UNITED STATES OF AMERICA

BEFORE THE

FEDERAL ENERGY REGULATORY COMMISSION

	)	
Inquiry Regarding the	)	
Commission's Policy for	)	**Docket No. PL19-4-000**
Determining Return on Equity	)	
	)	

INITIAL COMMENTS ON BEHALF OF THE LOUISIANA PUBLIC SERVICE COMMISSION ADDRESSING RETURN ON EQUITY METHODS AND APPLICATIONS

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The Louisiana Public Service Commission ("LPSC"), hereby submits the following comments, pursuant to the Federal Energy Regulatory Commission's ("FERC" or "Commission") March 21, 2019 Notice of Inquiry, 166 F.E.R.C. ¶ 61,207 (2019) ("Notice of Inquiry"), to express its views on the Commission's policies regarding the determination of return on equity ("ROE") and to address the ROE methodologies that the Commission espoused in its *Briefing Orders* in *Coakley*, 165 F.E.R.C. ¶ 61,030 (2018) ("*Coakley Briefing Order*") and *Ass'n of Businesses Advocating Tariff Equity v. Midcontinent Indep. Sys. Operator, Inc.*, 165 F.E.R.C. ¶ 61,118 (2018) ("*MISO Briefing Order*") (collectively, "*Briefing Orders*"). The LPSC has a substantial interest in this proceeding because it is the complainant and an intervenor in several dockets that will establish the just and reasonable return on equity for subsidiaries of Entergy Corp.

The LPSC submits its comments for two primary purposes. First, the LPSC submits comments that demonstrate that the "expected earnings" approach to determining the cost of equity for public utilities has no legitimate relationship to the investors' required return on equity and should not be used, or should only be used with a market-to-book adjustment. Those comments respond specifically to Issues E (Financial Model Choice), F (Mismatch between Market-Based ROE determinations and Book-Value Rate Base), and H (Model Mechanics and Implementation) of the Commission's Notice of Inquiry. *Notice of Inquiry*, ¶¶ 35, 36, 38. Second, the LPSC comments on the appropriate application of the Risk Premium method and Capital Asset Pricing Model ("CAPM") to determine the cost of equity. Those comments respond specifically to Issue H of the Commission's Notice of Inquiry. *Id.* ¶ 38.

The LPSC also supports the use of the Discounted Cash Flow ("DCF") methodology as outlined in *Opinion No. 531*, 147 F.E.R.C. ¶ 61,234 (2014), and in the Commission's *Briefing Orders*. *Notice of Inquiry*, ¶ 33 (Issue C). The LPSC further agrees with the Commission's use of proxy group screens and supports the Commission's decision to remove both low-end and high-end outliers in each applied ROE model as detailed in the *Briefing Orders*. *Id.* ¶ 34 (Issue D); *Coakley Briefing Order*, ¶¶ 50-54; *MISO Briefing Order*, ¶¶ 51-55.

The LPSC relies substantially on authoritative scholarly literature, including Roger A. Morin, *New Regulatory Finance* (2006), which the Commission cited repeatedly in *Opinion No. 531-B*, 150 F.E.R.C. ¶ 61,165 (2015). It also relies on data from the record in the *Martha Coakley v. Bangor Hydro-Elec. Co.* ("*Coakley*") proceedings to provide examples of the LPSC's proposals set forth herein. [*See* Docket Nos. EL11-66, EL13-33, EL14-86, and EL16-64].

SUMMARY OF THE ARGUMENT

1. ***Expected earnings method.*** The expected earnings on *book value* method outlined by the Commission in the *Briefing Orders* does not determine the investor's required rate of return and has no relation to the economic return on an investment. As the Commission determined in *Opinion No. 531*, the expected earnings approach has a "close relationship to the comparable earnings standard that originated in *Hope* . . . ." 147 F.E.R.C. ¶ 61,234, ¶ 147 (2014). But the earnings on book methodology has for decades been discredited as an accounting-based method that does not accurately determine the cost of capital. As Brigham, Shome and Vinson observed in 1985, the

comparable earnings approach "has now been thoroughly discredited . . . and it has been replaced by three market-oriented (as opposed to accounting-oriented) approaches: (i) the DCF method, (ii) the bond-yield-plus-risk-premium method, and (iii) the CAPM, which is a specific version of the generalized bond-yield-plus-risk-premium approach." Eugene F. Brigham et al., *The Risk Premium Approach to Measuring a Utility's Cost of Equity*, 14 Financial Management 33, 33 (1985).

The comparable earnings approach was grounded in the theory that the rate of return for utilities could be determined by examining the book returns of *unregulated* firms, which would have their profitability limited by the "free forces of competition." Roger A. Morin, *New Regulatory Finance* 381 (2006). Competition would limit profits, which would limit market-to-book ratios to the competitive level. The analysis was made impractical, however, because of differences in accounting between regulated and unregulated firms and the difficulty in measuring differences in risk between regulated and unregulated firms.

Using comparable earnings of utilities, such as the analysis accepted in *Opinion No. 531* and the *Briefing Orders*, destroys the essential premise of the comparable earnings approach. Utilities do not operate in competition. Utilities have monopoly power and will extract monopoly profits unless their prices are constrained by regulators. Thus, there is not even theoretical assurance that utility market prices reflect competitive norms.

Moreover, an analysis that proceeds from utility book earnings to the required utility rates of return is circular. Utility earnings as book value are the result of allowances by regulators. If regulators set the rate of return based on utility earnings on book value, the process replicates past results. Roger A. Morin, *New Regulatory Finance* 383 (2006). In the case of expected earnings, the circularity depends in part on analysts' predictions of what regulators will award, which allows *analysts* to establish utility returns on equity. An approach that depends on analysts' forecasts of what regulators will award removes regulatory standards and employs residual circularity in determining the required return because analysts' forecasts reflect, at least in part, past allowances.

The comparable earnings on book value approach, whether historical or forecasted, was discredited by scholars and abandoned several decades ago by most utility regulators. It was heavily criticized in the scholarly literature as unrelated to capital markets and not indicative of investors' required rates of return. As an accounting measure rather than an economic measure of the cost of equity, the method could not determine the reasonable return needed to attract capital for utility expansion. Scholars demonstrated that the accounting-based methodology overstated returns even compared to economic returns on capital invested in rate base, because accountants apply conservative measures in the determination of book value. Basil L. Copeland, Jr., *Alternative Cost-of-Capital Concepts in Regulation*, 54 Land Economics 348, 353, 355 (1978), Appendix A. Moreover, there is no practical means of adjusting for differences in accounting practices for different companies.

Scholarly articles demonstrate that earnings on book are not indicative of investor return requirements. Capital markets change – interest rates move up and down, risk factors change, and investor requirements adjust accordingly. But returns on book value have little variation even as investor return requirements change significantly.

Franklin M. Fisher & John J. McGowan, *On the Misuse of Accounting Rates of Return to Infer Monopoly Profits*, 73 American Economic Review 82 (1993), Appendix A. The Commission's own chart showing the results of expected earnings on book value and other methods over time confirms this conclusion. *Coakley Briefing Order*, 165 F.E.R.C. ¶ 61,030, ¶ 40 fig.2; *MISO Briefing Order*, 165 F.E.R.C. ¶ 61,118, ¶ 42 fig.2 (2018).

Accepted economic theory establishes that the investors' required rate of return is the expected return on the market price of the investment in stock, not the book value of the stock. If the market price and the book value of the stock differ, a reasonable investor cannot expect to earn the forecasted return on book value. If the stock price is $100 and the book value is $50, a return of $10 is a return of 20 percent of the book value. But only a foolhardy investor would conclude that the return on an investment in the stock is 20 percent. To the extent investors consider returns on book value at all, they do not consider it as a direct indication of returns on *their* investments.

The earnings-on-book value methodology cannot determine the cost of attracting capital and cannot be applied evenhandedly. If market prices exceed book value, it necessarily produces results in excess of the cost of capital and promotes supra-normal profits. If market prices are below book value, it produces returns that are inadequate to attract capital on reasonable terms. When market prices fall below book values, as they did in the 1970s and early 1980s, the use of this method would require any utility that sells stock to suffer dilution in the stock value, which would prevent or hinder expansion. The Commission would soon be required to abandon use of the method. If expected earnings can be used only when it pumps up utility earnings relative to the cost of capital, but not when it causes dilution, it is not a methodology that *balances* the interests of investors and consumers.

If the Commission continues to pursue the use of expected earnings on book value, it should require a market-to-book screen to select comparable companies or an adjustment to at least roughly relate the results to capital markets. Dr. Morin provides a market-to-book adjustment methodology in his book. Roger A. Morin, *New Regulatory Finance* 361 (2006). The adjustment would at least temper the tendency of this method to produce distorted results.

2. ***Risk premium.*** The risk premium method can be useful in determining the market cost of equity capital. But it is an inaccurate measure because risk premiums are difficult to quantify at any given time. An accurate measure of the risk premium would use the discounted cash flow ("DCF") methodology to determine the cost of equity and subtract the current risk-free cost of debt. But that would simply replicate the results of the DCF method.

Analysts use historic risk premiums, but that is likely to produce inaccurate results because risk premiums vary substantially over time. One measure would use risk premiums over a long period, on the theory that fluctuations even out over a long period, so that the risk premium will reflect a "norm." But that requires the use of *decades* of data; as Dr. Morin advises, using a short period would be "defective." Roger A. Morin, *New Regulatory Finance* 115 (2006).

A historic risk premium analysis should use actual realized returns on market equity and debt over a long period. This approach ensures that market data determines the risk premiums. Using returns allowed by regulators to determine the risk premium is circular and inaccurate.

In *Opinion No. 531*, the Commission accepted a methodology that would almost perfectly disprove the validity of the risk premium theory. The .93 percentage point offset for every percentage point change in the cost of debt means that the required return on equity is almost entirely unrelated to the cost of debt. The results using that method prove that there is no statistically-significant relationship between changes in the cost of debt and changes in investors' return-on-equity requirements. It is difficult to understand how the Commission could accept a specific application of a methodology that conflicts with the theoretical foundation of the same methodology. Moreover, the result conflicts with empirical research, which has found an inverse relationship of only about one-half.

Also, given the almost perfectly inverted relationship between risk premiums and changes in the cost of debt, the *Opinion No. 531* methodology almost perfectly mirrors the past. Dr. William Avera, the expert witness for the New England Transmission Owners ("NETOs") in *Coakley*, used returns allowed from 2004-12 in mostly non-litigated FERC cases, and almost perfectly mirrored those results despite a significant reduction in interest rates. The mirror image of the Commission's past actions was remarkably faithful to the originals. But given the significant changes in capital markets that occurred over that period, the image could not have accurately depicted investor return requirements.

The risk premium methodology used by the Commission in *Opinion No. 531* was riddled with errors. It used a short period – six years – to measure risk premiums, which Dr. Morin deems "defective." *Id.* at 115. It used FERC-allowed returns on equity for that period, which means that the Commission relied on its own past results to reach a decision – complete circularity. *Opinion No. 531-B* relied on *New Regulatory Finance* to dismiss the circularity issue on the basis that allowed returns *presumably* reflect market data, but Dr. Morin only stated that the problem is "mitigated." 150 F.E.R.C. ¶ 61,165, ¶ 98 (2015); Roger A Morin, *New Regulatory Finance* 125 (2006). Moreover, the vast majority of the cases relied on in the analysis provide no empirical evidence that the results were based on then-current data. Further, many of the cases involved settlements of multiple issues.

Reliance on Dr. Morin's presumption concerning the market basis for regulatory decisions is also suspect because Dr. Morin offers the opposite advice with respect to the comparable earnings approach. With respect to that method, Dr. Morin states that "[t]he historical book return on equity for regulated firms is not determined by competitive forces but instead reflects the past actions of regulatory commissions." Roger A. Morin, *New Regulatory Finance* 383 (2006). There, using regulator-allowed returns would be "circular." *Id.* Therefore, absent some more material connection to market data than a citation to one of Dr. Morin's conflicting pronouncements, there is no basis to use allowed returns as a proxy for market results.

If the Commission adopts the risk premium method, it should rely on actual realized returns on equity rather than allowed returns. It should use a period of at least several decades to measure the risk premium so as to at least in theory reflect a norm. To the extent an inverse relationship exists between changes in interest rates and risk premiums, the degree of that inverse relationship at least will not be distorted by unusual circumstances.

3. ***CAPM.*** The CAPM method is a specific application of the risk premium approach, in which the risk premiums for unregulated firms is determined and converted to the utility group using beta, a measure of the price volatility of stocks compared to the market as a whole. As the Commission stated in *Opinion No. 531*, the CAPM methodology is another tool that is useful in determining how changes in the interest rate environment have affected required returns on equity. 147 F.E.R.C. ¶ 61,234, ¶ 147 (2014). But in the CAPM methodology, if long-term bonds are used for the risk-free rate, long term equity requirements must be used to determine the risk premium. The stock index used to derive beta should be the same as the index used to determine the required return on equity. A size adjustment should not be applied unless there is some empirical data showing that the size adjustment is relevant for utilities. And the size adjustment should not be double-counted by: 1) applying a higher required DCF return for larger firms to utilities, and 2) then increasing the CAPM required return because utilities are smaller than the larger firms. *See Opinion No. 531-B*, 150 F.E.R.C. ¶ 61,165, ¶¶ 113, 117.

Dr. Morin makes clear in his text that the reason to use long-term bonds as the basis for the risk-free rate is that stocks are a long-term investment. As he states, the "expected common stock return is based on long-term cash flows," making it an appropriate match for long-term bond yields. Roger A. Morin, *New Regulatory Finance* 151 (2006). But in *Opinion No. 531-B*, the Commission used a medium-term growth rate for unregulated firms rather than a long-term rate. 150 F.E.R.C. ¶ 61,165, ¶ 113; *see also*

Coakley Briefing Order, ¶ 56 (citing *Opinion No. 531*, ¶ 147); *MISO Briefing Order*, ¶ 57 (citing *Opinion No. 551*, ¶¶ 140, 165). This mismatch boosted the required rate of return beyond the result produced through use of the long-term DCF method.

New Regulatory Finance instructs that the same stock index should be used to determine the market risk premium as is used to derive the beta estimate. Roger A. Morin, *New Regulatory Finance*, 159-60 (2006). But the Commission accepted an analysis that applied a beta derived from the New York Stock Exchange ("NYSE") to dividend-paying companies from the S&P 500. That beta was not appropriate to adjust the risk for those companies.

The Commission in *Opinion No. 531-B* found that the stock index used to determine unregulated returns on equity contained firms with larger capitalization than utilities. It said that these firms might grow more than the growth of overall Gross Domestic Product ("GDP") in the long term. *Id.*, ¶ 113. But there is no data to support that proposition. Moreover, if large cap companies will grow at a rate higher than GDP, utilities and other small cap companies would have to grow at *less* that GDP. Raising the rate of return for utilities because larger companies are expected to grow faster than utilities is backwards.

Opinion No. 531 also increased the derived CAPM return on equity twice on the basis of size. First, the Commission derived a higher return on equity for unregulated firms by using medium-term growth rather than long-term growth in the DCF analysis. Then, after applying beta, *Opinion No. 531* increased the return on equity again on the theory that utilities earn more than larger firms. There is no data-based support for either of these theories. Further, double-counting size for reasons that are inconsistent is irrational.

4. ***Reliability of methodologies.*** In *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), the United States Supreme Court ruled that expert methodologies that do not apply to the facts of the case and employ unreliable methods are not admissible evidence. That ruling has been adopted in Federal Rule of Evidence 702, which requires that expert testimony be based on a) sufficient facts and data, b) reliable methods, and c) a reliable application of the methods to the facts. A method that picks and chooses parts of methods from the literature, to achieve a litigation result, should not be accepted.

The expert's methodologies accepted in *Opinion Nos. 531* and *551* do not meet the minimum standard adopted by the Supreme Court. They deviated from the advice in the primary scholarly authority relied on by the Commission and employed adjustments without any showing of relevance to the circumstances of regulated utilities. The Commission should instead use methodologies with demonstrable relevance and accuracy.

I. THE SUPREME COURT HAS ESTABLISHED THAT SCIENTIFIC OR TECHNICAL METHODOLOGIES USED TO DERIVE RESULTS IN LITIGATION MUST BE RELIABLE, RELIABLY APPLIED, AND FIT THE FACTS.

Although the application of the Federal Rules of Evidence in federal courts is not binding in Commission proceedings, it has particular relevance in a case involving the application of new methods to determine the return on equity to be allowed for utilities. In *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), the Supreme Court determined that methodologies admitted into evidence in court must be demonstrably reliable and relevant to the facts of the case. *Id.* at 592-93. A methodology may have the actual reliability for some purposes, but it should not be used unless it fits for determining the issue before the tribunal. *Id.* at 591 ("'Fit' is not always obvious, and scientific validity for one purpose is not necessarily scientific validity for other, unrelated purposes.").

The Court suggested four potential criteria for assessing reliability of a method: a) whether the method can be tested; b) whether the method has been subjected to peer review and publication; c) whether there is a known or potential rate of error; and d) whether the method has general acceptance in the field. *Id.* at 593-94. With respect to testability, the Court referred to the need for empirical support for applying the method. *Id.* at 593. That requirement would also apply to assessing rate of error.

On remand, the United States Court of Appeals for the Ninth Circuit ruled that the expert opinions in the case were inadmissible. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 43 F.3d 1311 (9th Cir. 1995). The primary factor cited by the court was that the expert methods were not developed through independent research, but for litigation. *Id.* at 1317. Additionally, the court determined that the expert methodologies had not been published or subjected to peer review. *Id.* at 1318. Absent publication of the particular method, the expert must "point to some objective source – a learned treatise, the policy statement of a professional association, a published article in a reputable scientific journal or the like – to show that they have followed the scientific method, as it is practiced by (at least) a recognized minority of scientists in their field." *Id.* at 1319.

