Attachment 2

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Regulation and Capital Formation in the Oil Pipeline Industry

INTRODUCTION

Several U.S. industries are subject to rate-of-return regulation. The tariffs or prices charged by firms in these industries are supposed to recover the costs of providing service, including a just and reasonable rate of return on capital employed, which is measured as the regulated firm's rate base. If the firm is to attract capital, the allowed rate of return must at least equal that prevailing in capital markets for investments of comparable risk; that is, it must at least equal the cost of capital.[1]

However, the *form* of rate-of-return regulation crucially affects the firm's ability to recover its cost of capital in inflationary times, especially in the regulated transportation industries not granted monopoly franchises. The oil pipeline industry is an important example.

This paper grew out of a project that examined the appropriate rate-base and rate-of-return methodology for oil pipelines. The context was the *Williams Pipe Line Company* proceeding before the U.S. Federal Energy Regulatory Commission (FERC), Docket No. OR79-1 (hereafter *Williams*), a precedent-setting proceeding to reexamine a methodology underlying oil pipeline tariffs.[2] Although oil pipelines had formerly been regulated by the Interstate Commerce Commission (ICC) according to a unique rate-base formula, a court decision and the transfer of regulatory authority to the FERC afforded a new look at issues that had been thought settled, both conceptually in the economics of regulation and practically for specific regulated industries.

The research indicated that this complacency was not warranted. Some of the oldest issues in the economics of regulation require reexamination in light of today's circumstances. Both regulatory decisions and the economics literature were either confused regarding how inflation should be accounted for in the regulatory process or had not rethought old assumptions in light of today's inflationary economy and competitive environment, especially in transportation. The differences in the alternative regulatory approaches and their implications for regulatory objectives were often poorly understood.

The specific focus of the *Williams* proceeding was the rate base used by the ICC since the 1940s. The formula used to calculate this rate base, reproduced in Appendix

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A, grew out of the language of Section 19a of the Interstate Commerce Act, and was first revealed fully in an earlier round of the *Williams* case.[4] This formula is principally a weighted average of the original cost and the reproduction cost of the pipeline assets, with the weights changing over time to make reproduction cost more important as inflation proceeds.

The study led to the following conclusions and recommendations:

1. Despite their strange appearance, ICC procedures have worked. The industry has grown and rates of return have not been excessive. Because of this, current ICC procedures could be continued, although some modifications should be made. Regardless of the rate base eventually chosen, existing ICC procedures should be changed so that the depreciation method applied to the rate base is also used in determining allowed gross revenues.

2. If the ICC procedures are to be abandoned, regulation based on trended original cost (defined below as an original cost rate base trended for inflation) of pipeline assets has significant economic advantages over regulation based on original cost. A regulatory approach based on the traditional original cost concept would create severe economic distortions if it were used to regulate the oil pipeline industry.

3. Regulation should proceed by allowing each oil pipeline company to earn its overall cost of capital on average. The overall cost of capital is not sensitive to changes in the firm's debt-equity ratio. However, if it is measured by a weighted average of the debt and equity costs of capital, a hypothetical capital structure should be used.

4. A switch to rate base equal to the net original cost of the industry's current pipeline assets would retroactively confiscate a large part of their value.

5. In any switch of regulatory rate-base frameworks midway through the life of an investment, the best way to maintain a continuing fair return is to set the starting value of the new rate base at its final value under the old rate-base approach.

A review of these issues proceeds as follows: (1) the implications of alternative ways of compensating regulated investors for inflation for the regulated industry and its customers are summarized; (2) these principles are applied to the case of oil pipelines; and (3) the effects of switches between rate-base approaches are considered and the windfall loss to investors caused by a shift from the ICC methodology to the net original cost of pipeline assets is estimated.

Inflation and Rate-base Principles

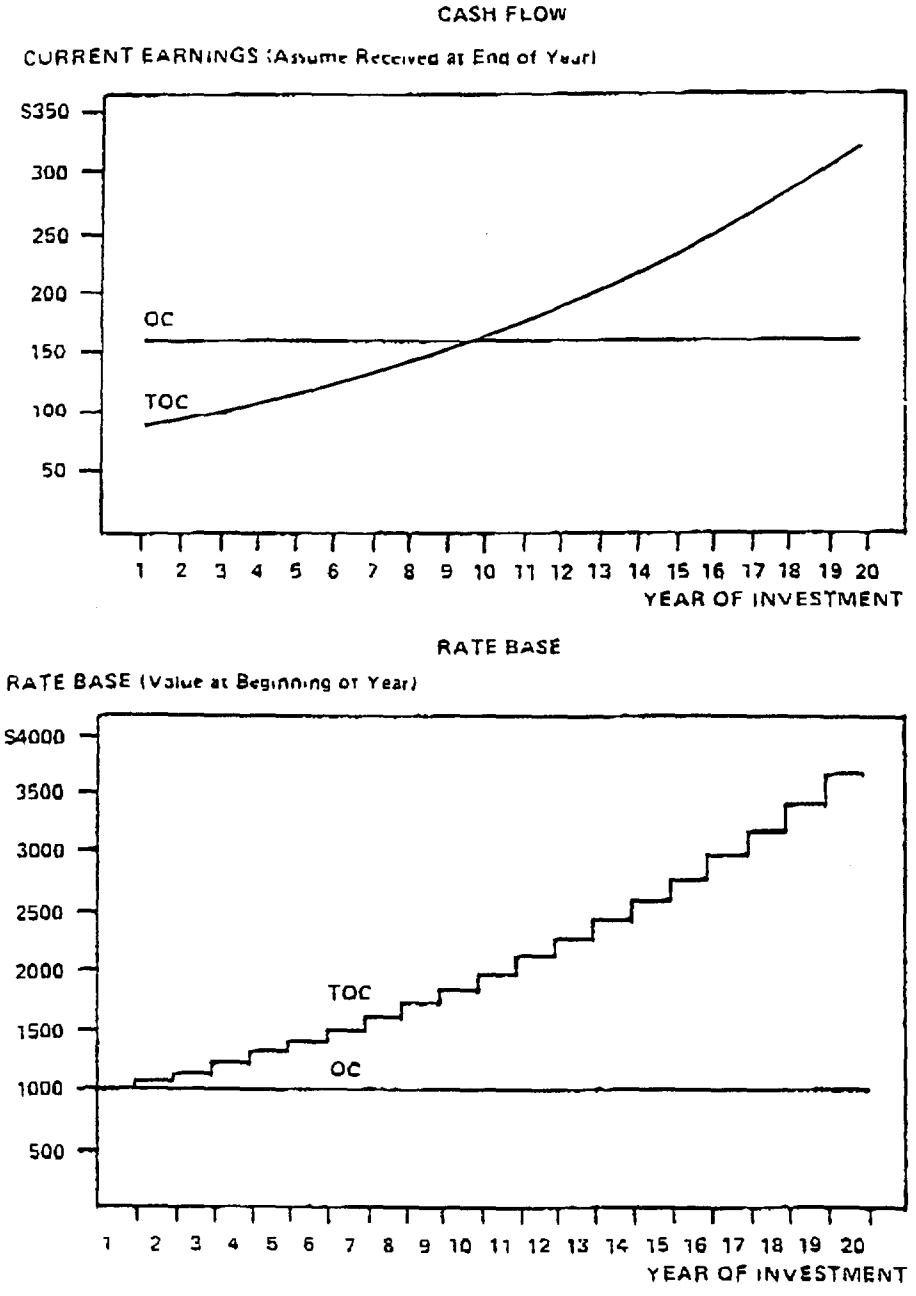
To understand the implications of the ICC rate-base formula, it is first necessary to understand how inflation affects rate-of-return regulation. In an earlier era, confusion regarding the impacts of inflation on regulated companies could be overlooked without too much harm because inflation rates were modest. But substantial increases in inflation rates have created problems for regulated firms that no longer can be ignored. New approaches to rate regulation must now be seriously considered.

