced within the regulatory context by "intertemporal bias" in the case of cost-saving investments; here the two effects are synergistic. Even if a utility subject to FERC-formula regulation decides to undertake, say, a conversion from oil to coal, the FERC formula creates an additional hurdle because consumers all too frequently will experience a rate increase in the short-run, even though the investment will result in real savings. The utility thus must overcome its own disincentives and then try to justify a rate *increase* in order to "save" costs for the consumers.

Hence, *vis-a-vis* both the regulatory commission and consumers, the utility faces a political obstacle to an "efficient" investment project simply because the FERC formula skews the costs sufficiently forward in time that the short-run rate increase can quite effectively mask the real savings. Since the regulated utility is forced to bear the political onus of *increasing* rates in order to achieve savings, there arises still another disincentive to achieve such savings. Since most such cases involve reducing oil demand through coal conversion or added nuclear capacity, the mechanics of the FERC formula create material obstacles to cut oil imports, and the formula is thus inconsistent with national policy objectives.⁶³

However, in one important respect utilities do benefit from "intertemporal bias." The front-end loading, so intrinsic to the FERC formula, greatly reduces the pay-out period on an investment by concentrating most of the cash flow into the earliest years. This skewing of revenues not only disproportionately loads costs onto the early users of the service, but it also very much accelerates the recovery of capital by the utility. This advantage is one reason, over and above tradition and innate conservatism, why the regulated utilities are not in the vanguard of any movement for basic regulatory reform.

The most rapid payout possible under the FERC formula benefits the utilities because it directionally offsets some of the other financial disadvantages to the FERC scheme. Moreover, the higher the inflation rate, the shorter the actual payout period, so that, *ceteris paribus*, the FERC formula under secular inflation paradoxically provides faster capital recovery and thus reduces the utility's exposure to regulatory risk while otherwise eroding its real rate of return.

This rather unheralded fringe benefit to the FERC formula is illustrated in Figure Five for two inflation rates—2 and 9%—where the FERC formula was adjusted to provide a *real* after-tax rate of return of 5% in each case. Full cash recovery takes 10.7 years under low inflation but is accelerated to 6.3 years for the more contemporary rate of inflation. An increase of seven points in the inflation rate thus cuts the payout period by almost 4.5 years, and this more speedy cash recovery is of obvious value to a financially beleaguered utility under today's conditions.

⁶²Stauffer, T.R., *The Social Efficiency of Electric Utility Decision Criteria*, in Lind, Robert C., ed., *Discount for Time and Risk in Energy Policy*, Resources for the Future John Hopkins University Press (Fall 1981).

⁶³This issue arose, *inter alia*, in the discussion of the Alaska Natural Gas Transmission System (ANGTS), where the skewed rates meant that in the earlier years, Alaska gas might be priced out of final markets without some additional guarantees. In particular, assurance was needed that these transport-intensive supplies could be subsidized through a "roll-in." For a general discussion of the financial disincentives facing electric utilities, see Navarro, P., "The Soft, Hard, or Smart Path: Charting the Electric Utility Industry's Future," *Public Utilities Fortnightly*, June 18, 1981.

B. Impacts Upon Consumers

The most important impacts upon consumers are consequential rather than direct. They result from the distorted investment decisions discussed above, especially from savings not realized as a consequence of disincentives to the utilities. In this sense, therefore, consumers suffer derivatively from the basic drawbacks to the formulae, especially the FERC formula. These costs, although probably the largest, are also less easily documented because they are hypothetical. They must be referenced to decisions *not* taken, rather than tracking actual investments and the resulting rates or tariffs.