Following *Daubert*, the Federal Rules of Evidence were amended to incorporate the court's standards for experts. FRE 702 now states:

> A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:
>
> **(a)** the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
>
> **(b)** the testimony is based on sufficient facts or data;
>
> **(c)** the testimony is the product of reliable principles and methods; and
>
> **(d)** the expert has reliably applied the principles and methods to the facts of the case.

The Advisory Committee noted that a factfinder, in evaluating expert testimony, must assess whether accepted principles "have been properly applied to the facts of the case." FRE 702 Adv. Comm. Notes (citing *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 745 (3d Cir. 1994)). The Advisory Committee stated that "'any step that renders the analysis unreliable . . . renders the expert's testimony inadmissible. *This is true whether the step completely changes a reliable methodology or merely misapplies that methodology.*'" *Id.* (quoting *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 745 (3d Cir. 1994)) (emphasis in original).

In enacting a new ROE methodology, the Commission should conform to the standards announced by the Supreme Court. It should determine whether each proposed methodology "fits" the purpose of determining an allowed return on equity for a regulated company. Further, it should decide whether each method is reliable and how *to reliably* *apply* it to the facts. The Commission's determinations affect the public interest at least as much as court decisions. The Commission should not accept junk economics, created solely for litigation, as the basis to establish utility returns.

II. THE EXPECTED EARNINGS ON BOOK VALUE METHODOLOGY DOES NOT "FIT" TO DETERMINE INVESTOR RETURN REQUIREMENTS AND IS AN UNRELIABLE INDICATOR OF ECONOMIC RETURNS.

In the *Briefing Orders*, the Commission proposed to use the "expected earnings" on book value approach as one of four methods for determining the cost of equity. *Coakley Briefing Order*, 165 F.E.R.C. ¶ 61,030, Appendix; *MISO Briefing Order*, 165 F.E.R.C. ¶ 61,118, Appendix. Those Orders and *Opinion No. 531-B* state that investors rely on the expected earnings on book equity to help determine the opportunity cost of investing in equity capital. *Id.*; *Opinion No. 531-B*, 150 F.E.R.C. ¶ 61,165, ¶¶ 128, 132. That determination does not mean, however, that investors believe the expected earnings on book is the earnings they will achieve on equity investments, because investors buy stock at market prices. A rational investor would not rely on this methodology to determine the opportunity cost of capital without adjusting for the difference between book value and market prices.

In discussing the expected earnings method, *Opinion No. 531-B* and the *Briefing Orders* do not appear to abandon the goal of a return-on-equity analysis – to determine the investors' required return on their investments. But the expected earnings approach is inapplicable to that purpose, because investors do not invest in stocks at book value; they invest at market prices. The comparable earnings on book value approach was commonly used prior to the 1970s, but that approach was later discredited by scholars and abandoned by most regulatory agencies. It is not based on market values, but seeks to replicate accounting returns of comparable companies. The method accepted in *Opinion No. 531* has no built-in mechanism to prevent monopoly profits on the one hand, or confiscation on the other.

Scholars have shown that comparable earnings on book value is a faulty method to determine economic returns. It is an accounting-based method and is inflated because accounting principles require conservatism in capitalizing assets. As applied in *Opinion No. 531*, the expected earnings on book value approach also is circular. Relying on the expected book earnings of utilities to determine an equity return for utilities replicates prior results and analysts' predictions of those results.

The expected earnings approach is likely to produce supra-normal profits or dilution of utility investments because it is not based on the market. If market-to-book ratios are substantially above 1.0, indicating monopoly profits, this method will tend to perpetuate them. If the ratio is substantially below 1.0, this method will promote dilution of share values and discourage utilities from raising capital. The Commission should not promote monopoly profits and could not for long tolerate stock dilution.

If the Commission decides to continue using this approach, it should at least require market-to-book adjustments to make the method relevant to investors' actual earnings. *New Regulatory Finance* provides a methodology that could be used, or the Commission could permit reasonable alternatives in return-on-equity cases. Otherwise, the expected book earnings has no place in utility regulation.

A. The Use of Book Earnings Does Not "Fit" the Objective of Determining the Investors' Required Return on Equity.

In proposing the expected earnings on book value methodology, the Commission does not appear to have abandoned its objective – to determine the investors' required return on equity. The Commission stated in the *Briefing Orders* that it believed returns on book equity help investors determine the opportunity cost of alternative investments. *Coakley Briefing Order*, 165 F.E.R.C. ¶ 61,030, Appendix; *MISO Briefing Order*, 165 F.E.R.C. ¶ 61,118, Appendix. But investors are well aware that the return on their investments in stocks will not mimic the book return. Absent market-to-book ratios of 1.0, expected earnings on book value do not determine the investors' required return on equity. In the language of *Daubert*, this methodology is not a "fit" with the objective.

Investors cannot purchase stocks at book value; the price is determined in the market. The investor calculates her rate of return based on the market price she pays for the stock. Expected book earnings are relevant to the investor only to the extent that they can be converted to earnings on the market price. Because differences between book value and market prices invariably exist, the expected earnings on book value *cannot* determine the investors' required return on equity.

Dr. William Avera, who sponsored the expected earnings analysis relied on in *Opinion No. 531*, conceded during the hearing in Docket No. ER13-1508 that investors do not expect to receive earnings on book value. His testimony refutes the conclusion that book earnings are important to investors, because he said "[a]s to investors, book value doesn't have meaning." [Docket No. ER13-1508; Tr. 275]. Further, he testified: Investors "cannot get to the book earnings. . . . What matters to me is the check I get in the mail and the price I'm able to sell my stock." [*Id.*, Tr. 276].

Also, Dr. Roger Morin, whose explanation of the expected earnings on book value approach was relied on by the Commission in *Opinion Nos. 531* and *551*, does not use this approach when presenting testimony concerning investor return requirements. *Opinion No. 531*, 147 F.E.R.C. ¶ 61,234, ¶ 147 n.294 (citing Roger A. Morin, *New Regulatory Finance* 381 (2006)); *Opinion No. 551*, 156 F.E.R.C. ¶ 61,234, ¶¶ 231-32 nn. 478, 480, 481 (2016) (citing Roger A. Morin, *New Regulatory Finance* 305-06, 382-83 (2006)). Dr. Morin explains the expected earnings approach in his treatise. But he does not use it himself. In *Oklahoma Gas and Elec. Co.*, Cause No. PUD201700496 (Okla. Corp. Comm'n), Dr. Morin stated:

> **Q. Do you agree with Mr. Parcell's Comparable Earnings Analysis?**
>
> A. *Although I myself do not rely on this accounting-based method*, I agree with Mr. Parcell's Comparable Earnings results.

[*Id.*, Reb. Test. of Roger A. Morin at 33 (May 29, 2018) (emphasis added)].

Dr. Morin's treatise explains the expected earnings approach. He emphasizes that the methodology requires an analysis of the expected book earnings of *unregulated* firms, an approach quite different than that employed in *Opinion No. 531*. Roger A. Morin, *New Regulatory Finance* 381 (2006). In *Opinion No. 551* the Commission distinguished that advise as applying to historic rather than expected comparable earnings, but the distinction does not eliminate the fact that regulated utilities' expected returns are the product of regulation, not competition. *See* 156 F.E.R.C. ¶ 61,234, ¶ 231. As he says, "[t]he rationale of the method is that regulation is a duplicate for competition." *Id.* Additionally, Dr. Morin makes clear that the method is *inconsistent* with accepted financial theory. He states:

> This particular interpretation of returns stands in contrast to financial theory, which interprets returns as forward-looking, market-determined returns. Accounting rates of return are not opportunity costs in the economic sense, but reflect the average returns earned on past investments, and hence reflect past regulatory actions. The denominator of accounting return, book equity, is a historical cost-based concept, which is insensitive to changes in investor return requirements. Only stock market price is sensitive to a change in investor requirements. Investors can only purchase new shares of common stock at current market prices and not at book value.
>
> More simply, the Comparable Earnings standard ignores capital markets. If interest rates go up 2% for example, investor requirements and the cost of equity should increase commensurately, but if regulation is based on accounting returns, no immediate change in equity cost results. Investors capitalize expected future cash flows and not current earnings, and what was earned on book value is not directly related to current market rates.

Id. at 393.

The Bonbright *et al.* treatise on public utility rate principles also makes clear that the comparable earnings approach does not determine investors' required returns on equity. It states:

> If a nonregulated stock is selling for two times its book value, and earning 20 percent per year on book equity, it would be erroneous to suggest that a new or prospective investor in this stock would receive a return on his or her investment of 20 percent. The investor's "book" value is the purchase price, and that return, given the assumptions would be 10 percent. Thus, comparing book returns of companies with quite different market to book ratios is highly questionable at best. This was

> a particularly acute problem when utilities were selling well below book value and nonregulated companies, on average, were selling well above book value.

James C. Bonbright et al., *Principles of Public Utility Rates* 330 (2d ed. 1988).

Other authorities in the field long ago recognized that an analysis of earnings on book value has little relevance in determining what investors require on market investments. A scholarly article by Dr. Brigham *et al.* comments that using returns on book equity "has now been thoroughly discredited . . . and it has been replaced by three market-oriented (as opposed to accounting-oriented) approaches," referring to the DCF, risk premium, and CAPM. Eugene F. Brigham et al., *The Risk Premium Approach to Measuring a Utility's Cost of Equity*, 14 Financial Management 33, 34 (1985), Appendix A. Another publication asserts:

> Investments in equity shares are made by the purchase of shares at market prices. Therefore, the fairness of the rate of return to the investor must be judged from the investor's point of view in the market place and not on the basis of book value.

Alexander A. Robichek, *Regulation and Modern Finance Theory*, 33 Journal of Finance 693, 701 (1978), Appendix A. Thus, the expected book earnings approach does not "fit" the objective of determining a fair return on equity for utilities.

In proposing a new rule that abandoned the use of book returns to determine carriers' allowed rates of return, the Federal Maritime Commission explained the basis for its action. It stated:

> The accounting rate of return for a company is not equivalent to the firm's true economic rate of return because accounting and economic concepts of income and value are substantially different. Accounting numbers are derived on the basis of

> generally accepted accounting principles while economics specifies the use of opportunity costs. . . Consequently, an accounting-based rate of return methodology such as the Commission's CET does not adequately measure a regulated carrier's true cost of capital. In Docket No. 91-51, the State of Hawaii noted the problems associated with using accounting data and criticized the Commission's CET for being accounting-based and not market-based.
>
> Several empirical tests have demonstrated that there is a large discrepancy between accounting rate of return and true economic return. These studies also demonstrate that biases inherent in book returns are systematic, and that these biases do not cancel out by averaging across companies.

Financial Reporting Requirements and Rate of Return Methodology in the Domestic Offshore Trades, Proposed Rule, 59 Fed. Reg. 16,592, 16,594 (1994). The rule, which was ultimately adopted, used the DCF method to determine the required return on equity. It permitted the use of the risk premium method as well. *Financial Reporting Requirements and Rate of Return Methodology in the Domestic Offshore Trades*, Final Rule, 60 Fed. Reg. 46,047, 46,062 (1995).

The data in the *Coakley* record establishes that the expected earnings on book value for the proxy group used by Dr. Avera, the witness for the NETOs, are markedly different than the expected earnings on market value. Dr. Avera relied on Value Line forecasts of book earnings for a period three to five years in the future. [Ex. NET-300 at 72-73]. But Value Line also publishes estimated price-to-earnings ratios for the same period, as shown in Dr. Avera's exhibits. [*Id.* (workpapers submitted with November 20, 2012 testimony)]. The inverse of the price to earnings ratios is the expected earnings on market prices. The data shows that expected earnings on market are vastly different from the expected book earnings. The results are set forth in Appendix B. On average, the expected book earnings were 264 basis points higher than the expected earnings on market prices.

Under *Daubert*, to have his analysis considered, an expert would have to explain how a proposed methodology is relevant to the issue before the factfinder. As the Court said: "Fit is not always obvious, and scientific validity for one purpose is not necessarily scientific validity for other . . . purposes." 509 U.S. 579, 591 (1993). Thus, there must be "a valid scientific connection to the pertinent inquiry as a precondition to admissibility." *Id.* at 592. At least as much is required of a method the Commission would use to set fair rates of return for utilities.

At the very least, the Commission would need to link the expected earnings approach to the pertinent question – what is the investors' required rate of return? The assertion that investors consider book earnings is not enough without an explanation of how they consider it – certainly they do not expect to receive book earnings. With a sufficient explanation – perhaps investors adjust the information to market values – an altered methodology perhaps could be made relevant. But as accepted in *Opinion No. 531*, the method has no relevance to the investors' required rate of return.

B. The Use of Earnings on Book Value Overstates Returns Compared to Economic Returns and Reflects Inconsistent Calculations.

In addition to the inconsistency of earnings-on-book-value methodologies with financial theory and the regulatory objective, these methods overstate returns and reflect the results of inconsistent accounting. Numerous studies suggest that accounting-based methodologies overstate returns compared to economic returns on invested capital. Moreover, inconsistencies in accounting practices make the book results non-comparable. These findings demonstrate that the Commission should not use expected book earnings to determine the return on equity.

A number of studies demonstrate that accounting rates of return are unreliable as a measure of economic returns. In *Alternative Cost of Capital Concepts in Regulation*, 54 Land Economics 348 (1978), Appendix A, Basil Copeland reviewed the literature on accounting rates of return and determined that they are biased upward. As he states: "[i]n the light of these comments, it seems clear that accounting rates of return on market aggregates are generally unreliable and are most likely biased upward." *Id.* at 353. Further, Copeland concluded that book returns are an inappropriate indicator of a return that would be consistent with the goals of regulation. He states:

> This, in the final analysis, is the greatest failing of the comparable earnings concept. The return earned on a broad market aggregate is likely to be biased upward, for all the reasons discussed earlier, as an indication of the average return on investment for competitive unregulated industries. Presuming these problems can be resolved, there remains the fact that the comparable earnings standard is not a measure of what *can* be earned on new investment, but of what *has been* earned on prior investment. The comparable earnings concept thus violates a marginal condition necessary to achieve for regulation the allocative efficiency that would exist under conditions of competition and fails to promote a proper allocation of capital between the regulated and unregulated sectors of the economy.

Id. at 356.

Another paper published by Fisher and McGowan concluded that accounting returns are not a measure of economic returns. Franklin M. Fisher & John J. McGowan, *On the Misuse of Accounting Rates of Return to Infer Monopoly Profits*, 73 American Economic Review 82 (1983), Appendix A. The authors state that "[t]he economic rate of return on an investment is, of course, that discount rate that equates the present value of its expected net revenue stream to its initial outlay." *Id.* at 82. They show that "the accounting rate of return – after tax as well as before tax – is a misleading measure of the economic rate of return . . . ." *Id.* at 89. Further, using accounting returns to measure whether a firm is earning monopoly profits is a "baseless procedure." *Id.*

Similarly, Ezra Solomon showed that book returns and economic returns cannot be used interchangeably. Ezra Solomon, *Alternative Rate of Return Concepts and their Implications for Utility Regulation*, 1 Bell Journal of Economics & Management Science 65 (1970), Appendix A. As he stated: "*Unfortunately, two altogether distinct units are employed for measuring rate of return:* (1) *book rate units and* (2) *discounted cash flow units. Rarely will the two produce the same result, and the use of one measure as a surrogate for the other may prove highly misleading.*" *Id.* at 65. In particular, Solomon shows that differences in accounting practices, such as capitalization versus expensing of outlays and different depreciation practices, produce inconsistent book returns for firms with the same economic returns on capital outlays. *Id.* at 70-75.

Some studies in the 1960s suggested that through heavy advertising, a firm can increase its rate of profitability. But in later studies, an analysis of accounting practices showed that the increase in book earnings resulted from the expensing rather than capitalization of advertising outlays. *E.g.*, Harry Bloch, *Advertising and Profitability: A Reappraisal*, 82 Journal of Political Economy 267 (1974), Appendix A. Expensing capital outlays rather than capitalizing them causes the return to be higher because the capital base is smaller. As Bloch states, "[u]nderstatement of reported net worth causes the measured profit rate to be above the true profit rate." *Id.* at 268; *see also* Robert Ayanian, *Advertising and Rate of Return*, 18 Journal of Law & Economics 479 (1975), Appendix A.

Using returns for an actual utility, Robichek showed that book returns remain stable even as returns to investors vary widely. Alexander A. Robichek, *Regulation and Modern Finance Theory*, 33 Journal of Finance 693, 701-02 (1978), Appendix A. Based on data for a 15-year period, he says: "We see that the annual rates of return based on book value have fluctuated very little, while the annual rates of return to the investor in the market have fluctuated quite wildly." *Id.* Robichek concludes that returns on book values are not indicative of true market returns.

The fact that book returns for utilities remain stable even as investor return requirements change is shown in the *Briefing Orders*. The *Coakley Briefing Order*, for example, provides a chart that shows the return requirements derived from the four proposed methodologies. For three of the methods, the return requirements vary from year to year. But there is little if any variance for the earnings-on-book methodology. *Coakley Briefing Order*, 165 F.E.R.C. ¶ 61,030, ¶ 40 fig.2. Consistent with the economic literature, the book earnings are also consistently the highest.

Using expected rather than historic book earnings does not eliminate the problems associated with this accounting-based method. In predicting expected book earnings, analysts would have to start with current book values and current earnings and adjust them for expectations. The current book values reflect all the problems associated with the accounting basis for calculating earnings. It simply adds the complication of relying entirely on analysts' forecasts.

As Brigham *et al.* concluded, the comparable earnings on book method was "thoroughly discredited" decades ago. Eugene F. Brigham et al., *The Risk Premium Approach to Measuring a Utility's Cost of Equity*, 14 Financial Management 33, 33 (1985), Appendix A. It does not measure the investors' required rate of return.

C. The Use of Expected Book Earnings of Utilities to Set the Return Requirement for Utilities Departs from Comparable Earnings Theory and Reflects Circularity in Analysis.