Almost all professional opinion and regulatory practice has long preferred the original cost (OC) rate-base methodology over any other form. Under OC regulation, the rate base essentially equals the net book value of the assets and is not adjusted for inflation. However, there is considerable merit in a long-known (but never fully applied) rate-base concept in which an index is used to write up asset values to reflect inflation. This general approach is designated trended original cost (TOC). The end results of ICC procedures can be better understood if the differences between OC and TOC are explored first.

The issue is not *whether* to compensate investors for inflation but *how* to accomplish that objective. OC compensates investors for inflation by increasing the return allowed as current earnings on the capital stock rate base. TOC compensates investors for inflation by embodying the inflation that has occurred in the value of the rate base itself. The time patterns of the cash flows received by investors are very different under the two alternatives.

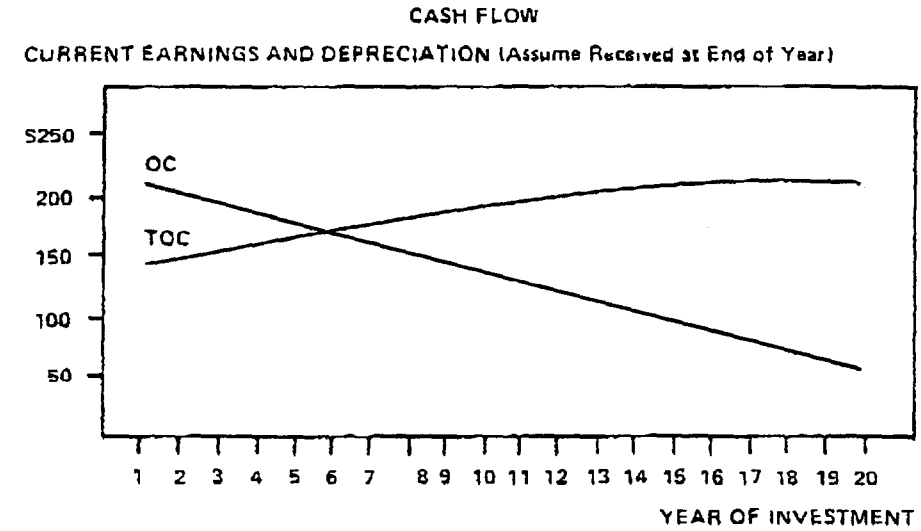
These differences are illustrated in Figure 1 for a nondepreciating asset and in Figure 2

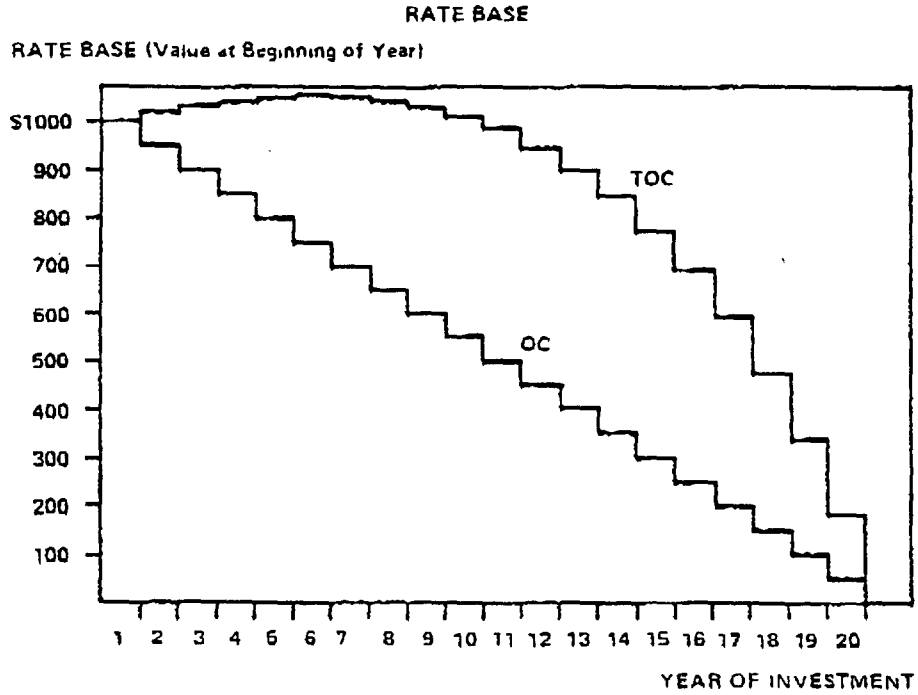
Figure 1
Cash Flow and Rate Base under Net Original Cost and Trended Original Cost Regulation (No Depreciation)



SOURCE. Verified Statement of Stewart C. Myers before the Federal Energy Regulatory Commission, Docket No. OR79-1

Figure 2
Cash Flow and Rate Base under Net Original Cost and Trended Original Cost Regulation (20-Year Straight-Line Depreciation)





SOURCE Verified Statement of Stewart C. Myers before the Federal Energy Regulatory Commission, Docket No. OR79—1.

for a depreciating asset. As the figures show, OC results in a front-end load of charges to consumers in times of inflation. TOC allows charges to consumers to grow more evenly with inflation by approximating the prices that would be charged in a competitive, unregulated industry in inflationary times. The advantage of a higher initial cash flow under OC is balanced by lower cash flow later, relative to that under TOC. Thus, once the initial year of the investment is past, switches among the regulatory methods may not be made without careful consideration of past policies as well as future revenues, unless the goal of fair regulation is to be abandoned.

Both OC and TOC permit investors to expect to earn their cost of capital.[4] Understanding this equivalent treatment of investors is essential to the arguments that follow, because much debate is predicated on the confusion that TOC, properly administered, somehow permits, or should permit, double-dipping for inflation.

In addition to the mistaken view that the regulated utility under TOC gets something for nothing, the general preference for OC sometimes rests on the view that OC is more scientific or that its familiarity and administrative convenience make it work well. Yet for the oil pipeline industry, the purported benefits of OC regulation over TOC are often slight or nonexistent, and far more important flaws in OC regulation have never been acknowledged in the traditional literature.

The following distinctions between OC and TOC provide a framework for analyzing ICC procedures:

1. TOC does not give a substantial extra return on capital to the regulated company.

2. TOC leads to tariffs equal to average cost in an equilibrium with inflation. It better approximates the tariffs a perfectly competitive industry would set.

3. OC causes a substantial "front-end load" of capital costs in the early years of an asset's life during a period of high inflation. The front-end load creates a number of serious problems. First, the carrier may not achieve sufficient throughput in the early years of the asset life to cover capital costs, or it may be unable to compete effectively with companies with older assets. This distorts capital investment and utilization in many regulated industries, such as transportation, where the carrier must compete directly with other regulated or unregulated carriers whose assets differ in vintage. (This is an important factor in view of today's trend toward reliance on greater competition in regulated industries.) Second, the OC front-end load causes an uneconomic and inequitable shift of the cost burden from future users to present users. Third, OC requires either widely fluctuating tariffs or capital gains and losses to investors during periods of rapidly changing inflationary expectations. Finally, it creates a dilemma for regulators, because consumer resistance to the dramatic rate increases often needed under OC makes it hard to grant rates sufficient to earn the cost of capital during a period of high and fluctuating inflation.