The most significant cost in this category is the lost opportunities to substitute coal or nuclear power (assuming either is a politically or environmentally viable option) for oil. Illustrative of such possibilities is the case of Brayton Point station in Massachusetts, where special *ad hoc* rate adjustments were necessary in order to facilitate an oil-to-coal conversion which proffered annual savings of millions of dollars (and barrels of oil) per year. Absent circumvention of the FERC-type formula otherwise applicable to the project, the utility almost certainly could not have undertaken the investment, in spite of the clear savings to consumers.⁶⁴

This form of "lost" savings is a particularly insidious byproduct of the rate-making formulae because the losses, while large, are camouflaged. Since most such opportunities involve major capital commitments to realize the savings—including the "softer" options of windpower or cogeneration—consumers will automatically lose whenever the joint effects of formula bias and intertemporal bias deter utilities from appropriate projects. Yet these losses, however real, can be indentified only on a case-by-case basis and even then the casual relation between the foregone savings and misspecified rate design will often be obscured by case-specific details.

A second consumer cost is equally diffuse but no less real. Formula bias results in lower overall rates of return to the utility, which then translate into poorer bond ratings and thus into higher costs for debt and, in some instances, into higher costs for equity as well. Both of these costs must then be incorporated into the nominal "allowable" rate of return in subsequent rate hearings.⁶⁵ Thus, while consumers gain in the short run at the expense of the equity investors in the utility, it appears possible that such "direct" savings may be reduced or even eliminated by the higher capital charges which ensue. In any event, it is not a foregone conclusion that consumers benefit from profitability squeezes due to formula bias. It is possible—subject to confirmation through further research—that overall consumer costs may actually be higher, because the lower realized rate of return is more than offset by the higher nominal debt and charges built in.

A second set of costs to consumers arises from the pure time shift due to intertemporal bias. This effect involves an intergenerational shift in the costs of utility services, so that for any given project, the current or near-term consumers

⁶⁴Petersen, B., Erfle, S., and Koplow, L., *A Dynamic Regulatory Model with an Application to Electric Utility Coal Conversion* (unpublished), November 1980.

⁶⁵The interaction between regulation and a utility's cost of capital is discussed in Navarro, *Electric Utility Regulation and National Energy Policy, Regulation*, Jan.-Feb. 1981. Empirical evidence on that relationship is also summarized in this article.

are forced to cross-subsidize future consumers. This is particularly marked for capital-intensive projects, where the *real* rates charged to consumers might decline by a factor of two or three-to-one over the first 15 years or so of the project's service life (see Figure Three). This intergenerational shifting of utility costs also becomes sharper as the inflation rate increases, as was discussed earlier with respect to the utility's "benefit" from the same effect, so that this aspect of consumer cost is becoming ever more serious.

C. Impacts Upon Regulators

The third set of false signals resulting from the ratemaking formulae affects the regulators themselves. The combined effect of formula bias and intertemporal bias is to render the regulatory authorities doubly blind—or, at the very least, doubly astigmatic. Like Janus, the regulators must simultaneously look forward, prospectively, to provide incentive rates of return and also look backward, retrospectively, to monitor the actual performance of the regulated firms.

"Ratemaking by decomposition" is also doubly-flawed, creating false signals for the authorities. Prospectively, all three formulae are biased, so that the rate regulators who apply them, adjudicating the components piece by piece, do not, or cannot, perceive the effects of formula bias. Therefore, they may well believe that the allowable rate of return actually offers appropriate incentives for the firms to invest. We have shown above that this perception is erroneous, and formula bias is dangerous in that it disguises from the regulators the fact that the rates of return which they provide are in reality lower than they believe.

This aspect of formula bias is still more serious because it becomes necessary to provide even higher notional, "allowable" rates of return in the formulae in order to yield an ROR which might in fact be acceptable. Thus the political acceptability of any "reasonable" rate of return is distorted by the mechanics of the formulae because one must allow a higher rate of return in order to offset the intrinsic bias.