The analyses accepted in *Opinion Nos. 531* and *551* used expected book earnings of utilities as a measure of the cost of capital for utilities. *Opinion No. 531-B*, 150 F.E.R.C. ¶ 61,165, ¶ 126; *Opinion No. 551*, 156 F.E.R.C. ¶ 61,234, ¶ 202. This approach departs from comparable earnings theory, which posits that using the book returns for *unregulated* firms will permit replicating competitive results. Moreover, it introduces circularity, in which regulators' allowances or their expected allowances determine what the regulator will allow. This approach should not be used in a cost of capital analysis.

New Regulatory Finance provides the rationale for the comparable earnings approach, which requires that unregulated firms be employed in the analysis. Dr. Morin states:

> The rationale of the method is that regulation is a duplicate for competition. The profitability of unregulated firms is set by the free forces of competition. In the long run, the free entry

> of competitors would limit the profits earned by these unregulated companies, and, conversely, unprofitable ventures and product lines would be abandoned by the unregulated companies.

Roger A. Morin, *New Regulatory Finance* 381 (2006). Copeland reports the same rationale: "The proponents of the comparable earnings approach argue that the goal of regulation is to approximate in the utility industry the rate-of-return conditions effected by competition in competitive unregulated industries . . . ." Basil L. Copeland, Jr., *Alternative Cost of Capital Concepts in Regulation*, 54 Land Economics 348, 355 (1978), Appendix A.

Using the expected book returns of utilities rather than unregulated firms departs from the theory on which the book return concept was based. Utilities do not operate in competition. Regulated utilities do not go out of business and there is very little, if any, new entry. Thus, the discipline provided by competitive forces is not implicit in the book returns used in a utility-based approach.

New Regulatory Finance advises against permitting any utilities to enter the comparable group used to derive book returns on equity. Dr. Morin states: "In defining a population of comparable-risk companies, care must be taken not to include other utilities in the sample, since the rate of return on other utilities depends on the allowed rate of return. The historical book return on equity for regulated firms is not determined by competitive forces but instead reflects the past actions of regulatory commissions." Roger A. Morin, *New Regulatory Finance* 383 (2006). The same is true of forecasted utility book earnings – they do not reflect the effects of competitive forces.

Using expected utility book earnings is also circular, in which regulators' determinations dictate regulators' determinations. As Dr. Morin states, "[i]t would be circular to set a fair return based on past actions of other regulators, much like observing a series of duplicate images in multiple mirrors." *Id.* The use of expected rather than historical utility earnings does not solve this problem, as suggested in *Opinion No. 551*, 156 F.E.R.C. ¶ 61,234, ¶ 231. Analysts' predictions are based at least in part on recent allowances. Further, the method shifts the circularity to analysts' predictions: analysts' predictions beget return allowances, which beget analysts' predictions. That form of circularity is even worse than mirroring regulators' allowances, because analysts have no interest in regulatory objectives.

If the accounting returns on unregulated firms are used instead of utility returns, the approach at least conforms to the theoretical basis for the comparable earnings approach. But it is fraught with problems of comparability, both for risk differences and accounting differences. The expected book earnings approach should not be used to determine *investor* expectations.

D. The Expected Earnings Approach Would Produce Supra-Normal Profits When Market-to-Book Ratios Exceed One and Subnormal Earnings When These Ratios Are Less Than One and Cannot Be Employed in Even-Handed Fashion.

In theory, the purpose of establishing a return on equity is to allow the utility to earn its actual cost of capital. But that cost of capital is determined by market forces. The market price reflects investors' expectations of what they will earn on investments in stock. If a company earns its cost of capital, the market-to-book ratio should be near 1.0.

If the ratio is substantially higher, the company is likely earning monopolistic returns; if it is lower, any attempt to attract capital will dilute the stock value. Setting the return on equity based on book earnings maintains these differences.

New Regulatory Finance sets forth these economic principles. As Dr. Morin states, "if regulators set the allowed rate of return equal to the cost of capital, the utility's earnings will be just sufficient to cover the claims of the bondholders and shareholders. No wealth transfer between ratepayers and shareholders will occur." Roger A. Morin, *New Regulatory Finance* 359 (2006). He also states that if regulators allow the *actual* cost of equity, "share price is driven toward book value." *Id.* Similarly, Bonbright asserts that in theory, "[a] rigorous and literal application of a cost-of-capital measure of a fair rate of return . . . would indicate that a commission should attempt to regulate rates so as to maintain the market value of a utility's stock on a par with its book value (or rate-base value) plus some allowance for underpricing." James C. Bonbright et al., *Principles of Public Utility Rates* 334 (2d ed. 1988). Both suggest, however, that regulating directly on market-to-book ratios would be impractical.

If market-to-book ratios exceed one, firms in a group "may be suspected of earning monopolistic returns in excess of the cost of capital, and the group's average book return is not an adequate measure of the cost of capital." Roger A. Morin, *New Regulatory Finance* 387 (2006). In this case, since the expected returns on book equity have produced market-to-book ratios well in excess of 1.0, the book return necessarily exceeds the investors' cost of equity capital.

If a utility has a market price of $100 and expected annual earnings of $10, the investors' expected return on a purchase of the stock is 10 percent. But if the book value is $80, the expected return on book value is 12.5 percent. Allowing a return of 12.5 percent would perpetuate earnings exceeding the investors' cost of capital and transfer wealth from ratepayers to investors.

Conversely, if the utility's stock price in the example was $60, the book value was $80, and the annual expected earnings were $10, the investors' return requirement would be 16.7 percent. But the regulatory allowance of 12.5 percent would understate the cost of equity. Allowing a 12.5 percent return would perpetuate the subnormal market-to-book ratio and discourage new investment. Utility managers would be reluctant to issue new stock because of the damage the action would inflict on existing shareholders. As *New Regulatory Finance* states, "[i]f a company sells stock for less than book value, the book value of the previously outstanding shares will be diluted, and so will the earnings per share, dividends per share, and earnings growth." *Id.* at 363.

In Docket No. ER13-1508, Dr. Avera conceded that utilities bitterly opposed using comparable earnings on book value when market prices were lower than book value. As he said, utilities "were facing a need to raise capital at a time their market to books were suppressed"; he agreed that they argued they would not be able to raise capital in the market if they were only allowed a return comparable to earnings on book value. [Docket No. ER13-1508, Tr. 279]. As Bonbright states, allowing returns on equity based on comparable book earnings was "a particularly acute problem when utilities were selling well below book value and non regulated companies, on average, were selling well above book value."

James C. Bonbright et al., *Principles of Public Utility Rates* 330 (2d ed. 1988). If such a situation were to reoccur, the Commission could not use "expected earnings" for long.

If the Commission uses expected earnings when market prices exceed book values, it will provide supra-normal returns to utilities. Conversely, if market prices are below book values, the method would discourage investment and inhibit the attraction of capital. The Commission would soon have to abandon a methodology that dilutes the value of utility stocks, as regulators did in the 1980s. The Commission should not employ a method that can be used only when it produces excessive profits, because that would not "balance" the interests of consumers and investors. *See Federal Power Comm'n v. Hope Natural Gas Co.*, 320 U.S. 591, 603 (1944).

If the Commission decides to forge ahead with this accounting method, it should at least adjust the analysis for market-to-book ratios. Morin suggests an adjustment to convert book earnings to the actual cost of equity. Roger A. Morin, *New Regulatory Finance* 364-65 (2006). Alternatively, he suggests screening the group of unregulated firms based on market-to-book ratios. *Id.* at 387. Book earnings alone cannot rationally be used to set a return on equity investments.

III. THE RISK PREMIUM METHOD MUST BE PROPERLY APPLIED TO YIELD REASONABLE RESULTS CONCERNING THE COST OF EQUITY.

The risk premium method is a generally-accepted approach for determining the cost of equity, but it must be applied correctly. Risk premiums are volatile, and if measured based on historical data, must reflect a period long enough to smooth out variations in annual data. The use of returns allowed by FERC rather than market data introduces circularity into an analysis that is intended to discover market risk premiums. Indeed, the circularity in the approach accepted in *Opinion Nos. 531* and *551* produced results that, if valid, would largely disprove the theory underlying the risk premium method. This result is partially explained because the data was bad, reflecting settlements and cases that renewed returns allowed in previous periods. The periods used by Dr. Avera in his *Coakley* and *MISO* risk premium analyses, six years in *Coakley* and nine years in *MISO*, were also far too short to determine a normal risk premium. If the Commission chooses to use this method, it should adopt an approach that produces rational results.

The theory underlying the risk premium method posits that investor return requirements change as the cost of debt changes, given investors' ability to choose either alternative in investing capital. The "risk premium" reflects the cost of accepting the higher risk in a stock, as stockholders stand last in line to receive cash flow returns on stocks. As Dr. Morin explains: "The Risk Premium methodology is based on the simple idea that since investors in stocks take greater risk than investors in bonds, the former expect to earn a return on a stock investment that reflects a 'premium' over and above the return they expect to earn on a bond investment." Roger A. Morin, *New Regulatory Finance* 108 (2006). If the investors' risk premium is known, the cost of equity can be determined by adding it to the current cost of debt.

The risk premium methodology has considerable support in the financial literature, although Brigham *et al.* demonstrated that risk premiums vary widely from time to time. Eugene F. Brigham et al., *The Risk Premium Approach to Measuring a Utility's Cost of Equity*, 14 Financial Management 33, 42-43 (1985), Appendix A. Dr. Morin proposes determining risk premiums over long periods – several decades at least – in order to "smooth out short-term aberrations." Roger A. Morin, *New Regulatory Finance* 114 (2006). That approach presumably determines a long-term risk premium "norm."

Since risk premium theory is based on the risk-return trade-off in financial markets, financial market data should be used to determine risk premiums. The use of returns on equity allowed by FERC over a six-year period, which was accepted in *Opinion No. 531*, unnecessarily introduces circularity into the analysis. This approach allows a return on equity based on what was allowed in the past. Dr. Morin acknowledges the problem, but says it is "mitigated" because the allowed returns are "presumably" based on "market-based methodologies" reviewed in "rate hearings." *Id.* at 125.

Unfortunately, the analyses accepted in *Opinion Nos. 531* and *551* were based almost entirely on allowances that were not determined based on "market-based methodologies" reviewed in "rate hearings." They largely reflected the results of settlements and were not determined in rate hearings. *Opinion No. 531-B*, 150 F.E.R.C. ¶ 61,165, ¶ 98; *Opinion No. 551*, 156 F.E.R.C. ¶ 61,234, ¶ 198. The Commission dismissed this concern in *Opinion No. 531-B* by assuming that "settling parties rely upon the same market-based methodologies in determining the rates they are willing to accept," but that is an assumption and is not based on any objective evidence. *Opinion No. 531-B*, 150 F.E.R.C. ¶ 61,165, ¶ 98. Parties settle for many reasons – trade-offs on other issues, cost of litigation, competing objectives among intervenors, and other factors besides market evidence. Under *Daubert*, the replacement of market evidence with the results of settlements would require objective evidence linking allowed returns to market evidence, not assumptions.

Moreover, Dr. Morin's dismissal of the circularity issue is directly refuted by his advice concerning the comparable earnings approach. He says:

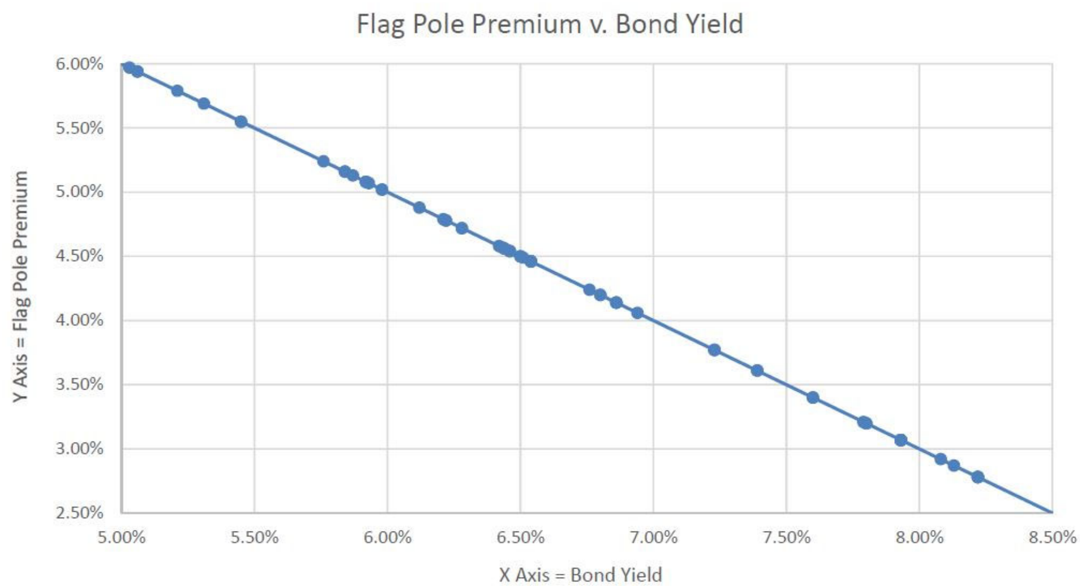
> In defining a population of comparable-risk companies, care must be taken not to include other utilities in the sample, since the rate of return on other utilities depends on the allowed rate of return. The historical book return on equity for regulated firms is not determined by competitive forces but instead reflects the past actions of regulatory commissions. It would be circular to set a fair return based on the past actions of other regulators, much like observing a series of duplicate images in multiple mirrors.

Roger A. Morin, *New Regulatory Finance* 383 (2006). If circularity is a concern when actual returns of utilities are used to determine comparable earnings, it is much more a concern when the actual decisions of the same regulator are used. And the concern is heightened when the decisions largely reflect settlements or other non-litigated results, with no record establishing that market data was even used in reaching results.

The defects in the approach accepted in *Opinion Nos. 531-B* and *551* are evident in the results. If Dr. Avera's results were believed, they would disprove the theoretical basis for the risk premium methodology. Dr. Avera's reliance on the allowed FERC returns for six years in *Coakley*, for example, showed an inverse relationship between changes in interest rates and changes in allowed return of .93, meaning that the risk premium went up by 93 percent of any interest rate reduction. 150 F.E.R.C. ¶ 61,165, ¶ 99. This calculation took the results back to what the Commission allowed in the previous cases, with a tiny reduction. The method created an almost perfect mirror image.

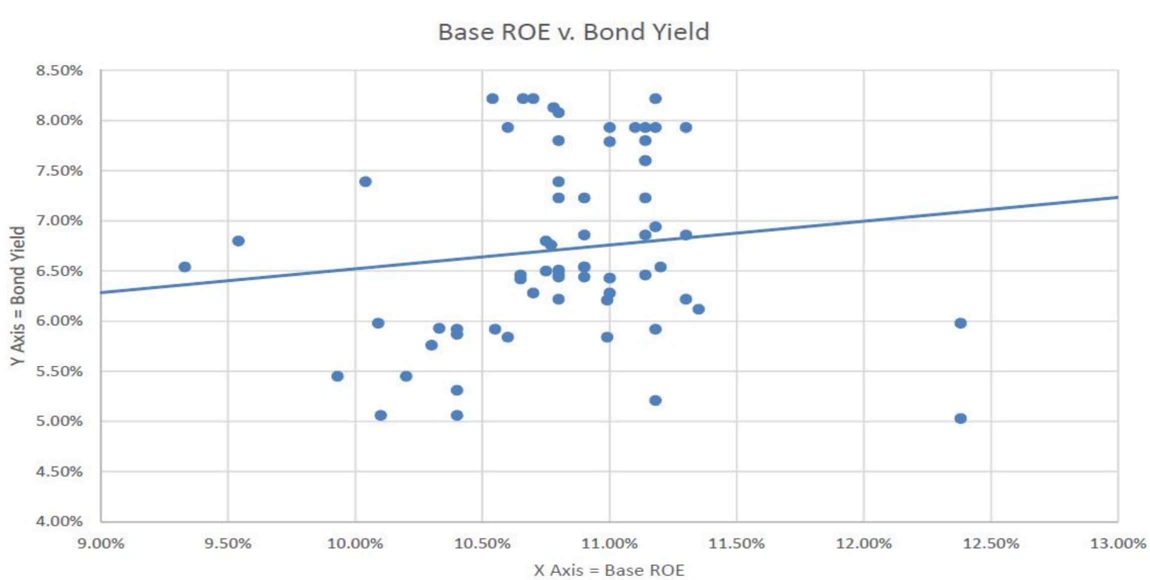
In both *Coakley* and *MISO*, Dr. Avera performed a statistical regression on the risk premium versus the change in interest rate reflected in his data and found a strong statistical correlation. *Opinion No. 531-B*, 150 F.E.R.C. ¶ 61,165, ¶ 99; *Opinion No. 551*, 156 F.E.R.C. ¶ 61,234, ¶ 176. That is true, but the regression simply proved that there is a statistically significant relationship between bond yields and risk premiums when the ROE barely changes over time. The data sets indicated that Commission-allowed ROEs barely changed as bond yields fluctuated. If that is true, the risk premium *of course* will change in relation to the change in bond yield.

Obviously, if the ROE barely moves, the risk premium will change as the bond yield changes, if the risk premium is defined as the difference between the ROE and the same bond yield. Simple arithmetic produces this result. That would be even more true and statistically significant if the ROE did not change at all. For instance, assume a flag pole outside FERC is 11 feet tall. A "Flagpole Premium" could be computed as the difference between 11 and the annual bond yield. If the results were then plotted, the *fit would be perfect*. The plot, using Dr. Avera's *Coakley* data from Exhibit NET-704, is below:



[Appendix C (for data)].

Had Dr. Avera performed a regression of ROEs and bond yields, his results would be quite different, and would show there is no statistically significant relationship given his data. The plot of his *Coakley* data from Exhibit NET-704 would show the following:



[Appendix D (for data)].