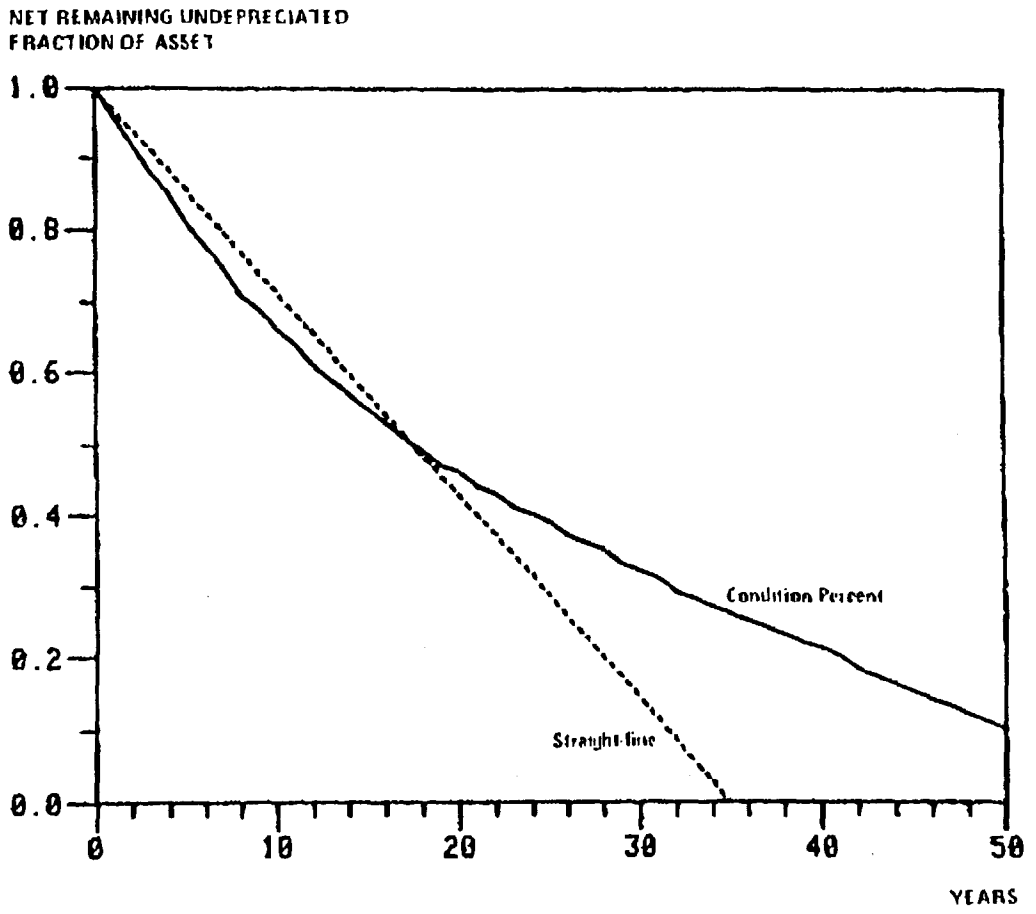
4. By avoiding the front-end load, TOC stabilizes the impact of changing inflation rates on tariffs, minimizes regulatory lag, reduces the need for frequent rate hearings during periods of changing inflation rates, and avoids some of the political difficulties facing regulatory commissions. TOC similarly avoids distortion of investment decisions and of competitive relationships between established firms and new competitors and among regulated carriers with assets of different vintages.

5. The administrative feasibility of the TOC approach depends on the economics of the industry. The chief question is whether an industry-specific or general inflation index is used to trend the rate base.[5]

6. The TOC method may lead to cash-flow and debt-service problems early in the lifetime of stand-alone projects heavily funded by debt. However, in many cases these problems can be mitigated by more realistic methods of reporting earnings, by creative forms of debt financing, by blending assets of different vintages, by applying the new approach only to new assets, or by changes in depreciation schedules.

7. The TOC standard facilitates comparable earnings tests of regulated and un-

Figure 3
Alternative Depreciation Profiles
for an Asset with a 35-Year Depreciable Life



SOURCE: Exhibit from Testimony of Jesse Oak, in *Ex Parte* 308, Interstate Commerce Commission, Bureau of Accounts, Cost Finding and Valuation, "Pipeline Condition Percent Table for Additions and Retirements," January, 1959.

down the value of the rate base. A graph of depreciation profiles for condition-percent versus straight-line depreciation for assets with a thirty-five-year life is shown in Figure 3. Like the weighted average of OC and RCN, condition-percent depreciation is not inherently inequitable. In fact, if used for ratemaking purposes, it may make more sense than straight-line depreciation for oil pipelines.[10]

The value of assets under a condition-percent method of depreciation is *lower* than it would be under straight-line depreciation for the first seventeen years of the thirty-five-year life.[11] This implies that write-off is faster in the early years under a condition-percent approach. For oil pipelines, given the capital intensity and riskiness of their investments, a form of depreciation which allows accelerated recovery of capital in the early years would be highly desirable. This would protect the investor to some degree from the risk of premature truncation of the investment's expected earnings stream. For example, premature drying up of an existing field may unexpectedly reduce the value of the investment.

On the other hand, some investments in petroleum pipelines continue to be productive long after they were expected to outlive their usefulness. Under pure straight-line depreciation, these investments can be fully depreciated before the expiration of their economic usefulness. In such a case, either a special exemption must be granted by the regulatory body or there is no incentive for the investors to maintain them in service. Since no asset is ever completely depreciated under the condition-percent approach, the investor always earns at least some return on this asset, with no need for special regulatory intervention.

Unfortunately, existing ICC procedures use book depreciation in calculating allowed revenue. These procedures would be simpler and more consistent if rate-base depreciation were used instead. Each year's rate-base depreciation would be defined as the write-down of ICC valuation resulting from the change in condition percent over the year. But under existing procedures, rate-base depreciation exceeds book depreciation in the early years of an asset's life. In later years book depreciation may exceed rate-base depreciation.[12] Since allowed pipeline revenues reflect book depreciation, the ICC procedures do not in fact allow accelerated recovery of capital.

Of course, the virtues of the condition-percent approach to valuation could also be attained by other forms of accelerated depreciation, provided the procedure chosen recognizes the continuing value of old, but still useful and operating, pipelines. Whatever time pattern of rate-base depreciation is chosen, in the future the dollar depreciation deducted from the rate base in any given year should match the dollar depreciation allowed as a cost in that year.[13]

Other Elements

Some of the remaining elements are inherently inequitable when considered in isolation. For example, the present value of lands is set at only 50 percent of original cost. Also, the only compensation for inflation for investments in land and rights of way is in the quite low (in today's capital markets) 8 and 10 percent current returns. Finally, as discussed in more detail below, the present method of calculating a company's aggregate rate base undervalues new investments.[14]

Rates of Return on the ICC Rate Base

Although there are illogical elements, the main parts of ICC procedures are not inherently unfair, and should in any case be judged by their overall results. A narrow focus on details could obscure a reasonable overall outcome. Whether or not ICC regulation has allowed a fair return is an empirical, not a theoretical, question. Several approaches might be used to answer this question, some of which have serious problems. These problems are addressed first.

Measuring Past Profitability of Oil Pipelines

Any attempt to measure the past profitability of oil pipelines must avoid several potential pitfalls. The most dangerous pitfall is

created by the extremely high debt ratios at which most new pipelines operate.[15] Consequently, equity rates of return earned by these pipelines are unusually high compared to equity returns earned by firms with normal capital structures. The temptation is to conclude, as have several studies of this industry, that equity investors in these pipelines have earned exorbitant returns. No such conclusion follows, for two reasons. First, the fair rate of return depends on financial risk. The expected rate of return demanded by equity investors increases with financial leverage. At extremely high levels of leverage, the expected return should likewise by extremely high. Second, throughput and deficiency agreements, by which pipeline owners effectively guarantee pipeline debt, keep borrowing costs low despite high debt ratios. This also raises equity returns.

Historical Rate-of-Return Standards

The task of evaluating oil pipeline regulatory history is complicated by a debate over what rate-of-return procedures were used with the ICC rate base. The 1940s decisions specified rate-of-return guidelines of 8 percent on crude oil pipelines and 10 percent on petroleum product pipelines. However, the 1941 Elkins Act Consent Decree between the Department of Justice and some major oil companies prohibited annual dividends by pipeline companies to shipper-owners in excess of 7 percent of the ICC rate base. The 7 percent consent decree earnings were *in addition to* interest expense,[16] while earning under the 8- and 10-percent guidelines would include interest expense under traditional regulatory practice.[17]

Lacking a clear record on the rate-of-return standard, some witnesses in *Williams* examined ex post performance.[18] The picture that emerges is not uniform. The industry-wide average return on the ICC rate base (after-tax earnings plus interest) is consistent with the ICC 8- and 10-percent guidelines, as are the returns of many individual pipeline companies. However, other companies' returns were higher, sometimes for a number of years in succession. What is *not* confirmed, however, is the view that pipeline tariffs yielded returns consistent with the so-called "consent decree standard" (i.e., the view that pipelines typically earned 7 percent on the ICC rate base plus actual interest).