Retrospectively, the formulae are symmetrically biased, so that the regulators who cannot perceive where they are going are also unable to perceive where they have been. Since the firm's reported rates of return due to retrospective bias will be higher than the underlying economic profitability, the corrective feedback loop is broken. The historical profitability of the regulated firm will appear to be higher than it really is, the adjudicable accounting records may display an ostensibly "adequate" historical rate of return, and the "retrospective bias" intrinsic to the formulae blunts the perception that investments are being pinched off due to inadequate allowable rates of return. The biased profitability signals, measured retrospectively, thus camouflage the need for constructive reaction.

Retrospective bias therefore creates an obstacle to real regulatory reform, both among the regulators themselves and *vis-a-vis* the general public. The regulators may well believe that the firms are in fact performing well, mistaking the biased profitability signals for reality. However, even if the regulatory commissions are willing to grant higher rates of return in response to utilities' claims that the allowable values are unacceptable, it becomes more difficult to justify higher rates if the intervenors or the public can point to high rates of return earned in the past.

The argument applies even if historical returns appear only to be “adequate”—then, too, one may argue, why is there need for reform? Retrospective bias thus adds to the “acceptability hurdle” and creates still another obstacle to reform which can be attributed to the ratemaking formula themselves.

The political environment in which rates are determined and are subject to public acceptance is further exacerbated by intertemporal bias. This effect is most serious under FERC-type ratemaking, where the charges for new capacity or any cost-saving project are massively shifted forward. This shift catalyzes consumer resistance and thus sensitizes the regulators to their own political welfare.⁶⁶

One response by regulators to the “front-end loading” of the FERC formula is to try to mitigate this impact by paring the allowable rate of return—not merely for the new investment but also on the entire rate base. This device, provoked by the intertemporal shift in rates, is palatable politically, but implies a dramatic reduction in the rate of return that can be realized on the new project and becomes a formidable disincentive for investment. A seemingly modest downward adjustment—or lack of upward correction—in the overall allowable rate of return can all but eliminate any return whatsoever on the newer, incremental investments. Yet the political temptation for this mode of protective reaction by regulators is clear.

A second effect of the marked forward-shifting of rates under the FERC formula is to force regulators, as well as the utilities proposing new investments, on to the defensive. As shown in Figure Four, where cost savings are translated by the formula’s mechanics into *higher* rates for consumers, the burden of proof becomes even more difficult and more extensive argumentation is needed to justify camouflaged benefits. This invitation to consumer opposition hides real benefits, however, and is a gratuitous complication in today’s political environment. A compelling drawback to the FERC formula, therefore, under today’s conditions, is its perverse characteristic tendency to disguise cost savings in the short- or medium-run, thereby distorting the perceptions of firms, regulators, and consumers alike.

VI. EPILOGUE

As stated in the introduction and indicated throughout the sections of this paper, we have not come to praise the three formulae being adjudicated in the *TAPS* and *WBPL* cases. Rather we want to bury them—*decently*, of course, because they served us sufficiently in an earlier era. But we want to bury them *finally* as well, since these formulae have outlived their usefulness.

To that end we have catalogued in the text the important disabilities inherent in all three of these formulae, especially in the FERC formula. We have also shown that these deficiencies are serious. The ICC and Consent Decree formulae proved to be tolerably effective in an era of low inflation, but neither can function effectively under today’s dramatically higher rates of inflation. Thus, while we have argued in defense of both (their antecedents and inconsistencies notwithstanding), we also argue that neither is appropriate today. Perhaps most significant, given the seriousness of our current energy situation, we have shown that the

⁶⁶See Mitnick, B., *The Political Economy of Regulation*, New York, Columbia University Press (1980) (for a good survey of the literature on the regulator’s response to political pressures).

FERC formula is broadly inconsistent with the principal tenet of national energy policy, i.e., the systematic reduction of oil consumption and oil imports.