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This chart shows that there is no statistically significant correlation between bond yields and allowed returns. If valid, the method accepted in *Opinion Nos. 531* and *551* would disprove risk premium theory – that equity returns vary in a significant manner in the same direction as interest rate changes. The results are inconsistent with the theory because Dr. Avera relied on bad data to represent investor return requirements. The Commission should not accept an analysis predicated on data that is demonstrably useless for performing a risk premium calculation.

The fundamental problem with Dr. Avera's analyses in *Coakley* and *MISO*, and particularly his regression, is *bad data*. The data covers too short a period, in violation of published cautions that short periods are not representative of reasonable premiums. Further, it is based on an analysis of cases that produced results without any linkage to a litigated record. The data reflects lags that destroy the basis for matching ROEs with bond yields. As applied, the methodology has no basis in financial theory and no support in any objective scholarly literature or empirical market analysis.

An inverse relationship of .93 between changes in interest rates and risk premiums is also contradicted by the empirical research in the area. As *New Regulatory Finance* states, "[t]he gist of the empirical research on this subject is that the cost of equity has changed only half as much as interest rates have changed in the past." Roger A. Morin, *New Regulatory Finance* 129 (2006). He cites his own empirical research in support of that observation. *Id.* Dr. Morin advises that the "empirical research cited above provides guidance as to the magnitude of the adjustment" for the inverse relationship. *Id.* The .93 adjustment is contradicted by objective, peer-reviewed research.

If the Commission adopts a risk premium methodology, it should employ market data. If the analysis is historical, a long enough period to suggest a "norm" in the risk premium should be used. The Commission should avoid a methodology that merely mirrors past Commission actions.

IV. THE CAPM METHODOLOGY SHOULD MATCH THE TIME PERIODS USED TO DETERMINE RETURNS FOR STOCKS AND BONDS, USE BETA FOR THE CORRECT MARKET, AND SHOULD NOT INCLUDE A SIZE ADJUSTMENT.

The CAPM model is a specific application of the risk premium method, in which the returns on a market index are used to develop a risk premium and the resulting premium is adjusted for risk, using "beta." Beta is a measure of stock's volatility compared to the market as a whole; if beta is below 1.0, the stock is less risky than the market as a whole, and vice versa. The beta-adjusted risk premium is added to the risk-free interest rate to determine the cost of equity.

The *Briefing Orders* determined that the CAPM zone of reasonableness in *Coakley* and *MISO* would be the zones that were determined in *Opinion Nos. 531* and *551*. *Coakley Briefing Order*, ¶ 56 (citing *Opinion No. 531*, ¶ 147); *MISO Briefing Order*, ¶ 57 (citing *Opinion No. 551*, ¶¶ 140, 165). In those orders, the Commission accepted CAPM analyses that forecasted equity returns and compared them with current long-term bond yields. But the method, sponsored by Dr. Avera in both cases, has numerous problems. First, it matched a short-term DCF equity return with long-term Treasury bond yields, contrary to the guidance in *New Regulatory Finance*. Second, it applied a beta developed by comparing utility stock volatility with that of the New York Stock Exchange, but then applied that beta to dividend-paying firms in the S&P 500. That mismatch also conflicts with advice in *New Regulatory Finance*.

Third, Dr. Avera's method applied a "size adjustment" to increase the return on equity, on the theory that beta does not fully account for risk differences resulting from the size of firms. No empirical evidence suggesting the need for a size adjustment for utilities was cited and it appears that none exists. The empirical evidence in the *Coakley* record – capitalization amounts and DCF results for the proxy group – shows that size is completely unrelated to the required return on equity. Fourth, the methodology proposed in the *Coakley Briefing Order* only used IBES growth rates in its market DCF analysis, whereas the proposed methodology in the *MISO Briefing Order* used an average of IBES and Value Line growth rates for the market DCF. As the Commission found in *Opinion No. 551*, it is reasonable to use both IBES and Value Line estimates in the calculation of the CAPM market DCF growth rates and the Commission should do so going forward.

In *Coakley*, as adopted by *Opinion No. 531*, Dr. Avera employed a DCF study to determine equity returns for the S&P dividend-paying firms. But he did not use long-term growth, as required in the Commission's two-step DCF methodology. The witness used IBES analysts' forecasts of medium-term growth and did not factor in a component for forecasted long-term growth of GDP. This approach inflated the yield compared to what would be developed using the two-step approach. *Opinion No. 531-B*, 150 F.E.R.C. ¶ 61,165, ¶¶ 109-12.

In *Opinion No. 531-B*, the Commission rejected this criticism, stating that the S&P 500 is regularly updated to include firms with high market capitalization. The

Order stated that "[w]hile an individual company cannot be expected to sustain high short-term growth rates in perpetuity, the same cannot be said for a stock index like the S&P 500 that is regularly updated to contain only companies with high market capitalization . . . ." *Id.*, ¶ 113. The Order did not provide a supporting citation, a reference to empirical evidence, or even a rationale for this bare conclusion.

The "size adjustment" accepted in *Opinion Nos. 531* and *551* suggests that utilities are generally smaller than the companies in the S&P 500. But if the Commission is right that large firms have long-term growth rates that remain above long term GDP, small firms must have long-term growth rates that are below long-term GDP. The statement in *Opinion No. 531-B*, thus conflicts with the Commission's determinations that utility growth rates will, in the long run, grow "at the rate of the average firm in the economy." *Opinion No. 531*, 147 F.E.R.C. ¶ 61,234, ¶ 38 (2014). If growth of smaller firms converge to the average, the growth of larger firms must converge as well.

More fundamentally, there is inconsistency in matching a short or medium-term DCF forecast of investors' equity return requirements with the yield on long-term bonds. Dr. Morin makes clear that a proper match requires the use of long-term expectations for both. He states:

> At the conceptual level, because common stock is a long-term investment and because the cash flows to investors in the form of dividends last indefinitely, the yield on very long-term government bonds, namely, the yield on 30-year Treasury bonds, is the best measure of the risk-free rate for use in the CAPM and Risk Premium methods. The expected common stock return is based on long-term cash flows, regardless of an individual's holding time period. Utility asset investments generally have long-term useful lives and should be

> correspondingly matched with long-term maturity financing instruments.

Roger A. Morin, *New Regulatory Finance*, 151-52 (2006). The suggestion that large-cap firms might have higher than average growth in perpetuity does not solve the mismatch in the *Coakley* and *MISO* allowance, because the analysts' forecasts still projected growth for only five years. There is no data establishing what they would project for 30 years.

Dr. Avera also created a mismatch in *Coakley* and *MISO* when he used a beta derived through comparisons of utilities to the NYSE market index, but applied that beta to the dividend-paying firms in the S&P 500. *New Regulatory Finance* advises that "for reasons of consistency, the market index employed [in the DCF calculation for the CAPM] should be the same as the market index used in deriving estimates of beta." Roger A. Morin, *New Regulatory Finance* 159-60 (2006). Simply put, there are differences in the volatility of the NYSE index and the S&P 500 and applying the wrong beta fails to accurately account for differences in risk.

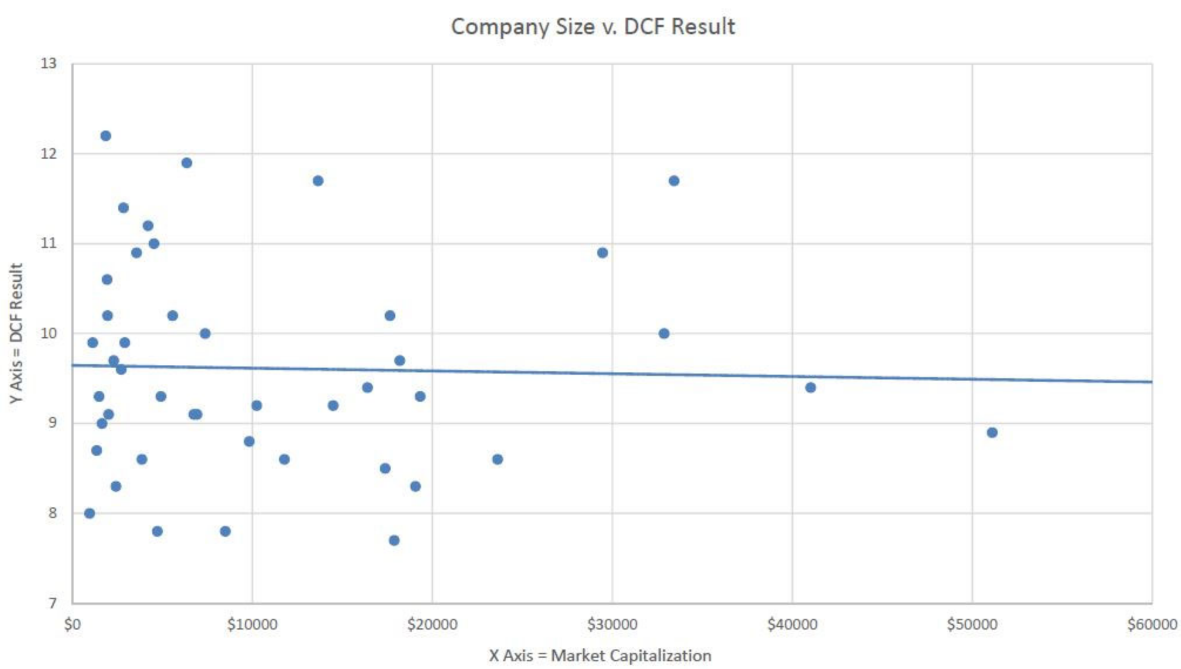
Dr. Avera applied betas published by Value Line in his analyses. *Opinion No. 531-B*, 150 F.E.R.C. ¶ 61,165, ¶ 109; *Opinion No. 551*, 156 F.E.R.C. ¶ 61,234, ¶ 139. Value Line betas "are derived from a least-squares regression analysis between weekly percent changes in the price of a stock and weekly percent changes in the New York Stock Exchange Average over a period of 5 years." Roger A. Morin, *New Regulatory Finance* 71 (2006). It makes no sense to apply a measure of a stock's risk compared to that index to the returns expected for firms in a different index. The answer cannot be correct.

Nor can this problem be dismissed on the assumption that the betas using the S&P 500 or the S&P 500 dividend-paying firms would be the same as the NYSE. *Yahoo Finance* publishes betas that compare companies to the S&P 500 and they differ drastically, and generally are lower, than the betas published by Value Line. As of January 2019, the average Value Line beta for the *Coakley* proxy group in Exhibit NET-708 was 0.61, but the average beta for the same proxy group published by *Yahoo Finance* was .07. Part of this huge difference can be explained by the fact that Value Line adjusts raw betas for the tendency of betas to converge toward one over long periods. Roger A. Morin, *New Regulatory Finance* 72-74. *Yahoo Finance* uses raw betas, but even if the Value Line adjustment is applied, the *Yahoo Finance* betas average .36. The results are replicated in Appendix E.

A *Yahoo Finance* adjusted beta of .36 indicates that utility riskiness is much less than the betas applied by Dr. Avera would indicate. This means that the actual risk premiums are much lower than those derived in Dr. Avera's CAPM analyses. This mistake greatly distorted the results.

On top of the mismatch in adjusting for beta, Dr. Avera applied a size adjustment to account for the suggestion in some literature that beta does not adequately account for the added risk of small-capitalization stocks compared to large-cap stocks. *See* Roger A. Morin, *New Regulatory Finance* 182-83. Dr. Morin cites data showing that large cap utilities earned less over a lengthy period than small-cap utilities, such as gas or sanitary services companies. *Id.* at 182. But Dr. Morin cites no study showing that beta fails to account for difference in risk for electric utilities subject to modern regulation versus the market. Regulation *reduces* risk; a conclusion that electric utilities are more risky than beta suggests should require supporting empirical evidence.

The empirical evidence in the *Coakley* record shows conclusively that the size theory does not hold up for the proxy group used by Dr. Avera. Appendix F shows the utilities in the group arrayed by market capitalization, smallest to largest, along with the DCF results. As can be seen, there is no inverse relation between size and required return on equity. Indeed, there is no statistical correlation at all between size and DCF results. The fit plot of a regression of the capitalization and DCF amounts shows that the results are random. The results are charted below:



[Appendix F]. Applying a size adjustment that is refuted by the evidence in the record would be irrational.

The size adjustment accepted in *Opinion No. 531* is also faulty because it doubled up on allowances for size. First, Dr. Avera used five-year growth forecasts for the

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dividend-paying firms in the S&P 500, and the Commission accepted the short-term forecast because large-cap firms might grow faster than average firms over time. The use of short-term growth inflated the DCF results compared to using the Commission's two-step DCF methodology.

Then, after allowing a higher DCF result for utilities because the return was determined for a comparison group of large-cap firms, the witness increased the return requirement for utilities because they are smaller than large-cap firms. There is no valid rationale for doubling up on a size premium. The only possible rationale would be that beta adjusts the first size increase out of the result, but if beta accounted for size, there would be no need for a size adjustment.

The analysis accepted by the Commission posits that large-cap firms grow faster than small cap firms, and do so in perpetuity, but that small-cap firms earn higher returns than large cap firms. The two positions internally conflict and *Opinion No. 531-B* provides no data, or other explanation, to reconcile the conflict. The Commission should avoid such conflicts if it adopts the CAPM method to determine returns on equity.

Lastly, the Commission's decisions in the *Briefing Orders* to use Dr. Avera's CAPM methodologies from *Coakley* and *MISO* conflict because Dr. Avera used different methods to determine the growth rates in his market DCF analyses in those two cases. *Coakley Briefing Order*, ¶ 56 (citing *Opinion No. 531*, ¶ 147); *MISO Briefing Order*, ¶ 57 (citing *Opinion No. 551*, ¶¶ 140, 165). In *Coakley*, Dr. Avera calculated the average S&P 500 growth rate using only IBES growth rates from *Yahoo Finance.* [NET-708 at 1 n.(b) ("Weighted average of IBES earnings growth rates for the dividend paying firms in the

S&P 500 from http://finance.yahoo.com")]. But in *MISO*, Dr. Avera calculated the average S&P 500 growth rate using an average of IBES and Value Line growth rates. [MTO-30 at 1 n.(b) ("Average of weighted average earnings growth rates from IBES and Value Line Investment Survey for dividend-paying stocks in the S&P 500 based on data from http://finance.yahoo.com . . . and www.valueline.com")]. In *Opinion No. 551*, the Commission found that it was reasonable to use an average of IBES and Value Line growth rates in a CAPM market DCF analysis and the LPSC agrees with that determination. *Opinion No. 551*, ¶ 169.

The CAPM approach accepted in *Opinion Nos. 531* and *551* reflect faulty economics. A proper long-term analysis matches long-term yields for stocks and bonds. The market DCF analysis should average IBES and Value Line growth rates and not rely on IBES growth rates alone. The beta used to adjust for risk must be a beta appropriate for the unregulated firms in the analysis. No support exists for applying a size adjustment for electric utilities and the empirical evidence refutes the need for a size adjustment. Doubling up on the size adjustment is particularly unsupportable. The Commission should conform the CAPM to accepted financial theory and evidence.

CONCLUSION

Experts who testify in litigation for a living often employ special approaches conceived for the litigation, without support in the literature or in empirical data. *See Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 43 F.3d 1311, 1317-19 (9th Cir. 1995) (discussing research results obtained outside litigation verses those in litigation). Naturally, experts seek to achieve results for their clients. But in adopting a methodology of general application, the Commission should take care to remove gimmicks from the approach. The methods should be based on solid financial theory, faithfully applied, with matching elements and consistent rationales.

Respectfully submitted,

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CERTIFICATE

I hereby certify that a copy of the above and foregoing "Initial Comments on Behalf of the Louisiana Public Service Commission Addressing Return on Equity Methods and Applications" has been served upon all counsel of record by email this 26th day of June, 2019.

Michael R. Fontham

APPENDIX A

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REGULATION AND MODERN FINANCE THEORY*

ALEXANDER A. ROBICHEK**

I. INTRODUCTION

IN RECENT YEARS, we have experienced numerous disputes over the rate a public utility should be allowed to earn. More often than not the difference between what a company requests and what the staff of a public utility commission recommends is substantial. Prolonged hearings are held with great costs to both parties. Even when the Commission reaches a decision, it sometimes is appealed to the courts with additional costs and delays. The problem is that the law relating to regulation is subject to ambiguous interpretations in a number of key areas.

The purpose of my address is to explore this ambiguity in some detail and to examine an alternative approach to establishing a proper rate of return on equity capital. While this examination is rooted in modern finance theory, the focus of my address is on developing a better understanding of the problem and on policy implications as opposed to extending the theory. We begin by reviewing the legal principles underlying regulation followed by an examination of the rate-making process as it is practiced. The meaning of a "just and reasonable" rate of return to the equity holder is next explored. An alternative approach to regulation and its implications will be discussed in Sections V and VI. Concluding comments appear in the last section.

II. THE LEGAL PRINCIPLES UNDERLYING REGULATION

The regulation of public utility companies is not a task assigned to a single governmental agency. Quite the contrary is true. At the national level, a number of federal agencies (such as the Federal Communications Commission, the Federal Power Commission, and others) are involved in regulating the companies engaged in interstate commerce. At the state level, each state has a "public utilities commission." In addition, many smaller jurisdictions (such as cities) regulate local utilities such as garbage collection, etc.

* Presidential address written for the American Finance Association, December 29, 1977.

** After an extended illness, Alexander A. Robichek died of cancer on February 2, 1978. At the time of his death, he was the A. P. Giannini Professor of Banking and Finance, Graduate School of Business, Stanford University.

The legal principles underlying the regulation of public utility companies rest primarily on two Supreme Court cases: *Bluefield Water Works & Investment Co. v. Public Service Commission of the State of West Virginia (262 U.S. 679, 1923)*, and *Federal Power Commission v. Hope Natural Gas Company (320 U.S. 591, 1944)*. The two cases will henceforth be referred to simply as "*Bluefield*" and "*Hope*." The case law specifies that the rate-making process "involves a balancing of the investor and consumer interests." (*Hope*, 603).