On the basis of this evidence, the ICC's 8- and 10-percent guidelines are the most relevant regulatory standard. ICC regulation is evaluated next by calculating the true rates of return implied by these guidelines when applied to the ICC rate base.

Rates of Return on Prototypical Oil Pipeline Investments under ICC Procedures

The approach taken here is to calculate the true economic returns which would have been earned on a prototypical investment in a petroleum pipeline if it exactly earned the allowed ICC rate of return (8 percent on crude oil lines and 10 percent on petroleum product lines) in each year of operation, and if existing ICC procedures were followed exactly. The rationale for the "prototypical asset" approach is that the peculiar features of oil pipeline ratemaking methodology create several problems. First, determination of the allowed industry-wide true average rate of return is difficult because both rate-base write-up and allowed income must be measured on a pipeline-by-pipeline basis and added, and because the total return also depends on the asset's age. The ICC formula is a weighted average of OC and the RCN version of TOC, and the weights change to favor RCN as the asset ages. The total return for an individual asset at any point in time therefore depends on the asset's age, so that the total allowed rate of return for the industry in any year depends on the disaggregated age-structure of the industry's assets.

To complicate matters further, the allowed total return of an asset or group of assets at any point in time under the ICC pipeline formula is not necessarily representative of the expected return over its lifetime because of the changing weights in the ICC formula. Finally, the industry uses three different depreciation schedules (for

the above procedures are followed. The true regulatory return allowed may be defined as.

$$RRET = CE + WU - (RDEP - BDEP) \quad (2)$$

where RRET is the regulatory return allowed, CE is current earnings (= .08 (or 10) × Rate Base), RDEP is rate-base depreciation, and BDEP is book depreciation.

The value of RRET is divided by the rate base to measure the nominal rate of return in a given year. The real rate of return is calculated by deflating the nominal rate of return by the change in the Consumer Price Index.[22] These rates are averaged over time to measure the true profitability of each prototypical investment.[23]

The internal rate of return is calculated by looking only at actual cash flows. Under ICC procedures, cash flow in a given year equals the sum of current earnings plus book depreciation. The nominal internal rate of return is that discount rate which equates an investment today with the present value of cash flows from this investment over its life. That is, it equals the discount rate, IRR, at which:

$$INV = \sum_{t=1}^{T} CF_t/(1+IRR)^t \quad (3)$$

TABLE I
TRUE PROTOTYPICAL RATES OF RETURN FROM YEAR OF CONSTRUCTION THROUGH THE END OF 1977

	Average of annual rates[b]		Internal rate of return[c]	
Year of construction[a]	Nominal	Real	Nominal	Real
1947	113	076	.102	.074
1948	.112	077	.101	.078
1949	113	.077	.103	.077
1950	113	076	.105	.077
1951	113	.077	.105	.084
1952	114	.077	.106	.085
1953	.113	.076	.107	.084
1954	112	073	.105	.080
1955	112	.071	.103	.075
1956	108	.066	.097	.067
1957	.108	.066	.096	.067
1958	.106	.064	.094	.065
1959	.106	062	.093	.062
1960	106	.060	.093	.060
1961	107	.059	.094	.058
1962	.108	.057	096	.056
1963	.110	.057	099	055
1964	.113	.056	.103	.054
1965	.115	.056	.107	054
1966	.118	.056	.111	054
1967	.120	.055	.114	.053
1968	.122	.055	.117	053
1969	.125	.057	.122	.056
1970	.133	.063	.131	063
1971	136	063	.135	.063
1972	.143	.061	.144	.061

Note. Rates of return are the results of simulation of prototypical investments in oil pipeline assets under ICC regulatory procedures. Crude lines; thirty-five-year life, 8 percent allowed book rate of return.

[a]Asset assumed to be placed in service as of the end of the year of construction.

[b]Average of (current earnings + write-up − rate-base depreciation + book depreciation)/rate base from year after construction through 1977, inclusive.

[c]Discount rate equating present value of actual cash flows (current earnings + book depreciation) to value of initial investment.

TABLE II
TRUE PROTOTYPICAL RATES OF RETURN FROM YEAR OF CONSTRUCTION THROUGH THE END OF 1977

	Average of annual rates[b]		Internal rate of return[c]	
Year of construction[a]	Nominal	Real	Nominal	Real
1947	132	095	.122	.093
1948	131	.096	.120	.099
1949	131	094	.123	097
1950	132	093	.125	.097
1951	.132	096	126	105
1952	.132	.095	127	107
1953	132	.094	128	106
1954	132	.092	.126	102
1955	130	.089	.124	096
1956	128	085	.117	.087
1957	126	084	.115	.087
1958	126	083	.113	086
1959	.125	.080	112	082
1960	125	.078	.112	.079
1961	126	077	.113	.077
1962	.127	076	.115	.075
1963	.130	076	118	.075
1964	.133	076	123	074
1965	.136	076	.127	.074
1966	.138	.075	.131	.074
1967	.141	074	.134	072
1968	.143	.075	138	073
1969	149	.079	.144	077
1970	155	.084	.153	.084
1971	157	.082	.156	.083
1972	.165	.082	.166	.082

Note: Rates of return are the results of simulation of prototypical investments in oil pipeline assets under ICC regulatory procedures. Product lines: forty-year life, 10 percent allowed book rate of return.

[a]Asset assumed to be placed in service as of the end of the year of construction.

[b]Average of (current earnings + write-up − rate-base depreciation + book depreciation)/rate base from year after construction through 1977, inclusive.

[c]Discount rate equating present value of actual cash flows (current earnings + book depreciation) to value of initial investment.

where INV is the initial investment, CF_t is the cash flow in year t, T is the expected number of years of cash flows, and IRR is the internal rate of return.

A problem arises because the available data for the Period ICC index (1947 through 1977, inclusive) cover only part of the expected duration of pipeline investments. This problem is solved by using the fact that the present value of future cash flows under regulation which allows a fair rate of return always equals the value of the rate base. The ICC valuation at the end of 1977 is simply added to the final value of CF_t. The value of IRR thus derived assumed that the *expected* rate of return on this *final* valuation is exactly equal to the cost of capital.[24]

The real internal rate of return is calculated on the basis of real cash flows, obtained by deflating each element of the future cash flow stream by the cumulative change in the Consumer Price Index since the prototypical investment's construction.

The results of the above process are shown in Tables I and II. Table I shows the four rates of return which have been described for investments in crude oil pipelines from 1947 through 1972. Table II shows the same for product pipelines.

TABLE III
RATES OF RETURN FROM YEAR OF CONSTRUCTION THROUGH THE END OF 1977 ON PROTOTYPICAL INVESTMENTS UNDER MODIFIED INTERSTATE COMMERCE COMMISSION REGULATORY PROCEDURES

	Average of annual rates[b]		Internal rate of return[c]	
Year of construction[a]	Nominal	Real	Nominal	Real
1947	.114	.077	.103	.074
1948	.112	.077	.096	.074
1949	.113	.075	.095	.069
1950	.112	.074	.095	.067
1951	.111	.075	.094	.072
1952	.111	.075	.093	.072
1953	.110	.072	.092	.069
1954	.110	.071	.094	.069
1955	.111	.069	.095	.066
1956	.108	.066	.091	.061
1957	.107	.065	.089	.059
1958	.106	.063	.088	.059
1959	.106	.062	.089	.057
1960	.107	.061	.090	.056
1961	.108	.060	.091	.055
1962	.110	.059	.094	.054
1963	.112	.058	.098	.054
1964	.116	.059	.104	.056
1965	.116	.056	.105	.052
1966	.118	.055	.108	.051
1967	.119	.054	.112	.050
1968	.122	.054	.115	.050
1969	.124	.055	.119	.053
1970	.129	.058	.125	.058
1971	.129	.055	.127	.055
1972	.133	.051	.133	.052

Note: Rates of return are the results of simulation of prototypical investments in oil pipeline assets under modified ICC regulatory procedures. The modifications are: (1) use of Annual ICC Reproduction Cost Index in lieu of the Period Index, (2) deletion of the going-concern write-up, and (3) deletion of the write-down of 50 percent of the value of land. Crude lines: thirty-five-year life, 8 percent allowed book rate of return.