It must now be noted that there are technically viable alternative methodologies for determining the rates of regulated utilities—methods which eliminate or greatly reduce the biases and distorted policy choices inherent in the three competing formulae. We wish to conclude this critique, then, by emphasizing that these options do exist—even though neither has found currency and only one has found even the occasional partisan. We also want to emphasize that *both* are preferable to the existing systems, which now prove to be less and less relevant, and indeed more and more disfunctional, under today's chronic inflationary trends.

The comparative advantages of the alternative ratemaking concepts have been developed elsewhere, and it suffices here to sketch these two alternatives lest it be concluded that regulators are forced to choose, by default, among the ICC, FERC, or Consent Decree formulae. These two options—better than the three competing formulae in the sense of meeting economic criteria—should be considered. We now turn to a capsule summary of their essential features.

A. Levelized Real Rates

This formula involves a radical departure from existing regulatory practice, partly because the Levelized Real Rates entail arithmetical exercises beyond simple multiplication and addition. The procedure⁶⁷ is to compute the constant annual cash flow, in real terms, which is needed each year over the service life of the asset. The result is the given real rate of return, which is comparable to a mortgage installment. This annual figure is then escalated each year by a monetary inflation index, such as the GNP deflator, to preserve its real value. This levelized, real amount is the analogue of the "revenue requirement" in conventional ratemaking.

This calculation of rates eliminates formula bias by construction, and it also eliminates intertemporal bias because the real rate or tariff for each product unit (e.g., kilowatt or barrel) remains the same over the entire service life of the asset, except for any increases in the real cost of fuel which flow through each year to the consumer. One drawback of this approach is that it actually increases the retrospective bias: a utility subject to this form of rate regulation will exhibit an accounting profitability, year-to-year, which exceeds its real rate of return on capital, as was the case for the ICC and Consent Decree formulae. This bias *can* be compensated for, however, through an adjustment to the rate base, analogous to that described below.

The utilities, however, resist this concept because it stretches revenue over a longer period, thereby stretching their payout period. Given these fears of being trapped between reduced cash flow *and* an inadequate real rate of return—the pitfalls of partial rate reform—the utilities' suspicions are indeed plausible.

⁶⁷See Navarro, Petersen, & Stauffer, *supra* n.1 (for the mechanics of Levelized Real Rates).

Nonetheless, the great advantages of Levelized Real Rates are compelling:

- Intertemporal bias is eliminated completely.
- Cost savings are not concealed, but instead are passed through to current beneficiaries.
- Formula bias can be eliminated completely.

Except for the residual issue of retrospective bias, then, the Levelized Real Rates formula meets the dual normative economic tests of : 1) allocating opportunity costs uniformly across users over time, and 2) ensuring congruence between the allowed and realized rates of return. The mechanics of the calculation are routine and involve only methods long established in corporate financing or banking, even if they are unfamiliar in the regulatory context.⁶⁸

B. Escalated Utility Rates

This alternative (also at times designated as Trended Original Cost) was advanced in the *Williams Brothers* case⁶⁹ but thus far has found few adherents. The Escalated Utility Rates (EUR) formula tracks the conventional FERC formula through the first step: annual rates are calculated exactly in conformity with the FERC formula *except* that a real rate of return is used instead of some nominal rate of return which embodies inflationary expectations. The real rates so determined in each year are then escalated according to an inflationary index; however, unlike the preceding case for Levelized Real Rates, the “real” rate declines with time, parallel to the FERC case, before being escalated by inflation.

If implemented correctly, this method will also eliminate formula bias, but the rates still exhibit a distinct front-end shift. Thus, intertemporal bias, while reduced under this formula, is in no way eliminated. The real rates are still highest in the early years and fall off steadily in later years; rates will be too low by a factor of as much as two or three-to-one in those later years. Conversely, the front-end loading in the earliest years might skew rates by as much as 50 to 75%. Thus, this formula still could create material obstacles to cost-saving or oil-substitution projects, although notably less so than its cousin, the FERC formula. Finally, even though the intergenerational rate shift is reduced, it is still large and involves a considerable degree of cross-subsidization over time.