The Congress in the Natural Gas Act of 1938 defines the rate-making process as the fixing of "just and reasonable rates." (*Hope*, 603). The legal standard against which "just" and reasonable" is measured was stated in the *Bluefield* case: "A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public equal to that generally being made at the same time and in the same general part of the country on investments in other business undertakings which are attended by corresponding risks and uncertainties.... The return should be reasonably sufficient to assure confidence in the financial soundness of the utility, and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise money necessary for the proper discharge of its public duties." (*Bluefield*, 693).

In the *Hope* case, the Court explicitly recognized that revenues must also cover "capital costs." The Court stated: "From the investor or company point of view it is important that there be enough revenue not only for operating expenses but also for the capital costs of the business. These include service on the debt and dividends on the stock.... By that standard the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks." (*Hope*, 603).

Some of the most difficult issues in regulatory cases have concerned the manner in which a regulatory body is to determine what constitutes "just and reasonable" rates. The Supreme Court has held that the regulatory commissions need not be "bound to the use of any single formula or combination of formulae in determining rates." (*Hope*, 602). The Court stated further that "under the statutory standard of 'just and reasonable' it is the result reached not the method employed which is controlling...." It is not theory but the impact of the rate order which counts. If the total effect of the rate order cannot be said to be unjust and unreasonable, judicial inquiry... is at an end. The fact that the method employed to reach that result may contain infirmities is not then important." (*Hope*, 603).

Several Justices who took part in the *Hope* decision disagreed with the majority opinion on some of these issues. For example, Justice Reed, dissenting, states: "When the phrase (just and reasonable) was used by Congress to describe allowable rates, it had relation to something ascertainable.... The rates fixed would produce an annual return and that annual return was to be compared with a theoretical just and reasonable return..." (*Hope*, 621). He continues, "My disagreement with the Court arises primarily from its view that it makes no difference how the Commission reached the rate fixed so long as the result is fair and reasonable." (*Hope*, 623).

Justice Jackson, dissenting on the same point, states: "We need not be slaves to a formula but unless we can point out a rational way of reaching our conclusions they can only be accepted as resting on intuition or predilection.... The Court sustains this order as reasonable, but what makes it so or what could possibly make it otherwise, I cannot learn." (*Hope*, 645–646).

Justice Frankfurter, also dissenting, makes a telling point when he states: "The requirement that rates must be 'just and reasonable' means just and reasonable in relation to appropriate standards. ...To what sources then are the Commission and the courts to go for ascertaining the standards relevant to the regulation of...rates? ...There appear to be two alternatives. Either the fixing of...rates must be left to the unguided discretion of the Commission so long as the rates it fixes do not reveal a glaringly bad prophecy of the ability of a regulated utility to continue its service in the furture. Or, the Commission's rate orders must be founded on due consideration of all the elements of the public interest..." (*Hope*, 626). Frankfurter continues, "In order for this Court to discharge its duty of reviewing the Commission's order, the Commission should set forth with explicitness the criteria by which it is guided in determining that rates are 'just and reasonable'..." (*Hope*, 627–628).

In order to better understand some of the reasons for the difficulties encountered by regulatory Commissions and the courts in resolving rate controversies, the next section will provide a review of various practical aspects of the rate-making process.

III. Review of the Rate Making Process

A. *The Approach in General*

The process of determining the "just and reasonable" rates is difficult to discuss in the abstract. For this reason, Figure 1 and Table 1 were prepared to illustrate the principal areas of controversy. Figure 1 presents a simplified summary of the process used to reach the "allowed return to capital." The "allowed return to total capital" of $81,000,000 shown as the final step in Figure 1, is reached by first determining a "just and reasonable" rate of return (9.0% in the example and then multiplying this rate by the approved "capital base" ($900,000,000). To reach the "rate of return," the commissions usually follow the steps illustrated in the upper part of Figure 1. That is, the commissions determine the "just and reasonable" rates to debt and to the equity (7.0% and 12.0% respectively).[1] These rates are then multiplied by the appropriate proportions of debt and equity in the firm. Thus, the 9.0 per cent "rate of return to total capital" is a weighted average of the return to the debt holders and to the equity holders.

Table 1 presents a sample of calculation of the amount of "total revenue" to be generated from the allowed rates, using as the basis the values of Figure 1. One item to be noticed is that the allowed rates must provide not only the "return to the capital" but also be sufficient to cover the operating expenses of the business

1. Preferred stock and interest charged construction are ignored for purposes of this illustration.

TABLE 1

SAMPLE CALCULATIONS TO DETERMINE TOTAL COSTS TO SERVICE CAPITAL AND TOTAL REQUIRED REVENUE

		%
Assume: Debt =	$540,000,000	60%
Equity =	360,000,000	40%
Total Capital	$900,000,000	100%
"Just and Reasonable" Return to Equity (12% × 360,000,000)	$43,200,000	
+ Income Taxes (50% of Profit Before Taxes)	43,200,000	
Required Profit Before Taxes	$86,400,000	
+ Interest (7% × 540,000,000)	37,800,000	
Required Profit Before Interest and Taxes	$124,200,000	
+ Operating Expenses (Assumed)	350,000,000	
= Total Required Revenue	$474,200,000	

Memo:

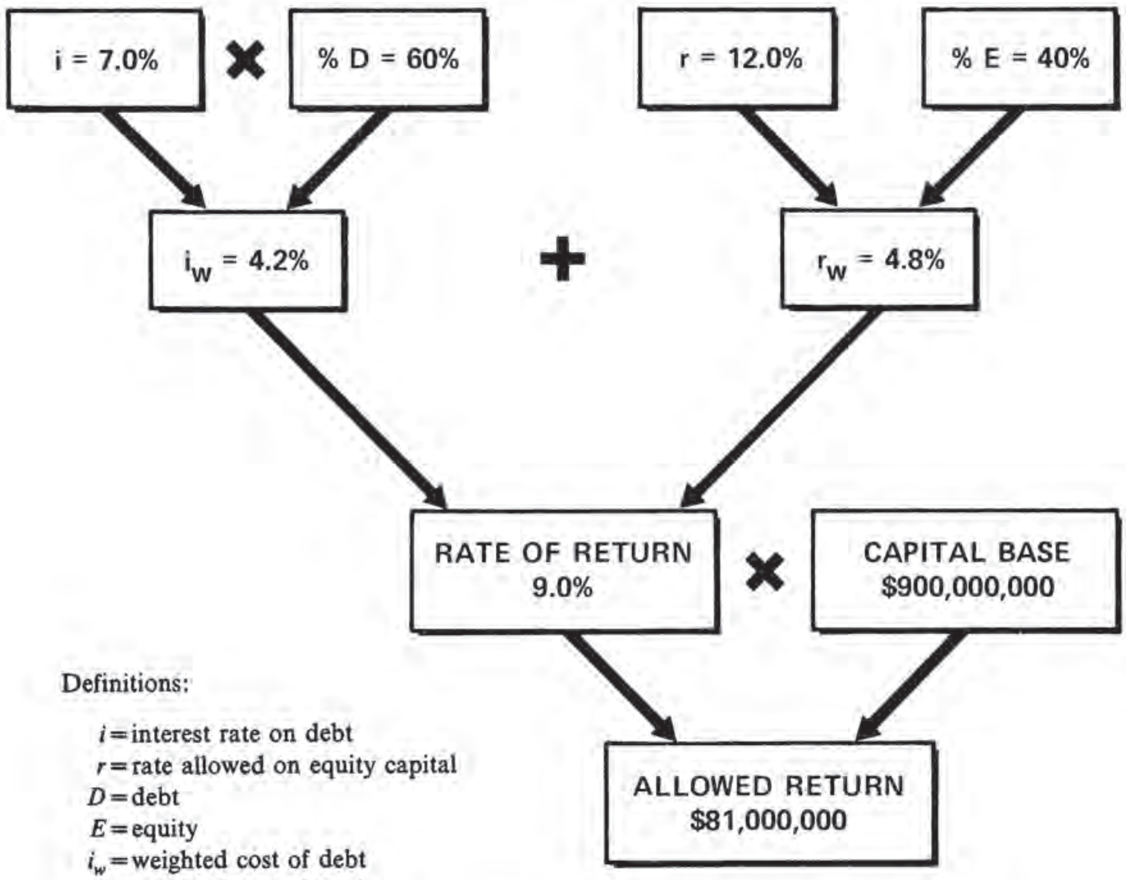
Cost Rate to Service Capital and Taxes = (Required Profit Before Interest and Taxes) ÷ Capital Base

or

Cost "Rate" = 124,200,000/900,000,000 = 13.8%.

(assumed at $350,000,000 in the example) and income taxes (assumed at 50% of profits before taxes). Since income taxes are based on the profit before taxes but *after* interest expense, the amount of total revenue required to service capital cannot be determined merely from a knowledge of the allowed rate on total capital. The required amount of revenue will also depend on the proportions of debt and equity in the firm. In other words, knowledge of the 9.0% allowed rate of return on total capital (Figure 1) is not sufficient information to determine the total cost to the consumers of servicing capital.

Given our current tax laws, to provide a $1 return to the debt holders (*i.e.*, interest), the commission need provide only $1 of revenue. But, it takes approximately $2 of revenue to provide a $1 return to the equity holders because the firm must pay income taxes. In Table 1, in order to provide a return of $43,200,000 to the equity holders, the commission must allow a profit before taxes of $86,400,000. From the point of view of the consumer, the total cost to service capital *and* taxes is the "profit before interest and taxes" or $124,200,000 in Table 1. The last item on Table 1 shows this total to be 13.8 per cent of the total capital.



Definitions:

i = interest rate on debt
r = rate allowed on equity capital
D = debt
E = equity
i_w = weighted cost of debt
r_w = weighted cost of equity

FIGURE 1. A Summary View of the Regulatory Process

B. *Areas of Regulatory Controversy*

Almost all items shown in Figure 1 and Table 1 are subjects of controversy in regulatory proceedings. A brief summary of the principal questions at issue is given below.

1. As a rule the rate of return on debt is the least controversial item. Still, the problems arise in resolving the questions of what the rate should be in a period where future interest rates can be expected to exceed the interest costs of the existing debt. In the last dozen years, there has been a steep rise in interest rates and this issue has become more significant in recent regulatory hearings.
2. The "just and reasonable" rate of return to the equity holders is a matter of major controversy. It is not at all unusual for various expert witnesses in a case to recommend widely differing rates in this regard.
3. The appropriate proportions of debt and equity are on occasion a matter at issue. An important reason is traceable to the fact that equity "costs" the consumer roughly twice as much as debt, because of the tax effect. If the commission accepts the company's capital proportions as reasonable, the problem does not arise. But, in some instances, the commissions do not accept such proportions and impute debt/equity proportions other than those actu-

ally used by the firm. As a rule, the imputed proportions assume a larger proportion of debt than the actual proportions.

4. The appropriate level of the "capital base" usually is a controversial subject. A number of questions arise in this regard, the most common of which are concerned with: (a) what should be included in or excluded from the base; (b) which "test" period should be considered; and (c) should the base be measured in terms of historical cost or "fair" value.
5. The level of "operating expenses" generally is subjected to some regulatory scrutiny. Certain expenses (*e.g.*, advertising) are sometimes excluded from allowed expenses. Other expenses may be reviewed for reasonableness.
6. Finally, the commissions, having determined an allowed level of total revenue, must also regulate the manner in which such revenue is to be raised. Specifically, the commission approves a schedule of rates for each type of service offered by the utility. By estimating the rate of service use, the commissions can estimate the total revenue to be generated from all services.

The range of problems mentioned above should convince even the most severe critic of the regulatory procedures that the commissions are faced with a complex task. To an important extent, the difficulties facing regulators arise because the law itself is subject to alternative interpretations in a number of important areas affecting rate-making. The next section will describe some important aspects of rate-making where ambiguities in interpreting the law exist.

C. *Problems in Interpreting the Law*

As we know, the law on rate-making is a subject of considerable controversy even among the justices of the Supreme Court. The areas of controversy are numerous, as evidenced by the large number of dissenting opinions on a wide variety of issues. Four key areas of judicial controversy will be examined below: (1) the Rate of Return and the Rate Base; (2) Investment Risk; (3) Comparison of Rates and Return; and (4) Return to the Equity Owner.

1. *The Rate of Return and the Rate Base.* As shown in Figure 1, the process of rate-making generally involves the determination of a "just and reasonable" rate of return *and* a "capital base" against which this rate is to be applied. The legal basis for this general approach can be traced to one of the earliest Supreme Court decisions in the regulatory area. In Smyth v. Ames (169 U.S. 467) the court stated: "What the company is entitled to ask is a fair return upon the value of that which it employs for the public convenience.... And, in order to ascertain that value,..., the amount and market value of its bonds and stock,...are to be given such weight as may be just and right in each case."

Some of the problems of determining the proper "base" have been discussed in one of the earlier sections. But, the problem is far more complicated than the question of what to include or exclude from the "rate base." The Supreme Court recognized this problem in the *Hope* case: "It does, however, indicate that 'fair value' is the end product of the process of rate making not the starting point.... The heart of the matter is that rates cannot be made to depend upon 'fair value' when the value of the going enterprise depends on earnings under whatever rates may be anticipated." (*Hope*, 601). Having recognized the existence of circularity, however, the court does not suggest how this issue is to be resolved.

2. *Investment Risk*. A similar problem to the one just described is present in the case of "investment risk." As noted in an earlier section, the law states that allowed rates of return should be commensurate with those earned by enterprises "attended by corresponding risks and uncertainties." (*Bluefield*, 692).

The problem arises because, for a regulated company, the business (and, hence, investment) risk *depends* on the regulatory decision. To require that the rates be set after giving due consideration to "risk" is circular when such "risk" is determined to a large extent by the rate-making process.

3. *Comparison of Rates of Return*. The law requires that regulators allow rates "equal to that generally being made at the same time...on investments in other business undertakings..." (*Bluefield*, 692).

Clearly, the law implies a concurrent standard. But, regulatory hearings typically stretch over several months. Testimony upon which the rate decision is based may often be several months old by the time the decision is rendered by the commission. Moreover, any comparisons to other business enterprises are based on the past, while the rates, once set, apply to the future.

4. *Return to the Equity Owner*. The law is explicit in identifying "the equity owner" as the investor group which should receive a return "commensurate with returns in investments in other enterprises having corresponding risks." (*Hope*, 603). Yet, the application of this standard has a number of problems. How is "return to the equity owner" to be measured? Should it be on the basis of "book" value or "market" value? Over what time period should the comparison be made?

Before attempting to suggest answers to some of these questions, one needs to understand the meaning of a "just and reasonable" return to the equity holder. To this problem we now turn.

IV. The "Just and Reasonable" Rate of Return to the Equity Holder

A. *The General Problem*

The equity holder, of course, is the residual owner of the firm. This factor is nowhere more clearly evident than in regulated public utilities. *Ceteris paribus*, an increase or decrease in allowed revenues "flows", except for income taxes, directly through to the equity owner. In contrast, the debt rate is determined by market forces. In the absence of defaults, the debt holder receives neither more nor less than the "just and reasonable" rate. Any difference (positive or negative) between the allowed rate on debt and the actual rate on debt will be absorbed approximately equally by the government (in the form of higher or lower income taxes) and the equity holders.

It follows that the test of whether allowed rates of return to the capital providers are "just and reasonable" must be applied to the company's equity holders. It is precisely on this issue that the commissions and the courts have experienced the greater difficulties. The main problem has been one of defining the standard against which to measure the "just and reasonable" criterion.

Before considering the question of an appropriate standard, it is essential to understand the two main approaches used in regulatory proceedings to arrive at "just and reasonable" rates of return to the equity holders: "comparable earnings" and "discounted cash flow."

B. "*Comparable Earnings*" *vs.* "*Discounted Cash Flow*"

Of the two approaches mentioned above, the "comparable earnings" approach has been around as long as the regulatory process itself. The essential elements of this approach are as follows:

1. Analyze rates of return earned on the *book value* of the equity capital of various industry groups—both regulated and unregulated.
2. Establish comparability of "investment risk."
3. Determine the "just and reasonable" rate based on (1) and (2) above.

Several significant problems are encountered in applying the "comparable earnings" approach.

First, comparison of rates of earnings with other regulated companies leads to circularity. If all regulatory commissions looked merely at each other, no deviations of any magnitude would ever occur even if economic conditions were to warrant a change.

Second, comparisons of rates of earnings on book value between regulated and non-regulated companies are easily challenged on at least two gounds: (1) Lack of comparability of investment risk; and (2) Differences in accounting practices between regulated and non-regulated companies often make rate of return comparisons meaningless.

To avoid some of the problems noted above, the "discounted cash flow" (or DCF) approach has been proposed as an alternative to the "comparable earnings" approach. This approach is relatively new—its use in regulation is limited to the past dozen years. The "discounted cash flow" name derives from the basic financial principle that investors value securities by "discounting" to the present the expected future "cash flows" attributable to the securities. The "cash flows" include dividends and the expected eventual liquidation market value of the shares; the "discount" rate is a market determined rate that takes into account current market conditions *and* the investment risk of the particular security. The rationale for the DCF approach rests on the argument that by estimating the current investors' required rate of return, one takes into account the investment risk of the security. If the estimate is correct, no longer is it necessary to make extensive comparisons to establish "comparability of investment risk."

While the method has considerable intuitive appeal, its actual application in regulation is far from simple. The principal difficulties surround the process by which one estimates the investor's required (DCF) rate of return and how one applies the estimated rate of return to determine the "just and reasonable" rate of return on the *book value* of the company's equity.

If a company's allowed rate of return on book value is set exactly equal to the investors' required rate of return then the company's market value per share will approximate its book value. But, regulation which is intended to force the market price to equal book value is inconsistent with the concept that equity securities of regulated companies should be treated as equity securities. Maintaining market value around book value is tantamount to converting an equity security to a perpetual, subordinated bond. Such regulation could be unfair both to equity holders *and* to consumers. For example, the regulation of rates in such a way as to force the market value of shares to equal book value could be unfair to the equity holders when equity securities of non-regulated companies are rising in market value. On the other hand, not permitting the market price to decline at a time when the market values of equities of non-regulated companies are declining could cause utility rates to consumers to be higher than otherwise would be the case.