[a]Asset assumed to be placed in service as of the end of the year of construction.

[b]Average of (current earnings + write-up − rate-base depreciation + book depreciation)/rate base from year after construction through 1977, inclusive.

[c]Discount rate equating present value of actual cash flows (current earnings + book depreciation) to value of initial investment.

The real and nominal rates of return on prototypical crude and product investments made in each of the years from 1947 through 1972[25] are summarized in Tables III (for crude pipelines) and IV (for product pipelines). Actual industry performance under these assumptions would lie between the two, depending on the relative investment in crude versus product lines.

Older assets earn higher rates over the period, largely because (1) their rate base is weighted more heavily toward RCN (versus OC) in any given year, and (2) inflation has eaten more heavily into the 8 percent and 10 percent allowed rates of return in recent years. It is these effects that necessitate a prototypical study rather than a study of actual pipeline companies, which consist of assets of many ages and different depreciable lives. As Table V and Figure 4 illustrate, older assets are less significant than newer assets in the industry's total invest-

ment base. Thus the rates of return shown for newer assets are more representative of actual industry experience.

Comparing Pipeline Profitability with Normal Rates of Return

The rates of return shown in Tables III and IV indicate true rates of return earned under exact application of ICC procedures. These rates of return are, on average, approximately equal to normal real rates of return in the U.S. economy.

Table VI shows various measures of past average rates of return. Panel A shows average rates of return on Treasury bills, long-term government and corporate bonds, and common stocks over the fifty-year period from 1926 to 1976. The first row of Panel B shows the average real rates of return earned by investors in all U.S. nonfinancial corporations.

TABLE IV
RATES OF RETURN FROM YEAR OF CONSTRUCTION THROUGH THE END OF 1977 ON PROTOTYPICAL INVESTMENTS UNDER MODIFIED INTERSTATE COMMERCE COMMISSION REGULATORY PROCEDURES

	Average of annual rates[b]		Internal rate of return[c]	
Year of construction[a]	Nominal	Real	Nominal	Real
1947	.132	095	123	094
1948	.130	.094	.115	093
1949	.130	.092	.114	.088
1950	.129	.091	.113	.085
1951	129	.092	.112	.091
1952	.129	.091	.112	.091
1953	.128	.089	.110	.088
1954	129	.089	.113	.088
1955	129	.087	.113	085
1956	.127	.084	.110	.080
1957	.125	.082	.106	.078
1958	.125	.082	.106	.078
1959	.125	.079	.106	.075
1960	.126	.079	.108	.075
1961	.127	.078	.110	.073
1962	.129	.077	.112	.072
1963	132	.078	.117	073
1964	.136	079	124	075
1965	136	.076	.124	.071
1966	.138	.074	127	.070
1967	.140	.073	.131	.069
1968	143	.074	135	.070
1969	.147	077	141	074
1970	151	079	147	079
1971	.150	075	.148	.075
1972	154	.071	.155	.072

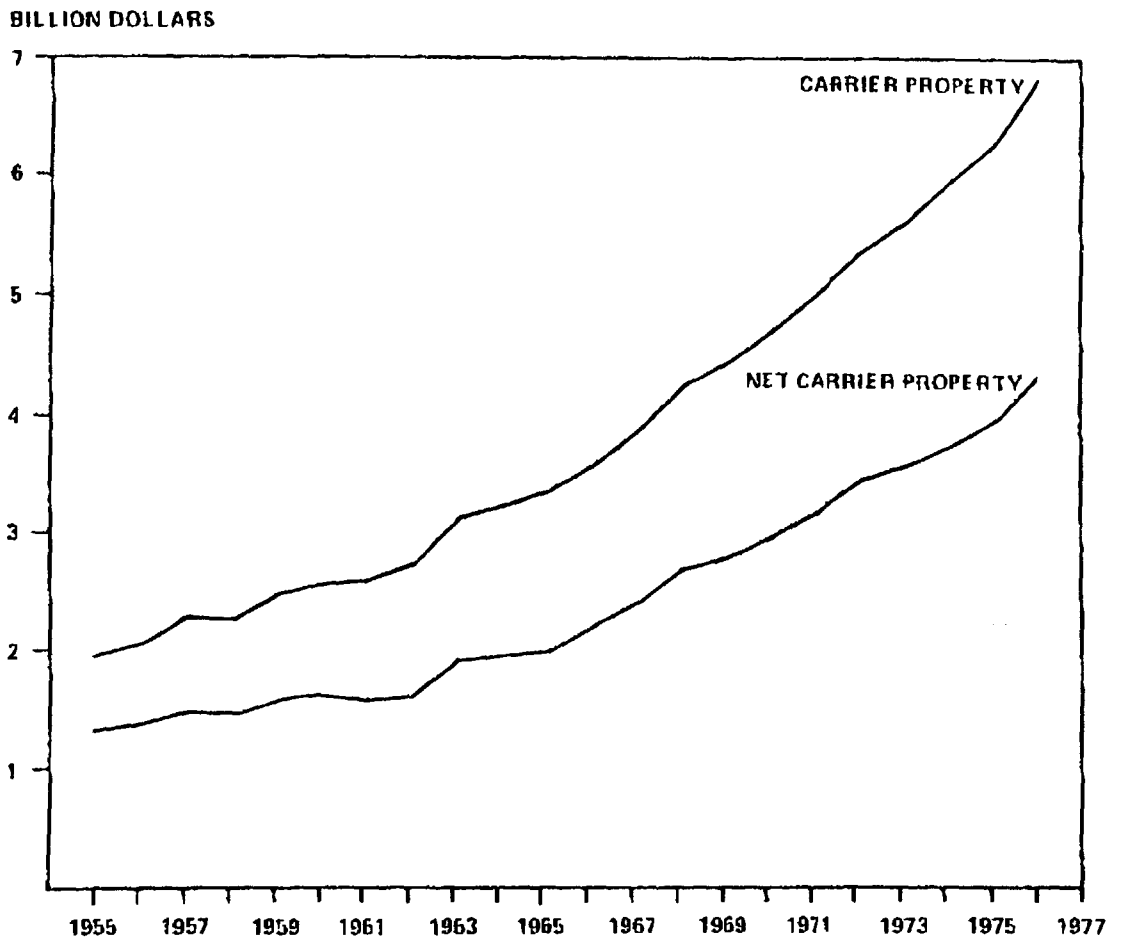
Note: Rates of return are the results of simulation of prototypical investments in oil pipeline assets under ICC regulatory procedures. The modifications are: (1) use of Annual ICC Reproduction Cost Index in lieu of the Period Index, (2) deletion of the going-concern write-up; and (3) deletion of the write-down of 50 percent of the value of land Product lines, forty-year life, 10 percent allowed book rate of return

[a]Asset assumed to be placed in service as of the end of the year of construction.

[b]Average of (current earnings + write-up − rate-base depreciation + book depreciation)/rate base from year after construction through 1977, inclusive

[c]Discount rate equating present value of actual cash flows (current earnings + book depreciation) to value of initial investment.