The EUR formula also exhibits retrospective bias, although the effect is less marked than for Levelized Real Rates. Here, too, however, it is possible to modify the accounting format so that this effect is eliminated. Indeed, one version of EUR involves an annual recomputation of the inflation-corrected, depreciated rate base as an intermediate step in calculating rates. That rate base can also be used to redefine an inflation-corrected asset base for the measurement of retrospective profitability.

⁶⁸The calculation of levelized rates requires using an annuity formula to distribute the total costs over the service life in a uniform installment. This can be specified mathematically or referenced to tables. In practice, Levelized Real Rates could only be approximately “level,” since the income tax liabilities cannot be forecast precisely. The actual taxes depend upon actual, as distinct from projected, rates of inflation, so that an annual adjustment would be needed to raise or lower rates (revenue requirements) in order to reflect actual taxes. This procedure could be made automatic.

⁶⁹See n.6 *supra*.

The principal advantage of the EUR is its mechanical simplicity. Its requisite calculations are fully compatible with current utility and accounting practices. The important and persistent disadvantage, however, is that the front-end loading persists to a dangerous degree so that most of the fundamentally perverse consequences of intertemporal bias carry over. While imperfect, it is nonetheless still materially superior to the FERC formula, and could be preferred on purely pragmatic grounds if comprehensive reform involving a closer approximation to Levelized Real Rates proves to be too ambitious.

The existence of these alternative ratemaking formulae, which are both superior and feasible, means that we are not obliged, *faute de mieux*, to be condemned by regulatory precedent into perpetuating the litany of disabilities we have described earlier. Rather, we should be obliged to regard basic reform as compellingly necessary, because inflation has become increasingly serious.

Hopefully, the courts and FERC will not remain strapped by legal precedent, but can instead transcend precedent and introduce economic or financial criteria into what are ultimately economic and financial decisions, even if they are in judicial format. It is now time to venture into this charted, but as yet unexplored, regulatory frontier of the Levelized Real Rates and EUR formulae. These mechanisms are better suited both to inflation and the modern political and economic mandates to develop alternative energy sources and substitutes for oil.