V. An Alternative Approach to the Regulation of "Just and Reasonable" Rates

Rather than comparable earnings or DCF, we suggest in this section an alternative approach to the regulatory process of determining "just and reasonable" rates. It is based on the following five principles: 1. The role of regulation is to act as a substitute for competition. While this principle may be considered self-evident, it needs to be specifically stated. So long as it is the national policy to be a capitalistic society and to permit privately owned utility companies, the return to capital suppliers should be consistent on a risk-adjusted return basis with all the returns available from non-regulated companies. In particular, regulation should not eliminate equity characteristics from the equity securities issued by regulated companies. It is the role as well as expectation of common stockholders to bear the "residual investment risk" of a company and to be rewarded or penalized accordingly.

2. The desired *end product* of regulation is to set rates so as to "balance the interests of consumers and investors." From the point of view of the consumers, "just and reasonable" rates imply minimum operating expenses and minimum costs to service capital consistent with a given quality of service. From the point of view of providers of capital, "just and reasonable" rates imply rates of return comparable to rates of return on alternative investments of similar risk in the non-regulated sector. The task faced by regulators, then, is to set rates that are "just and reasonable" from the viewpoint of both the consumer *and* the investor.

3. Investments in equity shares are made by the purchase of shares at market prices. Therefore, the fairness of the rate of return to the investor must be judged from the investor's point of view in the market place and not on the basis of book value. Table 2 was prepared to illustrate the large differences which are possible in market versus book rates of return. The table shows annual rates of return on the two bases for an actual electric utility company from 1962 to 1976 inclusive. We see that the annual rates of return based on book value have fluctuated very little, while the annual rates of return to the investor in the market have fluctuated quite

TABLE 2

ANNUAL RATES OF RETURN TO THE INVESTORS OF SIERRA PACIFIC POWER COMPANY SHARES COMPARED TO RATES OF RETURN ON AVERAGE BOOK EQUITY (1962–1972 Inclusive)

Year	Annual Rate of Return to the Investor*	Rate of Return on Average Book Equity
1962	− .4%	11.3%
1963	34.7	13.1
1964	22.3	12.3
1965	−2.8	12.1
1966	−12.8	11.9
1967	−3.8	12.2
1968	37.0	12.7
1969	−22.4	11.6
1970	15.4	11.3
1971	−1.7	11.9
1972	−11.5	11.0
1973	−25.9	11.5
1974	−12.0	11.8
1975	0.6	8.8
1976	106.3	11.8

* Annual Rate of Return = (Change in Price + Dividend)/Closing Price at End of Preceding Year

wildly. This illustration shows that a stable rate of return on book value *does not* necessarily lead to stable rates of return to the investor in the market place.

It is clear that regulators should be concerned with the rates of return in a *market value* context. Since the market value of a regulated firm's shares depends to an important extent on the rates allowed, regulatory commissions must be concerned with the expected impact of their decisions on the market price of the firm's shares. The allowed rate of return on the book value of the equity holders' interest may be considered as *the means* by which the commission attains its desired end, but should not be an end in itself.

4. The degree of investment risk is not independent of the rate-making process itself. Moreover, since "investment risk" may be defined in a variety of ways, it is necessary to state explicitly what is meant by the term. This topic will be explored in more detail below.

5. The fairness of the rate of return to the equity holders can only be judged retrospectively. The determination of whether the allowed rates will lead to a rate of return to the investors that is too high, too low, or "just and reasonable" cannot be made *ex ante*. The judgment can only be made *ex post*.

Given these five principles, the essential feature of the proposed approach is to compare the rate of return to the equity holder of a regulated utility company with a clearly identifiable standard from the non-regulated financial sector. The standard proposed draws on the well known capital asset pricing model and requires the specification of two financial variables: (1) The return on a riskless security; and (2) the return on a broadly diversified portfolio of equity securities of non-regulated companies. The investment risk factor for a given company is defined in terms of a specified beta. With these inputs we know that we are able to compute the required rate of return on equity for the company in question. As the approach is well known, it is unnecessary to illustrate its application. The idea, of course, is to determine a "just and reasonable" rate of return to the equity holder. That the approach has appeal is evident in the recent State of Oregon hearings where the Public Utility Commission has ruled that the capital asset pricing model be the primary means by which required rates of return on equity are determined.

VI. Implications for the Regulatory Process

The capital asset pricing model approach has a number of implications for regulation, and this is the area where attention needs to be focused. It is important to recognize that the approach can only be extended to the aggregate rate-making problem if several conditions are met:

1. The company's operating expenses are judged to be reasonable;
2. The company's expansion policy is appropriate to the needs of the consumers;
3. The company's financial structure (*i.e.*, the proportions of debt, preferred stock, and equity) is appropriate;
4. The company's specific financing choices (*e.g.*, timing of debt or equity issues) are justified; and
5. The regulation of the company's rates of return was judged "just and reasonable" as of a previous point in time. This point in time would then serve as the starting point from which to judge the fairness of realized rates.

If these conditions are met, the regulatory approach proposed in the paper would provide the basis for resolving some of the current conflicts in rate-making. Needless to say, however, these conditions pose considerable problems. The application of the capital-asset pricing model approach in this context requires a dramatic change in the manner in which regulation is handled.

In its idealized form, the approach would operate along the following lines:

1. The company and the regulators would agree on the specific parameters along which to measure the "just and reasonable" rate of return to the equity holders. These parameters would be along the lines discussed in the preceding section.
2. The regulators would need to approve the major items of operating expenses, such as salaries, labor contracts, etc., and major capital commitments.
3. An agreement would need to be reached on the appropriate capital structure for the company.
4. Major financing decisions would be subject to regulatory approval.
5. A starting point in time and a "fair market value of the shares" at that time would be subject to agreement.

Once agreement is reached on the above points, such agreement would be considered binding. For example, if the regulators approved the company's expansion policy and the manner in which the expansion were to be financed, the investors would then become entitled to receive a "just and reasonable" expected return on the funds committed for expansion purposes. But, as noted above, the proposed approach would work well *if and only if* the company and the regulators were to agree on all the various points mentioned above.

If implemented properly, however, the proposed approach would serve to partially resolve or even to eliminate a number of complex and controversial issues in rate-making. The list below illustrates some of the principal benefits.

1. The approach provides a standard against which to measure the fairness of the rates of return to the equity holders. The standard takes into account investment risk and avoids the problem of circularity by using the non-regulated sector as the basis for comparison.
2. The question of whether "flow-through" or "normalization" should be used for purposes of rate-making would no longer be relevant. Similarly, other accounting questions (such as over-capitalization, interest charged construction, etc.) would no longer be a matter of great concern.
3. It no longer would be necessary to worry as much about what to include in the "capital base" and what "rate" to allow on that base. The overall rates allowed would have to provide for: (a) all proper operating expenses; (b) interest on debt; (c) income taxes; and (d) "just and reasonable" rates of return to the equity holders in the market place.
4. Finally, the proposed approach should be simpler to administer than the current method of rate-making. Given the high cost of regulatory hearings, the savings could be significant.

While the capital-asset pricing model approach should eliminate some of the complex issues facing regulators, the approach brings with it some new problems.

1. The approach itself would need to be studied, understood, and probably revised so as to meet the practical needs of regulators.
2. What external standards should be selected for investment comparison purposes?
3. How often should rates be adjusted?
4. Is there a possible "chicken or egg" problem? That is, if the market *expects* the commission to act so as to bring the rate of return of a regulated company's shares to a particular target level, will the price adjustment affect the rate of return calculations?
5. How does the market react to regulatory action? In particular, how does the rate of return on a book value basis influence the market value of the company's shares?
6. How should the regulators deal with the "plant under construction?" That is, how does the commission provide a "just and reasonable" return on plant that is not yet in use?

The preceding sections discussed the extent to which the proposed approach to rate-making would eliminate some of the current problems facing regulators and cause new ones. There exist, however, a set of problems that will continue to be with us whichever approach is used. Among these are:

1. How to compensate efficiency and penalize inefficiency. A well-managed, efficient company should be entitled to share to some extent the benefits resulting from an efficiently run operation. Similarly, an inefficient company should be forced to bear the costs of inefficiency. The mechanics of developing a system that would resolve this point in an equitable manner faces regulators today and will continue to face them under the proposed approach.
2. What is the economically justified manner of setting the rates to the various subscribers? Should rates be set so as to subsidize certain user groups?
3. How to resolve issues where the commission's staff and the company disagree on key points.

In addition to the problems listed above, other issues may exist or arise as time passes. These were not intentionally omitted. Rather the intent was to list those issues with which I am most familiar.

VII. Concluding Comments

Much of the time in regulatory hearings is spent in presenting testimony or examining witnesses in areas where no useful standard exists against which to judge the reasonableness of the testimony. The approach examined in this address, while introducing some new issues into the regulatory process, suggests ways of resolving some of the most complex current issues. In particular, the approach provides a standard against which to measure the fairness of the rates of return to the firm's equity holders which does not contain elements of circular reasoning.

It is important that the capital-asset pricing model approach be evaluated in relation to the legal environment in which utilities and regulators operate, and that was the purpose of the early part of this address. It seems to me that the approach has much to offer in establishing a "just and reasonable" return standard, around which much of the hearings and legal complications revolve. To the extent such standardization would reduce the cost of and lags in rate hearings, there would be a real gain to society. The approach should not be viewed as the "finished product," but rather as a prototype which needs improvements, but which is beginning to prove its usefulness.

Alternative Cost-of-Capital Concepts in Regulation

Basil L. Copeland, Jr.

Harry Trebing [1974] recently suggested that the greatest failing of public utility regulation has been its inability to accomodate change. An opportunity for change presented itself a generation ago when the U.S. Supreme Court released regulation from the burden of "fair value."[1] But rather than avail itself of the opportunity presented, regulation allowed the old debate on fair value to become a new debate on fair return. If once you could always find an engineer somewhere to testify that the fair value rate base was one figure rather than some other, you can now always find an economist somewhere who will testify that the fair return is some figure rather than another. The inability of expert witnesses to agree either as to the methods that ought to be employed to determine the allowable return, or as to the results that follow from the application of different methods, has created a situation where it is now a convention for regulators to assume that the fair or required return on equity is a "subjective factor" that cannot be determined without the application of "informed judgment."[2] The ability of expert witnesses to fall back on their "informed judgment" makes it difficult to assess the usefulness of their testimony and assures that the recommended rates of return proffered by the various witnesses in a regulatory proceeding will be bounded only by the limits to their imagination.

The present consensus in regulation supports the view that the *cost of capital* is an appropriate standard of fair return for public utilities. There can be little comfort in such consensus since the issues that matter in a practical sense are disputed. The present state of affairs can be attributed in a very general way to two developments. The first, mentioned here only in passing, concerns the substitution of subjectivity for objectivity in the empirical procedures used to determine a fair return, once the conceptual framework has been established. According to Popper, the

> . . . way in which knowledge progresses . . . is by unjustified (and unjustifiable) anticipations, by guesses, by tentative solutions to our problems, by *conjectures*. These conjectures are controlled by criticism; that is by attempted *refutations*, which include severely critical tests.[3]

Methodologically, even a *guess* at what is a fair return is permissible if a serious effort is made to search for evidence that will refute it, although a practical imple-

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[1] *F.P.C.* v. *Hope Nat. Gas Co.*, 320 U.S. 591 (1944).

[2] In *Gen. Teleph. of the Southeast* v. *P.U.C.*, 7 PUR 4th 273 (1974), the Tennessee Public Service Commission said: "The cost of equity is a subjective factor and cannot be determined by precise mathematical formula. A determination of the cost of equity capital requires the application of informed judgment (at 286)." This attitude is not at all uncommon among regulators.

[3] See Popper [1968, p. vii].

mentation of Popper's Principle of Falsifiability in regulation seems to require a theory of return that produces testable (i.e., falsifiable) propositions. Rarely will one ever encounter rate-of-return testimony in which the witness employs a truly testable theory of return. What one *will* encounter, however, and quite often, is testimony in which the witness describes a search for *confirming* evidence and, having found it, proffers it as an evidentiary basis for his rate-of-return recommendation. But as Popper says, you can almost always find confirmations of every theory if that is what you are looking for. The absence of a critical attitude among cost-of-capital witnesses accounts in no small measure for some of the confusion surrounding the issue of rate of return in regulation.

The second development, which is the topic of discussion in this paper, concerns the use of alternative *concepts* of the cost of capital in regulation. No effort will be made to assess all of the theories that have ever been advanced as a basis for determining the cost of capital for public utilities. The arcane theories are safely ignored and the only cost-of-capital concepts economists need to take seriously are the cost-of-capital concepts regulators take seriously. At the present time two cost-of-capital concepts are more widely used than any other in regulation as a basis for determining the cost of equity capital. One of these is the *discounted cash flow* (DCF) concept which is based on a dividend valuation model of common stock prices. The application of DCF in regulation is essentially an effort to estimate the equilibrium expected return (yield) on public utility shares. This yield is then taken to be the return equity investors require before they will commit their funds to an investment in the equity of the particular firm under consideration. The other cost-of-capital concept widely used in regulation is the *comparable earnings* concept. The economic rationale for comparable earnings as a cost-of-capital concept presumes that investors have the opportunity to invest in direct investment and that the earnings on book value of alternative comparable investment opportunities is therefore properly considered to be the opportunity cost of capital.[4] According to the National Association of Regulatory and Utility Commissioners (NARUC) more than half of the state commissions presently rely upon or accept comparable earnings as a method of determining the cost of equity for public utilities.[5] Only about one-third of the state commissions have indicated an acceptance of DCF.

A critical analysis of the use of comparable earnings and DCF in regulation is important for several reasons. First of all, a substantial portion of the total equity capital presently invested in U.S. corporations is invested in the equity of public utilities.[6] Regulatory policies with respect to return on equity can consequently have a significant impact upon the distribution of income and the allocation of capital in the U.S. economy. Furthermore, the choice of one concept or the other is not a moot question because DCF tends rather consistently to produce a lower estimate of the required return than the actual earned returns of alternative comparable investment oppor-

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4 Throughout this paper the term "direct investment" refers to the possibility of directly employing the factors of production, as opposed to purchasing the shares of a firm which in turn employs the factors of production.

5 The source of this information is NARUC's *1975 Annual Report on Utility and Carrier Regulation*.

6 According to Citibank's *Monthly Economic Letter*, April 1977, of a total of $633.27 billion of equity capital invested in the manufacturing, nonfinancial, and financial sectors of the economy, $116.52 billion is invested in public utilities. This figure does not include investment in the regulated sector of the transportation industry.

tunities.[7] It is necessary to determine the reason for this difference if regulation is to serve the public interest. Too high a return will only result in unnecessary investment and serve to aggravate the effect of rising utility costs on the cost of living. But too low a return will be no less disastrous to the public welfare if it results in inadequate investment to serve the public need for future generating capacity or the development of future gas supplies. The subject is also deserving of attention because the conclusions reported here do not speak well of the present effectiveness of rate-of-return regulation in serving the public interest. The comparable earnings approach, which is more widely used and relied upon than any other method in regulation, suffers from a number of conceptual and methodological infirmities that render it inappropriate as a regulatory tool for determining the cost of equity. The body of the paper that follows begins with a review and critique of the comparable earnings concept as it is applied in regulation, and argues, among other things, that the comparable earnings approach violates a fundamental marginal condition necessary to achieve efficiency in the allocation of capital, and generally results in an overestimate of the cost of equity. The paper then reviews the corresponding strengths and weaknesses of the DCF approach and suggests that DCF embodies a proper concept of return at the margin that makes it preferable to comparable earnings as a regulatory tool for determining the cost of equity for public utilities.

THE COMPARABLE EARNINGS CONCEPT

The origins of comparable earnings analysis in regulation are often traced to decisions of the U.S. Supreme Court in the cases of *Bluefield Water Works & Improvement Co.* v. *Public Service Commission of West Virginia*, 262 U.S. 679 (1923), and *Federal Power Commission* v. *Hope Natural Gas Co.*, 320 U.S. 591 (1944).[8] In the *Hope* decision the Court ruled that

> The rate-making process under the Act, i.e., the fixing of "just and reasonable" rates, involves a balancing of the investor and the consumer interests . . . . From the investor or company point of view it is important that there be enough revenue not only for operating expenses but also for the capital costs of the business. These include service on the debt and dividends on the stock . . . . By that standard the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital . . . . The conditions under which more or less might be allowed are not important here. Nor is it important to this case to determine the various permissible ways in which any rate base on which the return is computed might be arrived at. For we are of the view that the end result in this case cannot be condemned under the Act as unjust and unreasonable from the investor or company viewpoint.[9]

The phrase in *Hope* cited most often to support the comparable earnings concept of fair return is the phrase "the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks." Cost-of-capital witnesses (and regulators) often take the Court's language to mean that a comparable earnings approach to

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[7] For evidence of this fact, see Morton [1970*a*], who cites a study by Ezra Solomon. This writer's experience in rate-of-return regulation will corroborate the finding that comparable earnings estimates of the cost of equity are generally higher than DCF estimates. In this paper the author offers an explanation for this phenomenon.

[8] Kahn [1970, p. 52, note 77], for example, traces the comparable earnings standard to the language of the Court in the *Bluefield* and *Hope* cases.

[9] *F.P.C.* v. *Hope Natural Gas Co.*, 320 U.S. 591 (1944) at 603.

fair return is *prescribed* by law.[10] But as Stewart Myers [1972*a*] once noted, the proponents of the comparable earnings approach in regulation interpret the language of the Court in a particular way, as if to say that: "The return to the equity owner should be commensurate with [*recent book*] returns on [*past*] investments [*made by*] other enterprises having corresponding risks."[11] Before reviewing the conceptual and methodological difficulties inherent in this particular view of fair return, some comment is in order as to whether this particular view of fair return was actually ever *prescribed* by the Court.