Figure 4
Investment in Oil Pipelines[1]



[1] Excludes companies investing in the Trans-Alaska Pipeline System

TABLE V
INVESTMENT IN CARRIER PROPERTY
U.S. OIL PIPELINE COMPANIES
(Dollars in Thousands)

Year	Carrier property	Accrued depreciation	Carrier property, less accrued depreciation	Net investment
1956	$2,716,233	$ 979,758	$1,736,475	$130,668
1957	2,843,033	1,051,660	1,791,373	126,800
1958	2,948,598	1,115,268	1,833,329	105,564
1959	3,196,908	1,239,632	1,957,276	248,310
1960	3,299,501	1,332,190	1,967,310	102,592
1961	3,406,830	1,429,116	1,977,713	107,329
1962	3,518,419	1,523,221	1,995,198	111,589
1963	3,914,664	1,613,988	2,300,676	396,244
1964	4,040,385	1,719,133	2,321,251	125,720
1965	4,177,562	1,830,675	2,346,887	137,177
1966	4,433,271	1,857,480	2,575,790	255,708
1967	4,744,501	1,971,996	2,772,505	311,230
1968	5,139,044	2,083,290	3,055,754	394,543
1969	5,378,821	2,189,784	3,189,037	239,776
1970	5,786,358	2,305,279	3,481,079	407,537
1971	6,305,124	2,425,816	3,879,308	518,765
1972	6,758,911	2,540,472	4,218,438	453,786
1973	7,016,064	2,650,284	4,365,780	257,152
1976	8,186,333[a]	NA	NA	1,170,269[b]

SOURCES: ICC, *Transport Statistics in the United States Part 6, Pipelines, 1955-1976*, and *1978 Moody's Transportation News Report*.

[a]Excludes investment in Trans-Alaska Pipeline in the following amounts:

Sohio:	$2,229,768,000
Arco:	1,404,473,000
Exxon:	1,337,593,000
Mobil:	334,398,000
Phillips:	111,020,000
Hess	100,319,000

[b]Net investment 1974-76, excluding Trans-Alaska Pipeline.

The second row of Panel B shows long-run average real rates of return computed from estimates of real corporate profits and capital stock from the National Income and Product Accounts, rather than from capital market data. These are returns on total corporate assets, not just on equity investment, and they represent income available to all corporate bondholders and stockholders, taken together.

Table VI shows a wide range of "normal" returns. In real terms the average return on Treasury bills is barely positive; on common stocks it is about 9 percent. This is exactly what one would expect given the risk that stockholders have borne relative to investors in short-term government securities.

Are the past rates of return derived for prototypical pipelines under ICC regulation reasonable in terms of the figures shown in Table VI? The answer to this question depends on the risks that investors in oil pipelines were actually forced to take.[26] This is difficult, because hindsight examines what happened, not the events that could have happened but did not. Nevertheless, as indicated by the dispersion of rates of return of oil pipelines reported by different witnesses in *Williams*, such as Rodney A. Harrill and Gerald A. Pogue, investors in oil pipelines bear significantly greater business risks than investors traditionaly have in other regulated industries, such as gas pipelines or electric utilities.

Suppose oil pipelines face the same business risks as typical nonfinancial corporations. This is a reasonable, possibly a con-

TABLE VI
AVERAGE HISTORICAL RATES OF RETURN

Panel A. Rates of return on debt and equity securities, 1926-1976. (Average annual returns in percent.)

	Normal return	Real return
Treasury bills	2.4	1
Government bonds	3 5	1 3
Corporate bonds	4 2	2.0
Common stocks	11 6	9.2

Panel B: Historical rates of return for all U S nonfinancial corporations. (Average annual returns in percent.)

	1929-1976	1947-1976
Overall real return to investors in corporate stocks and bonds[a]	5 9	7 4
Real rate of return on capital[b]	6.3	6.7

[a]Average of estimated annual real rates of return on the portfolio of all bonds and stocks issued by U.S. nonfinancial corporations

[b]Ratio of after-tax operating income to net replacement cost of capital stock Operating income includes net interest paid. It is calculated after depreciation based on net replacement cost, not on original cost. It does not include inventory profits.

SOURCES Panel A: R.B. Ibbotson and R.A. Sinquefield, *Stocks, Bonds, Bills and Inflation The Past (1926-1976) and the Future (1977-2000)* (Charlottesville, Va : Financial Analysts Research Foundation, 1977), Exhibit 38, p. 57; Panel B D.M. Holland and S.C. Myers, "Trends in Corporate Profitability and Capital Costs," in Robert Lindsay, ed., *The Nation's Capital Needs: Three Studies* (New York: Committee for Economic Development, 1979).

servative, assumption. In this case, the returns shown in Panel B of Table VI are the appropriate standards of comparison. They would indicate a normal real rate of return of 5.9 to 7.4 percent. By this standard the real rates of return shown in Tables III and IV are not excessive. The average annual real returns shown in Table III range from 5.5 percent, for a pipeline constructed in 1967, to 7.7 percent for a pipeline constructed in 1952. The range of internal rates of return is somewhat greater, but the internal rates of return are not systematically above or below the 6 to 7 percent range. Rates of return for product pipelines shown in Table IV are higher, as the ICC intended when it allowed product lines 10 percent, versus 8 percent for crude lines. Average annual rates of return for early product lines are on the order of the average real rate of return for common stocks shown in Panel A of Table VI. The same figures for later pipelines are in the area of 7 to 8 percent.

Overall, the returns shown in Tables III and IV are not excessive, particularly when returns for pipelines built after 1960 are examined. These returns are more relevant because (1) they more closely represent the returns that might be expected on pipelines built today and (2) older assets are less important than newer assets in the industry's total investment base.

Biases from Asset Aggregation

The rates of return shown in Tables III and IV are for single pipeline investments, which are able to earn the allowed returns in every year. These rates almost certainly overstate the true average rates of return that would have been earned on oil pipeline investments under the ICC guidelines. The chief reason is that the present method of calculating a company's aggregate rate base undervalues new investments. A numerical example will illustrate this problem. Suppose OC value (before depreciation) of a pipeline's rate base is $250 million and its RCN value is $400 million, with a condition percent value of 60 percent. For the moment, ignoring the going concern element, the current ICC rate base for these assets is:

$$\text{ICC VALUATION} = \$[(250/650) \times 250 + (400/650) \times 400] \times .6 = \$342.3 \times .6 = \$205.4 \text{ million}$$

If $100 million in new investment is added, the new rate base for these assets becomes:

$$\text{NEW VALUATION} = \$[(350/850) \times 350 + (500/850) \times 500] \times [(.6 \times 400 + 100)/500] = \$438.2 \times .68 = \$298.0 \text{ million}$$

This is only $92.6 million greater than the initial rate base. Investors lose 8.4 percent of their new investment. When the going concern write-up is considered, this loss is reduced. It becomes $1.8 million, or 1.8 percent of the new investment.[27]

under OC regulation. If a decision is ever made that ICC procedures should not continue, the commission should set the value of existing assets under their new rate-base methodology at their final value under the ICC methodology.

The preferred methodology, if a switch is made, should allow compensation for inflation in the rate base. This will generate tariffs that better match the time pattern of prices charged in a competitive industry. OC regulation cannot accomplish this. Under TOC regulation, FERC should allow a rate of current earnings equal to the real cost of capital applied to an asset base trended by the ICC's index of oil pipeline construction costs. As a second-best approach, the inflation index could be a more general index of inflation in the economy.[31]

Implications for Other Industries

The United States presently faces the prospect of financing numerous very large energy transportation projects. Shifting sources of supply (from U.S. domestic to foreign and Alaskan) and changes in energy type (to coal and synthetic from oil) have created immense requirements for investment in energy transportation. For example, the proposed Alaskan segment of the Alaska Gas Pipeline would cost $23 billion or more, dwarfing the existing original cost rate base of the industry.

Such projects represent significant problems for original cost ratemaking methodology. High rates of inflation and concomitant high rates for the nominal cost of capital place a heavy burden of capital costs on the initial throughput of these projects. Very often the expected time profile of volume throughput bears little relationship to the time allocation of the capital costs. Since early losses cannot be "carried forward" to later years, the application of OC methodology could easily be imagined to result in the economic infeasibility of projects that are perfectly sound under TOC —methodology.

Other examples of misguided incentives are found when a utility is considering an extremely large investment project relative to the OC rate base. Politically unacceptable rate increases may be required immediately to recover the front-end load costs, thereby deterring the utility from implementing a capital-intensive project whose life-cycle costs are lower than continued use of underpriced existing assets under the OC rate base. Distortions would also be expected wherever a new capital-intensive mode such as coal slurry pipelines were required to compete with a mode whose services were priced on the basis of an original cost valuation of relatively old assets, a mode such as the railroads.