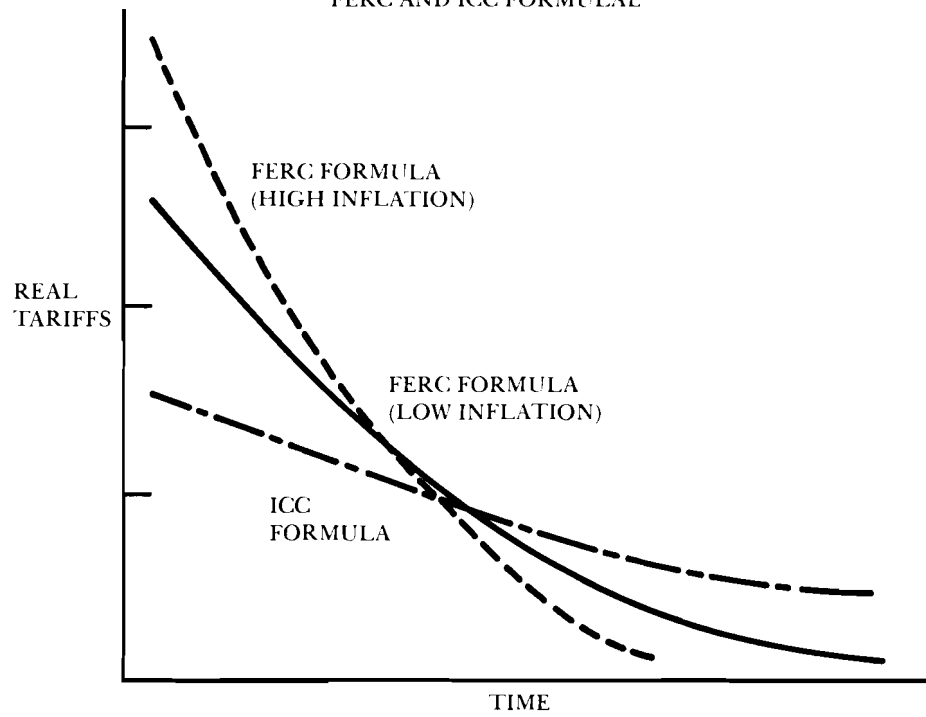
FIGURE THREE. FRONT-END LOADING EFFECTS OF THE
FERC AND ICC FORMULAE

FIGURE FOUR. CAMOUFLAGED SAVINGS: FERC FORMULA

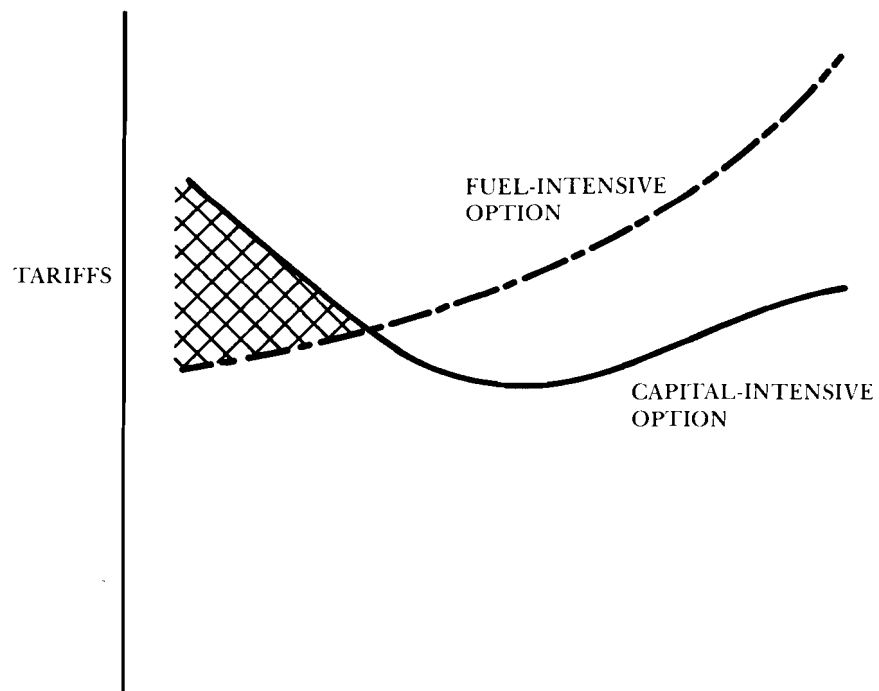