The legal and economic implications of *Hope* cannot reasonably be inferred apart from the historic context leading up to the decision. During the half-century preceding *Hope* regulation labored under the perverse burden of *Smythe* v. *Ames*, 169 U.S. 466 (1898). Under the rule of *Smythe* v. *Ames* regulated firms were considered to be entitled to a "fair return" on "fair value." The "fair value" concept was challenged by the institutionalists as an elusive, subjective, and improper standard of value and there developed, under their tutelage, a growing recognition of the superiority of net original cost as a measure of the value of investment in regulated firms. The central issue in the *Hope* case was the Federal Power Commission's use of original cost as a rate base rather than fair value, and the *Hope* decision became a landmark because of the Court's refusal to insist on the use of a fair value rate base. A return was fair, the Court decided, if it provided a return sufficient to cover the operating expenses and capital costs of the business, and it made little difference to the Court if by this standard the firm earned a large return on a small rate base or a small return on a large rate base.[12]

The real meaning of *Hope* was soon lost on everyone. After meandering through a maze of meaningless exercises intended to establish the "true" value of the rate base the Court had finally realized the error of anything other than a pragmatic standard of truth. A careful reading of *Hope* suggests that there remained, once the fair value doctrine was struck down, a *single* standard of fair return: financial viability. No return which enables a firm "to operate successfully, to maintain its integrity, to attract capital, and to compensate its investors for the risks assumed" would henceforth be condemned as unjust, unreasonable, or unfair. The standard of fair return that remained was thus pragmatic and instrumental, and any particular allowed return could now be judged by its effectiveness in action: an allowed return on equity was fair if it maintained the financial viability of the firm and was not, if it did not. Just a year later, in *Panhandle Eastern Pipe Line Co.* v. *Federal Power Commission*, 324 U.S. 635 (1945), the Court said: "We are unable to say . . . that the

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[10] Morton has said: "It is a fact demonstrable from a great deal of testimony that some of those who have used some or all of the four fallacious methods just described, have also rejected the *comparative earnings method prescribed by the* courts [emphasis supplied—B.C.]. In doing this, they have openly admitted that they were not being guided by court decisions. . ." [1970*b*, p. 28]. As noted in the paragraphs to follow, Morton's interpretation of the law is somewhat in error. The Court never prescribed the method of determining the allowable return. The ruling principles of fair return set forth in the *Hope* decision concern the *effect* of the allowed return on the financial well-being of the regulated firm, and not how the return was determined.

[11] Myers [1972, p. 62].

[12] In the *Hope* decision the Court said: "Rates which enable the company to operate successfully, to maintain its 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 only a meager return on the so-called 'fair value' rate base" (*F.P.C.* v. *Hope Natural Gas Co.*, 320 U.S. 591 (1944) at 605).

[13] *Panhandle Eastern Pipe Line Co.* v. *F.P.C.*, 324 U.S. 635 (1945) at 650.

return is not commonsurate with the risks, that confidence in petitioner's financial integrity has been impaired, or that petitioner's ability to attract capital, to maintain its credit, and to operate successfully and efficiently has been impeded."[13] Since there was no evidence to suggest that the allowed return had in any way impaired the financial integrity of the enterprise, the Court applied the pragmatic standard of *Hope* and ruled that the allowed return was thus fair and reasonable.

Hope was an ambitious effort on the part of the Court to release regulation from the subjectivism inherent in the determination of fair return on fair value by substituting a pragmatic standard of fair return that looked to the effect or end-result of regulatory decision-making as the test of whether a regulatory decision was fair and reasonable. Unfortunately, the Court did not foresee that its decision would be wrested from its historic context to impose a set of standards on regulation no less subjective and unmanageable than the standards of *Smythe* v. *Ames*.[14] But in the final analysis the rule of law on this issue seems clear. The constitutional guarantee of due process does not prescribe or require the use of any particular method to determine the fair return but it does *proscribe* regulatory decisions which are arbitrary, capricious, and unsupported by substantial evidence. Since there is nothing in the law to give favor to one concept of the cost of capital or fair rate of return over any other—the law is only concerned with the end result of any allowed return on the financial viability of the enterprise, and not with the academic subtleties that may cause expert witnesses to prefer one approach over another—the law cannot be used to justify preference for the comparable earnings concept in the absence of any compelling economic argument in its favor. With this in mind we may now proceed to a discussion of the conceptual and methodological problems of comparable earnings as a cost-of-capital concept in regulation.

The comparable earnings method of analysis generally consists of the selection of a sample of firms purported to be comparable in risk to the firm under regulatory review. The mean return on book equity for the group is then taken to be a measure of required return for the applicant firm, i.e., its cost of equity. There is a temptation on the part of some to refer to this as an "opportunity cost" approach.[15] The thought seems to be

[14] See Leventhal [1965] and Roseman [1970] for examples of authors who attempt to distinguish between comparable earnings and capital attraction as separate (and sometimes conflicting) standards of fair return. In view of the present tendency to make this distinction, the predictions of Ben Lewis [1966] in the following memorable quotation seem painfully prescient; speaking of the "several" standards of fair return, he said:

> All of these, taken together, constitute a direct, functional workable approach. What shall we do with it? I suggest that we follow it, simply, positively and with determined purpose. I must warn you that there is reason to fear that we will not proceed in this fashion. Instead, as we begin in sheer disgust to move away from the debacle of valuation, we will probably substitute a new form of Roman holiday—long-drawn-out, costly, confusing, expert-contrived presentations, in which the simple directions of the *Hope* and *Bluefield* cases are turned into veritable witches' brews of statistical elaboration and manipulation. I have recently been witness to such an exercise—an attempt to establish "comparability" between utilities and certain industrials. It was a fearsome business—a scientific facade, and a parade of evidence and calculations leading to the "establishment" of predetermined conclusions, which the exercise permitted but certainly did not establish. We do not need to do this sort of thing to regulation; we do not need to do it to ourselves. The behavior of investors will tell us, day by day, all we need to know about "comparability." If, by the grace of God, we manage to free ourselves from the clutches of calculations to determine "scientifically" and "expertly" the substantive content of each of the *Hope* and *Bluefield* criteria as independent, competing variables, we will deserve the fate that will certainly overtake us—the demise of regulation as an institution, and the sooner the better [Lewis 1966, pp. 242, 243].

[15] Commenting on a witness's characterization of his comparable earnings analysis as an opportunity cost approach the Iowa State Commerce Commission has said, "[His] application of the opportunity cost method ignores the marketplace and is founded on the myth that earnings on book value can be used as the alternative investment opportunities. An investor cannot normally purchase a stock at book value, he must purchase at the market price" (*Re Northwestern Bell Teleph. Co.*, 97 PUR 3d 444, at 459).

that by investing in the applicant firm the investors have foregone the opportunity to earn the return earned by the comparable firms. But it is not clear that the investors in the applicant firm would necessarily relish the opportunity to earn a similar return; what if the comparable firms are earning less than the cost of equity? As a way around this problem some witnesses are careful to select only those firms with "adequate returns."[16] The logical inconsistency of this practice apparently escapes them. The purpose of comparable earnings analysis is to *determine* an adequate return and it is difficult to imagine how anyone can employ the findings of a study as an a priori criterion for the selection of the data that goes into the study! Where this happens it is obvious that the end result of the study is a foregone conclusion consistent with the analyst's subjective conception of what he thinks the return ought to be.

As an alternative to the selection of a specific sample that may be criticized for omitting firms with low returns, some witnesses use the return earned on broad market aggregates such as Standard & Poor's 425 as a measure of the opportunity cost of capital for public utilities. This procedure avoids the problem of arbitrarily omitting certain firms from the analysis, and has a certain conceptual appeal for some (to be discussed later), but presents problems of its own. In the first place, there is the question of whether the earned rate of return on a broad market aggregate is an accurate reflection of the economic return to capital. Solomon [1970] argues that accounting rates of return will tend to overestimate the economic or true return on capital. Stauffer [1971] counters with an argument that accounting rates of return may underestimate the economic return on capital, but he does acknowledge that accounting rates of return in some industries (e.g., the pharmaceutical industry) overstate considerably the economic return on capital, and to a lesser extent in some other industries (e.g., the chemical industry and the nonferrous metals industry). A slightly different attack on the reliability of accounting rates of return is offered by Ayanian [1975], Bloch [1974], and Clarkson [1977] who argue that accounting rates of return are biased upward in many industries by the practice of expensing outlays on advertising, research, and development.[17] And apart from these observations we should expect the average earned return on market aggregates to overstate the average return to capital in a competitive market environment because the aggregates include survivors only and exclude firms that have gone bankrupt. In the light of these comments, it seems clear that accounting rates of return on market aggregates are generally unreliable and are most likely biased upward.

Apart from the problem of measurement inherent in the use of earned returns on market aggregates, there is the nagging problem of comparability. Even if one somehow succeeds in determining the economic return on book equity for a broad market aggregate, it does not neces-

[16] See, for example, the testimony of John K. Langum [1975].

[17] In the foreword to Clarkson's [1977] book, Brozen quite succinctly states the problem encountered when measuring accounting rates of return for industrial and manufacturing firms:

> Accounting rates of return are generally biased upward because accounting principles are "conservative." That is, accountants usually charge to current expense intangible investments such as organization costs, costs of establishing trade connections and of breaking in equipment, expenditures on recruiting, selecting, and training personnel, outlays on promotion (including advertising), and outlays on research and development. All these activities produce future income and therefore create economic assets. But accountants do not record such "intangible" assets, with the result that the rate of return obtained by expressing income as a percentage of recorded assets is overstated because the cost of assets is understated [Brozen 1977, p. 7]

sarily follow that this is a proper standard of return for public utilities. The proper return for a regulated firm is one that is "commensurate with the returns on investments in other enterprises having *corresponding* risks." It has long been a convention in regulation to think that investments in the regulated sector are exposed to less risk than investments in the competitive sector.[18] But only recently have developments in the theory of risk measurement provided economists with a conceptual basis for measuring risk. Sharpe [1964], Lintner [1965], and Mossin [1966] have shown that the equilibrium expected return on a capital asset will be a linear function of the systematic risk of the asset where systematic risk is measured by the covariance of the asset's returns with the returns to a "market" portfolio consisting of all risky assets, divided by the variance of the returns to the market portfolio.[19] Quantitative estimates of systematic risk for common stocks are obtained by regressing holding period returns for the stocks on the market returns. The regression coefficient, or "beta", is an estimate of systematic risk.[20]

The use of beta as a measure of risk in a regulatory proceeding has been criticized by Breen and Lerner [1972] and defended by Myers [1972*b*]. A common concern is whether beta is a reliable measure of risk for *individual* firms. Blume [1971] and Levy [1971] have shown that individual betas estimated for relatively short holding periods tend to be unstable. But there are methods of adjusting betas for this instability.[21] Problems relating to the measurement and use of beta are not formidable and should not be exaggerated to the point where the positive value of beta as a measure of risk is ignored. Melicher [1975] has shown that there is an empirical link between systematic risk and financial characteristics for regulated firms, corroborating a similar finding for broader groups of firms by Beaver, Kettler, and Scholes [1970] and Beaver and Manegold [1975].[22] These findings suggest that beta is useful as an objective measure of risk for assessing the degree of comparability between utilities and nonregulated firms. This observation has a bearing on the use of market aggregates in comparable earnings studies because these aggregates are essentially identical to "the market." Since utilities with few exceptions have betas less than one, the use of the aggregates as a comparable investment opportunity is not consistent with the criteria that the allowed return be one which is "commensurate with the returns on investments in other enterprises having corresponding risks."[23]

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[18] Keynes was of this view. In *The General Theory of Employment, Interest, and Money* he said: "In the case of another important class of long-term investments, namely public utilities, a substantial proportion of the prospective yield is practically guaranteed by monopoly privileges coupled with the right to charge such rates as will provide a certain stipulated margin" [Keynes 1965, p. 163].

[19] The fundamental proposition of the capital asset pricing model is that the equilibrium expected return on a risky asset i is

$$E(R_i) = R_f + \beta_i[E(R_m) - R_f]$$

where R_f is the return on a risk-free asset, $E(R_m)$ is the expected return on the market, and β_i is $\mathrm{COV}(R_i, R_m)/\mathrm{VAR}(R_m)$. The expected return on i varies directly with its β, which is a measure of its systematic risk.

[20] Beta can be considered a measure of relative volatility, with the market beta having a value of unity. A security with a beta of 2.0 is twice as volatile as the market, and a security with a beta of 0.5 is only half as volatile as the market.

[21] Klemkosky and Martin [1975] have evaluated the various methods of adjusting betas.

[22] However, Melicher and Rush [1974] failed to establish a link between changes in betas over time and changes in financial characteristics.

[23] No effort is made in this paper to assess the use of the capital asset pricing model as a method of estimating the cost of equity in regulation because it has not (yet) been widely employed for that purpose. It is even doubtful to this writer that it can be employed to estimate the cost of equity. Application is contingent upon a

The problems discussed thus far are essentially methodological and it is not inconceivable that a comparable earnings analysis could be so constructed that the earned returns are accurately computed and the sampled firms are actually comparable in terms of market risk. There remains a conceptual problem of some significance. The proponents of the comparable earnings approach argue that the goal of regulation is to approximate in the utility industry the rate-of-return conditions effected by competition in competitive unregulated industries, and that the regulatory authorities should therefore look to the average rate of return earned in competitive unregulated industries as a benchmark or standard of fair return for the regulated firm. But the only economic rationale for using competition as a prescriptive model for regulation is to effect in the regulated sector the allocative efficiency that would exist if utilities operated in a competitive market. This implies that regulation should seek to achieve the same *marginal conditions* that exist under conditions of competition. This result is not obtained when regulators use comparable earnings as a standard of fair return.

In a competitive industry the capitalized value of old plant will tend to equal the cost of constructing and operating competitive (new) plant at current prices, and new capital will enter the industry as long as demand is sufficient to permit the new firm to earn a return equal to or greater than the cost of capital.[24] The marginal firm, which earns a return just equal to the cost of capital, is constructed and operated at current prices so its book value and market value are the same. Intramarginal firms may have capitalized values in excess of book value, and earn a return greater than the cost of capital, but the excess return is a rent that is capitalized in the value of the firm and it is not an element of opportunity cost to capital employed elsewhere: new capital cannot enter the industry and earn any more than the return earned by the marginal firm in the industry. And as long as the industry supply curve is upward sloping, it follows that the average return on investment (ARI) for the industry will exceed the marginal return on investment (MRI).

Now consider what will happen if the regulatory authorities use a competitive unregulated industry with an upward sloping supply curve as a comparable investment alternative and allow a firm under regulatory review a return on in-

proper determination of the market risk premium. So far this market risk premium has been estimated by subtracting market yields or holding period returns for a risk-free asset (Treasury Bills) from ex post market returns. The use of ex post returns to estimate yield spreads poses problems that are apparently unappreciated by those working within the CAPM paradigm. Just to take a simple example, suppose a risk-free bond with a $10 coupon is selling to yield 5%, and a risky asset with a constant dividend of $10 is selling to yield 10%. The yield spread is 5%. Now suppose the yields increase to 10% and 15%, respectively, thus maintaining the 5% yield spread. The holding period return on the risk-free bond will be −50% and the holding period return on the risky asset will be −33 1/3% for a spread of 16 2/3%. This spread of 16 2/3% in the holding period returns is not a very good estimate of the 5% yield spread! The general result is that spreads in ex post returns overestimate the yield spread when yields are rising, and underestimate the yield spread when yields are falling. Ibbotson and Sinquefield [1976] estimated a risk spread between stocks and Treasury Bills over the period 1926–1974 of about 6.1%. Since the dominant secular trend in yields over this period was upward, this ex post return spread most likely overestimates the ex ante yield spread.

[24] Fifty years ago Glaeser [1927] employed a similar argument in his critique of reproduction cost as a rate base in regulation. Anyone interested in the economics of regulation ought to read Glaeser. Much has been written on regulation since his time, but little of it constitutes an intellectual advancement over his insight into the problems and economics of regulation.

vestment equal to the average return on investment earned by the firms in the unregulated industry. At first the use of an average return may seem "fair and reasonable" since it sets as a standard neither the most profitable return nor the least profitable return earned by the purportedly comparable firms. But since it is an average return it is higher than the return that can be earned by any firm in the industry on *new* investment. The "fairness" of the comparable earnings standard is thus illusory. In regulation the allowed return is allowed on *all* investment and there is nothing to stop the regulated firm from engaging in unnecessary investment so as to earn on new investment a higher return than is earned on new investment in the comparable unregulated industry. This breakdown in the comparable earnings standard becomes obvious once it is recognized that the standard violates a necessary marginal condition for allocative efficiency by allowing regulated firms the *average* return on investment in competitive unregulated industries rather than *marginal* return.

This, in the final analysis, is the greatest failing of the comparable earnings concept. The return earned on a broad market aggregate is likely to be biased upward, for all the reasons discussed earlier, as an indication of the average return on investment for competitive unregulated industries. Presuming these problems can be resolved, there remains the fact that the comparable earnings standard is not a measure of what *can* be earned on new investment, but of what *has been* earned on prior investment. The comparable earnings concept thus violates a marginal condition necessary to achieve for regulation the allocative efficiency that would exist under conditions of competition and fails to promote a proper allocation of capital between the regulated and unregulated sectors of the economy.