These examples suggest that serious economic distortions are occurring in transportation and other regulated industries as a result of continued reliance on original cost ratemaking. For the long-run health of the regulated sector of the economy, it is important that flaws in traditional rate-base methodologies be corrected.

Appendix A
ICC Rate-Base Valuation Formula

$$\cdot \left\{ [(\cdot\ \cdot\ \cdot)(\cdot)\ (\cdot\ \cdot\ \cdot)(\cdot)](\tfrac{\cdot}{\cdot}) \right\} - (\cdot\ \cdot\ \cdot)$$

In this formula,

V = single-sum value
R_1 = cost of reproduction new
R_2 = cost of reproduction new less depreciation
O_1 = original cost to date
L_1 = present value of lands
L_2 = present value of right-of-way
W_1 = working capital

SOURCE: Testimony of Jesse Oak in *Ex Parte* 308 before the Interstate Commerce Commission.

Appendix B
Estimate of the Consequences of an Uncompensated Switch to OC Regulation for Oil Pipelines

An uncompensated shift to an OC rate base from a TOC rate base will cause a capital loss to investors, regardless of its immediate impact on tariffs. The proposed shift from the ICC oil-pipeline methodology to OC will likewise impose a capital loss, unless the FERC sets the new rate base for existing assets at their final ICC valuation.

The amount of this confiscation would depend on exactly what new procedures were adopted, and on the date of transition. However, the amount may be very large. As an illustration, consider the proposed uncompensated transition from the ICC rate-base methodology (essentially a weighted average of OC and TOC) to a strictly OC standard. Concentrating on the lower forty-eight states (and thus excluding the Trans-Alaska Pipeline System—TAPS), the loss of rate base is approximately $2.8 billion, as shown in the following calculations.

TABLE B1
ESTIMATED NET LOSS IN RATE BASE FOLLOWING AN UNCOMPENSATED SWITCH TO THE NET ORIGINAL COST OF CARRIER PROPERTY NOW INCLUDED IN ICC VALUATION
(Millions of Dollars)

Panel I: Summary, 1976

	Sample of forty-seven companies[a]	Estimated industry except TAPS investors	Estimated industry except TAPS
ICC valuation	5,452[a]	7,000	7,987
Net original cost[b]	3,415[a]	4,385[a]	5,211[a]
Net loss in rate base	2,037	2,615	2,776

Panel II: Sample of Forty-Seven Companies, 1976

A Calculate net investment in carrier property	
(8) Net carrier property[c]	3,415
B Calculate ICC valuation	
(9) ICC valuation	5,452
C Calculate net loss in rate base	
(10) ICC valuation (9)	5,452
(11) Net carrier property (8)	3,415
(12) Net loss ((9) − (8))	2,037

Panel III: Industry Excluding TAPS Investors, 1976

A. Calculate net investment in carrier property	
(13) Net carrier property, excluding TAPS investors[d]	4,385
B Calculate ICC valuation	
(14) Net carrier property, excluding TAPS investors (13)	4,385
(15) Net carrier property, forty-seven companies (8)	3,415
(16) Net carrier property, other companies ((13) − (8))	970
(17) Estimated ratio of ICC valuation to net carrier property ((9) ÷ (8))	1.596
(18) Estimated ICC valuation, other companies	1,548
(19) ICC valuation, forty-seven companies	5,452
(20) Estimated ICC valuation, excluding TAPS investors	7,000
C. Calculate net loss in rate base	
(21) Estimated ICC valuation, excluding TAPS investors (20)	7,000
(22) Net carrier property, excluding TAPS investors (13)	4,385
(23) Estimated net loss in rate base	2,615

Panel IV: Industry Excluding Investments in TAPS, 1976

A Calculate net investment in carrier property	
(24) Carrier property, excluding TAPS investors	6,889
(25) Net carrier property, excluding TAPS investors	4,385
(26) Ratio of net carrier to total ((25) ÷ (24))	0.637
(27) Carrier property, TAPS investors	6,815
(28) Investment to date in TAPS	5,518
(29) Carrier property, TAPS investors, excluding TAPS	1,298
(30) Estimated net carrier property, TAPS investors, excluding TAPS ((26) ÷ (29))	826
(31) Estimated net carrier property, excluding TAPS ((25) + (30))	5,211
B. Calculate ICC valuation	
(32) ICC valuation, forty-seven companies (9)	5,452
(33) Estimated ICC valuation, other companies (18)	1,548
(34) ICC valuation, TAPS investors, excluding TAPS	988
(35) Estimated ICC valuation, excluding TAPS ((32) + (33) + (34))	7,987
C. Calculate net loss in rate base	
(36) Estimated ICC valuation, excluding TAPS	7,987
(37) Estimated net carrier property, excluding TAPS	5,211
(38) Estimated net loss ((36) − (37))	2,776

TABLE B1
ESTIMATED NET LOSS IN RATE BASE FOLLOWING AN UNCOMPENSATED SWITCH TO THE NET ORIGINAL COST OF CARRIER PROPERTY NOW INCLUDED IN ICC VALUATION (Continued)
(Millions of Dollars)

NOTE Figures may not add exactly due to rounding

[a]Sample does not include companies investing in TAPS. Companies included in the sample are.

Amoco Pipeline
Arapahoe Pipe Line
Ashland Pipe Line
Buckeye Pipe Line
Butte Pipe Line
Chevron Pipe Line
Chicap Pipe Line
Cities Service Pipe Line
Colonial Pipeline
Continental Pipe Line
Cook Inlet Pipe Line
Dixie Pipeline
Eureka Pipe Line
Four Corners Pipe Line
Gulf Central Pipeline
Gulf Refining Co.
Hydrocarbon Transportation
Kaneb Pipe Line
Lakehead Pipe Line
Laurel Pipe Line
Mapco, Inc.
Marathon Pipe Line
Mid-Valley Pipeline
Minnesota Pipe Line
Olympic Pipe Line
Phillips Pipe Line Co.
Plantation Pipe Line
Platte Pipe Line
Portal Pipe Line
Portland Pipe Line
Pure Transportation
Sante Fe Pipeline
Shell Pipe Line
Southcap Pipe Line
Southern Pacific Pipe Lines, Inc.
Sun Pipe Line
Tecumseh Pipe Line
Texaco-Cities Service Pipe Line
Texas Eastern Transmission
Texas-New Mexico Pipe Line
Texas Pipe Line Co of Texas
West Shore Pipe Line
West Texas Gulf Pipe Line
Williams Pipe Line
Wolverine Pipe Line
Wyco Pipe Line
Yellowstone Pipe Line

[b]Actual

[c]Original cost as used in this exhibit pertains only to the value of carrier property (including land and rights-of-way). This is the basis of the loss from an uncompensated switch to original cost regulation. See the testimony of Richard Hildahl in *Williams Pipe Line Co.* before the FERC in *Williams Pipe Line Company*, Docket Nos. OR79-1, et al., for the details of how an actual original cost rate base calculation would have to be made.

[d]Net investment in carrier property at book value. This is actually an overestimate of original cost which will result in an underestimate of the net loss, because of purchases and sales of pipeline assets among companies. (Because pipelines use a trended rate base, the average resale price exceeds the net original cost.)

[e]Carrier property less accrued depreciation and amortization.

[f]Data on two of the eight companies investing in TAPS, BP and Union, are not reported in Part 6 for 1976, and so these companies are not reflected in either the industry data or in the figures on TAPS investors. The six companies investing in TAPS and listed in 1976 are Arco, Exxon, Hess, Phillips, Mobil, and Sohio.

SOURCES: (1) Data on investment in carrier property published by the Interstate Commerce Commission, *Transport Statistics in the United States, Part 6, Oil Pipe Lines*, for the year ended December 31, 1976; (2) ICC valuation for forty-seven companies and TAPS investors, Interstate Commerce Commission; and (3) investment in TAPS reported in *1978 Moody's Transportation News Report*, p 1401. The amounts invested to date are as follow (million dollars):

	1976
Sohio	2229.768
Arco	1404.473
Exxon	1337.593
Mobil	334.398
Phillips	111 020
Hess	100.319
	5517.571
BP	1059 374
Union	111 020
	6687.965

ENDNOTES

[1] See S. Myers, "The Application of Finance Theory to Public Utility Rate Cases," *The Bell Journal of Economics and Management Science* 3 (Spring 1972), pp. 58-97.