FIGURE ONE. VALUATION OVER TIME

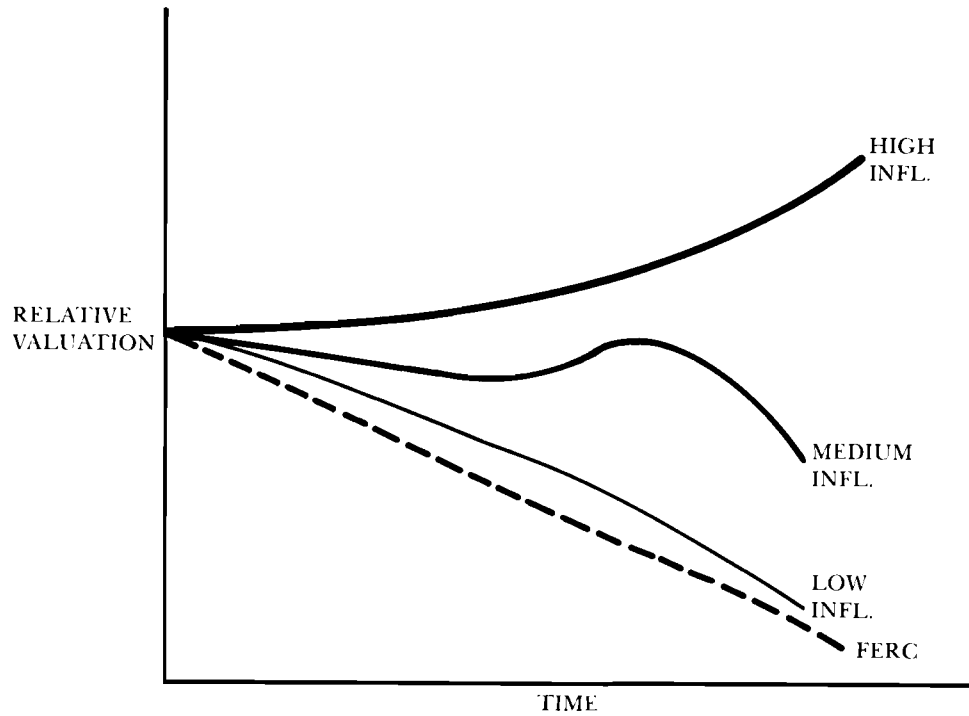


FIGURE TWO. REQUIRED RATE OF RETURN VS. INFLATION

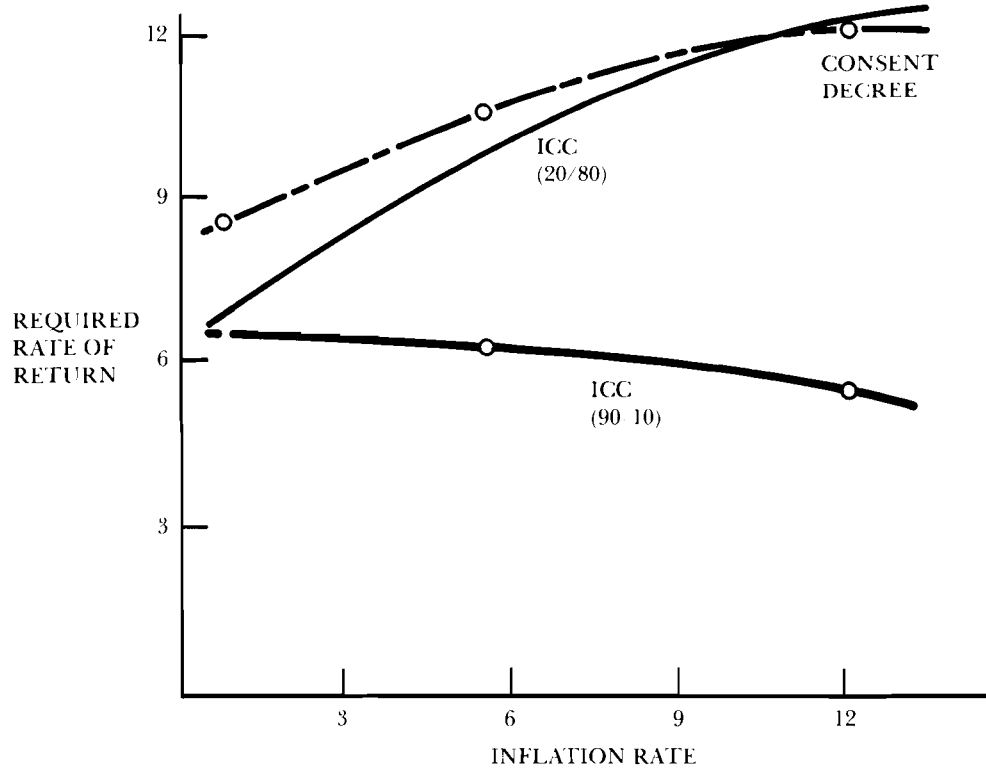


FIGURE FIVE. PAYOUT VS. INFLATION: FERC FORMULA