[2] Sections of this paper draw on testimony sponsored by Marathon Pipe Line Company and submitted in that proceeding. (See the Verified Statement and Verified Rebuttal Statement of Stewart C. Myers in *Williams*, July 1979 and August 1979, respectively. The views in the present paper, however, are the sole responsibility of the authors, and do not necessarily represent the views of Marathon Pipe Line Company.) After this paper was written, FERC issued a 394-page opinion on November 30, 1982, upholding the continued application of the ICC methodology for oil pipelines as far as valuation of the rate base is concerned. But FERC proposed a change in the methodology for determining the allowed rate of return on that rate base. The decision agreed with many of the conclusions stated here and disagreed with others. It agreed that the ICC formulation for the rate base must be evaluated in terms of its overall reasonableness and it took explicit consideration of the front-end load problem discussed in this paper in choosing the recommended methodology. However, it rejected most of our recommended modifications to ICC procedures. This decision was overturned on appeal, so the issues discussed here are once again under consideration by the FERC.

[3] See the testimony of Jesse C. Oak before the Interstate Commerce Commission in Ex Part No. 308, the ICC's predecessor to *Williams*, appended to the Verified Statement of Thomas C. Spavins in *Williams*, July 1979.

[4] S. Myers, L. Kolbe, and W. Tye, "Inflation and Rate of Return Regulation," forthcoming in *Research in Transportation Economics* (JAI Press). For a different view, see Peter Navarro, Bruce C. Peterson and Thomas R. Stauffer, "A Critical Comparison of Utility-Type Methodologies in Oil Pipeline Regulation," *The Bell Journal of Economics* (Autumn 1981), pp. 392-412.

[5] The pros and cons of each approach are discussed in Myers, Kolbe and Tye, mimeo, pp. 31-38.

[6] For a description of similar behavior in the electric utility industry, see P. Joskow, "Inflation and Environmental Concern: Structural Change in the Process of Public Utility Regulation," *Journal of Law and Economics*, Vol. 18, No. 2 (October 1974). There is at least one important difference between oil pipelines and electric utilities, however. Most oil is shipped by the owners of the pipeline, although many independent shippers exist as well.

[7] It is worth emphasizing the special circumstances leading to *Williams*. The phenomenon described by Joskow (see fn. 6 above) ended when inflation and other factors required frequent hearings under OC electric utility regulation. The trending features of the ICC rate base helped avoid these inflation-related problems.

[8] However, the write-up of Reproduction Cost New is based on the ICC's Period index, which is an average of three past years' values of the Annual index, the present year's value, and one projected. The Period index is not the best choice for this purpose. See the testimony of John A. Jeter in *Williams*.

[9] See the testimony of Gerald A. Pogue in *Williams* for alternative ways of meeting this requirement using the ICC rate base.

[10] See Appendix A of our companion paper.

[11] The condition percent approach is apparently always below straight-line depreciation for the first half of the designated straight-line period.

[12] The *rate* of straight-line book depreciation exceeds the *rate* of rate base depreciation under condition percent for old assets, but the latter rate is applied to a partially written-up rate base. Which is greater therefore depends on the exact vintage of the asset and the year for which depreciation is computed.

[13] The fact that this was not done in the past complicates measurement of true returns allowed, but does *not* imply that past regulation was necessarily unfair.

[14] We defer discussion of the 6 percent "going concern" write-up until then.

[15] These debt ratios are a rational response to the 1941 Elkins Act Consent Decree between the Department of Justice and most major oil companies. This Consent Decree limits *dividends* paid to shippers-owners to 7 percent of ICC valuation. Interest is treated as an allowable expense under the Consent Decree, encouraging shipper owners to use an artificially high proportion of debt financing. This debt is supported by throughput and deficiency agreements from the parent oil company.

[16] In response to the Consent Decree, new pipeline ventures typically begin with 90 percent or more debt financing guaranteed by agreements with the parent companies.

[17] Confusion about whether interest was to be included under the 8 and 10 percent standards apparently existed among those in the industry at various times.

[18] The most exhaustive such study is the *Williams* testimony and work papers of Robert S. Stich.

[19] Current income is defined in the customary way for regulated industries: after-tax net income plus total interest expense.

[20] The first year's write-up includes the 6 percent "going concern" add-on less the loss of 50 percent of the value of land.

[21] These proportions are based on the mix of carrier property of a particular pipeline company at the end of 1977.

[22] Let NR and RR equal the nominal and real rates of return, respectively. Then the formula for deflating the nominal return is:

$$RR = (1 + NR)/(1 + i) - 1,$$

where i = the rate of increase in the Consumer Price Index.

[23] RRET for the first year includes the 6 percent "going concern," write-up of other carrier property, and the deduction of 50 percent of the value of land.

[24] The use of final ICC valuation in this context was criticized by Thomas C. Spavins, a witness for the Department of Justice in Docket OR 79-1 et al. before

the FERC. The problem is that under traditional ICC procedures, the allowed return is not exactly equal to the cost of capital each year, so final ICC valuation is not an *exact* estimate of the present value of future cash flows under those procedures. Nonetheless, use of final ICC valuation (or the actual write-ups under the "average of annual rates" calculation) is unavoidable. Mr. Spavins himself admitted it was a very close approximation to the present value of future cash flows under *his* hypothetical scenarios of future inflation. To do better, one would have to predict not only future inflation in *each* of the remaining years of life for pipelines of each vintage, but also how long pipelines of each vintage will actually last. The effect of using final ICC valuation (or actual write-ups) is generally to overstate slightly, if anything, the returns under past ICC procedures. Thus the conclusion that these past returns were reasonable is *reinforced* by this assumption.

[23] Notice that we stop in 1972. Since the ICC did not explicitly attempt to assure that the true return achieved in a given year equalled the cost of capital in that year, comparisons with too few years of returns are likely to be highly misleading, because of their sensitivity to short-run factors. The most serious of these is the 6 percent "going concern" write-up in the first year, which adds roughly (6 ÷ number of years of operation) percent to the annual average rate of return. This is a 1.2 percent addition to the average rate for assets constructed in 1972 (and operated through 1977), compared to a 0.2 percent addition for assets constructed in 1947. As noted below, this 6 percent add-on may be more than offset by an aggregation-based write-down when new assets are added to an existing rate base.

[24] Note that these risks were suppressed in calculating the returns shown in Tables 3 and 4. The average returns for the prototypical pipelines may be unrealistically high, because in calculating them we assume that the allowed ICC return is always earned. Actual pipelines are sometimes *unable* to earn the allowed ICC return.

[25] $298.0 (1.06) − 205.4 (1.06) = $98.2 million. The loss is therefore $100 − 98.2 = $1.8 million.

[26] If ICC procedures are retained, they should be changed to correct this problem. A relatively simple correction would be to calculate the ICC valuation of each class and vintage of assets on the disaggregate worksheets now used to calculate the condition percent of the company's assets. Summing these disaggregate valuations to arrive at the total valuation avoids the undervaluation of new investments.

[27] The problems of such a switch are described from an accountant's point of view in Richard N. Hildahl's testimony in *Williams*.

[28] Specifically, we recommended that the FERC: (1) use each year's rate base depreciation to set revenue requirements (instead of book depreciation), (2) change the way assets are added to an existing rate base to remove the aggregation-based loss on new investments; (3) eliminate the 6 percent "going concern" write-up; and (4) eliminate the 50 percent write-down of land.

[31] The conclusions regarding the proper choice of an alternative rate-base methodology are based on the conceptual results of our companion paper.

VERIFICATION PAGE

I declare under penalty of perjury that the foregoing Declaration is true and correct.

/s/ John C. Klick

John C. Klick

Executed on: October 10, 2002

I declare under penalty of perjury that the foregoing Declaration is true and correct.

/s/ Brian F. Pitkin

Brian F. Pitkin

Executed on: October 10, 2002