THE DISCOUNTED CASH FLOW CONCEPT

As an alternative to the comparable earnings approach, a number of commissions have accepted the discounted cash flow model as a conceptual basis for rate of return decisions. As a model of share valuation, the DCF theory was first developed by John Burr Williams [1938] and then later extended, with emphasis on its application in regulation, by Myron Gordon [1974].[25] Theoretical expositions of the model often incorporate restrictive assumptions in order to clarify the relationship between and the effect of the dividend payout rate, internal versus external financing, leverage, etc. But few assumptions are actually necessary to make the concept operationally useful. In fact, the DCF model follows from simply assuming that investors capitalize dividends expected to grow at some constant rate of growth. Whether the assumption is valid or not is a question to be answered empirically.[26] But if the assumption is valid then it follows that current share prices are equal to the current dividend divided by the difference

[25] The DCF model is widely accepted in financial management textbooks as a model of the cost of equity. See, for example, Weston and Brigham [1975]. The third edition of Weston and Brigham [1969] is more explicit in giving Gordon credit for the modern development of DCF.

[26] This writer has shown in Copeland [1977] that the DCF model implies a testable relationship between the ratio of market value to book value and the expected profit rate (return on equity). He found that the model performed well in every year except 1974. He concludes that except during periods of market panic the model is a useful representation of the share valuation process. The assumptions embodied in the model are therefore operationally useful.

between the investor discount rate and the expected rate of growth in the dividend:

$$P = \frac{D}{k - g} \quad [1]$$

where P = the equilibrium market price per share; D = the current dividend per share; k = the investor discount rate, or cost of equity; and g = the expected rate of growth in the dividend. Rearranging [1] gives the familiar DCF identity whereby the cost of equity is inferred to be equal to the sum of the dividend yield and the expected growth rate:

$$k = D/P + g \quad [2]$$

The discounted cash flow model of the cost of equity is a model of the equilibrium expected return or yield on shares. If the expected return (current yield plus expected growth) is greater than the required return, share prices will rise and yields will fall, until equilibrium is restored. But DCF is not only a model of stock market equilibrium, it also implies equilibrium between share yields and the marginal return on direct investment. If, for example, the marginal return on direct investment is greater than the expected return on shares, there will be an incentive for investors to sell their shares, form a new company, and engage in direct investment. At the margin the return that can be earned on direct investment and the return that can be earned on shares will be equal.[27] The result of this equilibrating process is that the DCF yield on shares in a competitive unregulated industry will equal the marginal return on new investment. Since the stockholders of public utilities are always free to sell their shares and either purchase the shares of comparable unregulated enterprises, or engage in direct investment in unregulated industries of corresponding risks, the equilibrium yield on the shares of public utility stocks will tend (through the equilibrating process) to equal the equilibrium yield on shares of comparable unregulated enterprises *and* to equal the marginal return on new investment in unregulated enterprises of corresponding risks. To the extent, therefore, that one properly measures the equilibrium yield on public utility shares, this yield is the true opportunity cost of equity capital for public utilities and equals the marginal return on investments "in other enterprises having corresponding risks." So not only does DCF embody a proper concept of return at the margin, it fulfills, in a way the comparable earnings concept does not, the test of commensurate returns implied by the Supreme Court in the *Hope* case.

Despite general acceptance of DCF as a model of share yield, its use as a cost-of-capital concept in regulation has not been without resistance. The two substantive concerns with the use of DCF in regulation are in regard to: (1) the tendency of a DCF rate of return to drive share prices down to book value, and (2) the appropriateness of using a DCF rate of return with an original cost rate base during periods of inflation. No recommendation regarding the use of DCF in regulation is complete without addressing these issues.

Over an extended period of time the average ratio of market value to book value for industrial firms will tend to be

[27] This statement ignores transactions costs and market imperfections. However, there may be some difference between the marginal return on direct investment and the equilibrium yield on shares because of the greater cost of acquiring information and organizing a direct investment. But the net return on direct investment and the net return on shares will be equal. Since transactions costs for share issues are commonly taken into consideration when setting a rate of return for a public utility, the abstraction taken in the text does not affect the validity of the conclusion.

greater than one.[28] It is not always clear to those involved in the regulatory process why utilities shouldn't be allowed returns that will produce market-to-book ratios of a similar magnitude. The confusion follows from a failure to consider why industrial market-to-book ratios are ever greater than one and to consider whether the same forces are at work in the regulated sector. Average long-run market-to-book ratios greater than one for unregulated enterprises are a consequence of the upward sloping supply curves that characterize competitive industries.[29] As noted earlier, intramarginal firms earn rents that result in capitalized values in excess of book values, but the marginal firm only earns the cost of capital and has a market-to-book ratio of one. For a regulated firm to achieve a market-to-book ratio equal to the average market-to-book ratio for competitive firms of corresponding risks it must be allowed a return equal to the *average* return on investment earned by the competitive firms. This violates the necessary marginal condition for efficiency in the regulated sector. We are back, then, to the problem that results because regulated firms are allowed the same return on all investments (ARI = MRI) while unregulated firms in competitive markets generally operate under conditions of rising supply prices (ARI > MRI). The same prescriptive standard of allocative efficiency that calls for the use of a marginal return (DCF) rather than an average return (comparable earnings) therefore implies that the proper ratio of market value to book value for regulated firms is unity.[30]

Concern about the use of a DCF rate of return with a historical cost rate base results from a failure to acknowledge the efficiency of capital markets in adjusting required rates of return to account for changes in the anticipated rate of inflation. In order to clear up the issue, imagine initial equilibrium with no expected inflation. The required return given by the DCF model, $k = D/P + g$, is an expected real return. When this return is multiplied against an original cost rate base it produces a certain dollar return which we denote R. Now consider the advent of expected inflation with prices expected to grow at a rate Δ. In a manner analogous to the Fisher effect for bonds, the required return on shares will increase to $k' = k + \Delta$. If stocks are a complete hedge against inflation, earnings and dividends will now grow at a rate $g' = g + \Delta$. The DCF yield will now be $k' = D/P + g'$, and when this return is applied against the historical cost rate base it will produce a nominal dollar return R' which has a value of R in real terms (constant dollars). The appropriateness of DCF is not altered if stocks are an incomplete hedge against inflation. In this latter case, prices will fall so that the dividend yield rises a sufficient amount to offset the failure of growth in dividends to adjust by the full amount of the expected increase in prices. The DCF return will still be k', and the allowed dollar return R' will still have a

[28] The average market-to-book ratio for Standard and Poor's 400 Industrials has been 1.66 in the post-war period 1946–1975. Since this figure is biased upward because of the understatement of book values, the actual long-run ratio of market value to book value for industrials is probably between 1.25 and 1.50.

[29] The emphasis on "long run" in this paragraph is to recognize that market-to-book ratios may, for short periods of time (as on the downside of a business cycle), fall below average, and even below one. What matters is the profitability and market-to-book ratio over time as the swings in the business cycle offset one another and establish the long-run pattern of profitability.

[30] Institutionalists such as Clark [1926] and Glaeser [1927] argued long ago that regulators should set the rate of return so that it brings market value into equilibrium with book value.

real value R. There is ample evidence to suggest that equilibrium yields have risen with increases in the rate of inflation.[31] There is, therefore, no need to adjust the rate base for price level changes when using a DCF rate of return.[32]

SUMMARY AND CONCLUSION

In this paper we have looked at the two cost-of-capital concepts most widely employed at the present time in regulation as conceptual bases for recommendations regarding the return on equity to be allowed the regulated firm. The *comparable earnings* approach is currently the most widely employed method, and looks to the earned returns on equity of comparable firms as a purported measure of the opportunity cost of capital invested in the regulated sector. This approach to the cost of equity is subject to infirmities that render it inappropriate as a cost-of-capital concept in regulation. On the one hand are problems of measurement, with accounting rates of return being biased generally upward, and with the lack of comparability of risk between regulated firms and unregulated firms. On the other hand is the conceptual problem following from the fact that earned rates of return on equity are a measure of the average return on investment rather than the marginal return on investment. Since ARI > MRI is the general case for competitive unregulated firms, and since public utilities are allowed a constant return on investment (ARI = MRI), the comparable earnings approach leads to an overestimate of the opportunity cost of capital and fails to promote allocative efficiency.

An alternative cost-of-capital concept in regulation is the *discounted cash flow* concept. This approach bases the allowed return or yield on the shares of public utility stocks. Given the relative mobility of capital flows it can be argued that this share yield is equal to the marginal return on investment earned by "other enterprises having corresponding risks." Since the DCF approach embodies a proper concept of return at the margin, it is preferable to comparable earnings as a regulatory tool for determining the cost of equity for public utilities.

The monetary losses and wealth transfers associated with the use of comparable earnings may be substantial. The author's experience in rate-of-return regulation suggests that the comparable earnings approach overestimates the cost of equity (in absolute differences) by about 2–4%. Given a present equity base of about $116.5 billion, this suggests an overcharge of $20 to $50 billion annually. The use of a conceptually superior method of determining rate of return should have pragmatic appeal to those interested in lower utility rates as well as academic appeal to those who might be interested solely in conceptual implications of alternative cost-of-capital concepts in regulation.

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[31] See Keran [1976] and Copeland [1977] for evidence that share yields have risen with increases in the rate of inflation.

[32] Gordon [1977] has shown that investors will be indifferent between the nominal cost of capital on a historical cost rate base and the real cost of capital on a price-level adjusted rate base.

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Cost of Capital Estimation

The Risk Premium Approach to Measuring a Utility's Cost of Equity

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■ In the mid-1960s, Myron Gordon and others began applying the theory of finance to help estimate utilities' costs of capital. Previously, the standard approach in cost of equity studies was the "comparable earnings method," which involved selecting a sample of unregulated companies whose investment risk was judged to be comparable to that of the utility in question, calculating the average return on book equity (ROE) of these sample companies, and setting the utility's service rates at a level that would permit the utility to achieve the same ROE as comparable companies. This procedure has now been thoroughly discredited (see Robichek [15]), and it has been replaced by three market-oriented (as opposed to accounting-oriented) approaches: (i) the DCF method, (ii) the bond-yield-plus-risk-premium method, and (iii) the CAPM, which is a specific version of the generalized bond-yield-plus-risk-premium approach.

Our purpose in this paper is to discuss the risk-premium approach, including the market risk premium that is used in the CAPM. First, we critique the various procedures that have been used in the past to estimate risk premiums. Second, we present some data on estimated risk premiums since 1965. Third, we examine the relationship between equity risk premiums and the level of interest rates, because it is important, for purposes of estimating the cost of capital, to know just how stable the relationship between risk premiums and interest rates is over time. If stability exists, then one can estimate the cost of equity at any point in time as a function of interest rates as reported in *The Wall Street Journal*, the *Federal Reserve Bulletin*, or some similar source.[1] Fourth, while we do not discuss the CAPM directly, our analysis does have some important implications for selecting a market risk premium for use in that model. Our focus is on utilities, but the methodology is applicable to the estimation of the cost of

[1]For example, the Federal Energy Regulatory Commission's Staff recently proposed that a risk premium be estimated every two years and that, between estimation dates, the last-determined risk premium be added to the current yield on ten-year Treasury bonds to obtain an estimate of the cost of equity to an average utility (Docket RM 80–36). Subsequently, the FCC made a similar proposal ("Notice of Proposed Rulemaking," August 13, 1984, Docket No. 84–800). Obviously, the validity of such procedures depends on (i) the accuracy of the risk premium estimate and (ii) the stability of the relationship between risk premiums and interest rates. Both proposals are still under review.

equity for any publicly traded firm, and also for non-traded firms for which an appropriate risk class can be assessed, including divisions of publicly traded corporations.[2]

Alternative Procedures for Estimating Risk Premiums

In a review of both rate cases and the academic literature, we have identified three basic methods for estimating equity risk premiums: (i) the *ex post*, or historic, yield spread method; (ii) the survey method; and (iii) an *ex ante* yield spread method based on DCF analysis.[3] In this section, we briefly review these three methods.

Historic Risk Premiums

A number of researchers, most notably Ibbotson and Sinquefield [12], have calculated historic holding period returns on different securities and then estimated risk premiums as follows:

$$\text{Historic Risk Premium} = \left(\begin{array}{c}\text{Average of the}\\ \text{annual returns on}\\ \text{a stock index for}\\ \text{a particular}\\ \text{past period}\end{array}\right) - \left(\begin{array}{c}\text{Average of the}\\ \text{annual returns on}\\ \text{a bond index for}\\ \text{the same}\\ \text{past period}\end{array}\right). \quad (1)$$

Ibbotson and Sinquefield (I&S) calculated both arithmetic and geometric average returns, but most of their risk-premium discussion was in terms of the geometric averages. Also, they used both corporate and Treasury bond indices, as well as a T-bill index, and they analyzed all possible holding periods since 1926. The I&S study has been employed in numerous rate cases in two ways: (i) directly, where the I&S historic risk premium is added to a company's bond yield to obtain an estimate of its cost of equity, and (ii) indirectly, where I&S data are used to estimate the market risk premium in CAPM studies.

There are both conceptual and measurement problems with using I&S data for purposes of estimating the cost of capital. Conceptually, there is no compelling reason to think that investors expect the same relative returns that were earned in the past. Indeed, evidence presented in the following sections indicates that relative expected returns should, and do, vary significantly over time. Empirically, the measured historic premium is sensitive both to the choice of estimation horizon and to the end points. These choices are essentially arbitrary, yet they can result in significant differences in the final outcome. These measurement problems are common to most forecasts based on time series data.

The Survey Approach

One obvious way to estimate equity risk premiums is to poll investors. Charles Benore [1], the senior utility analyst for Paine Webber Mitchell Hutchins, a leading institutional brokerage house, conducts such a survey of major institutional investors annually. His 1983 results are reported in Exhibit 1.

Exhibit 1. Results of Risk Premium Survey, 1983*

Assuming a double A, long-term utility bond currently yields 12½%, the common stock for the same company would be fairly priced relative to the bond if its expected return was as follows:

Total Return	Indicated Risk Premium (basis points)	Percent of Respondents
over 20½%	over 800	
20½%	800	
19½%	700	
18½%	600	10%
17½%	500	8%
16½%	400	29%
15½%	300	35%
14½%	200	16%
13½%	100	0%
under 13½%	under 100	1%
Weighted average	358	100%

*Benore's questionnaire included the first two columns, while his third column provided a space for the respondents to indicate which risk premium they thought applied. We summarized Benore's responses in the frequency distribution given in Column 3. Also, in his questionnaire each year, Benore adjusts the double A bond yield and the total returns (Column 1) to reflect current market conditions. Both the question above and the responses to it were taken from the survey conducted in April 1983.

[2]The FCC is particularly interested in risk-premium methodologies, because (i) only eighteen of the 1,400 telephone companies it regulates have publicly-traded stock, and hence offer the possibility of DCF analysis, and (ii) most of the publicly-traded telephone companies have both regulated and unregulated assets, so a corporate DCF cost might not be applicable to the regulated units of the companies.

[3]In rate cases, some witnesses also have calculated the differential between the yield to maturity (YTM) of a company's bonds and its concurrent ROE, and then called this differential a risk premium. In general, this procedure is unsound, because the YTM on a bond is a *future expected* return on the bond's *market value*, while the ROE is the *past realized* return on the stock's *book value*. Thus, comparing YTMs and ROEs is like comparing apples and oranges.

Benore's results, as measured by the average risk premiums, have varied over the years as follows:

Year	Average RP (basis points)
1978	491
1979	475
1980	423
1981	349
1982	275
1983	358

The survey approach is conceptually sound in that it attempts to measure investors' expectations regarding risk premiums, and the Benore data also seem to be carefully collected and processed. Therefore, the Benore studies do provide one useful basis for estimating risk premiums. However, as with most survey results, the possibility of biased responses and/or biased sampling always exists. For example, if the responding institutions are owners of utility stocks (and many of them are), and if the respondents think that the survey results might be used in a rate case, then they might bias upward their responses to help utilities obtain higher authorized returns. Also, Benore surveys large institutional investors, whereas a high percentage of utility stocks are owned by individuals rather than institutions, so there is a question as to whether his reported risk premiums are really based on the expectations of the "representative" investor. Finally, from a pragmatic standpoint, there is a question as to how to use the Benore data for utilities that are not rated AA. The Benore premiums can be applied as an add-on to the own-company bond yields of any given utility only if it can be assumed that the premiums are constant across bond rating classes. *A priori*, there is no reason to believe that the premiums will be constant.

DCF-Based *Ex Ante* Risk Premiums

In a number of studies, the DCF model has been used to estimate the *ex ante* market risk premium, RP_M. Here, one estimates the average expected future return on equity for a group of stocks, k_M, and then subtracts the concurrent risk-free rate, R_F, as proxied by the yield to maturity on either corporate or Treasury securities:[4]

$$RP_M = k_M - R_F. \qquad (2)$$

Conceptually, this procedure is exactly like the I&S approach except that one makes direct estimates of future expected returns on stocks and bonds rather than assuming that investors expect future returns to mirror past returns.

The most difficult task, of course, is to obtain a valid estimate of k_M, the expected rate of return on the market. Several studies have attempted to estimate DCF risk premiums for the utility industry and for other stock market indices. Two of these are summarized next.

Vandell and Kester. In a recently published monograph, Vandell and Kester [18] estimated *ex ante* risk premiums for the period from 1944 to 1978. R_F was measured both by the yield on 90-day T-bills and by the yield on the Standard and Poor's AA Utility Bond Index. They measured k_M as the average expected return on the S&P's 500 Index, with the expected return on individual securities estimated as follows:

$$k_i = \left(\frac{D_1}{P_0}\right)_i + g_i, \qquad (3)$$

where,

D_1 = dividend per share expected over the next twelve months,
P_0 = current stock price,
g = estimated long-term constant growth rate, and
i = the i^{th} stock.

To estimate g_i, Vandell and Kester developed fifteen forecasting models based on both exponential smoothing and trend-line forecasts of earnings and dividends, and they used historic data over several estimating horizons. Vandell and Kester themselves acknowledge that, like the Ibbotson-Sinquefield premiums, their analysis is subject to potential errors associated with trying to estimate expected future growth purely from past data. We shall have more to say about this point later.

[4]In this analysis, most people have used yields on long-term bonds rather than short-term money market instruments. It is recognized that long-term bonds, even Treasury bonds, are not risk free, so an RP_M based on these debt instruments is smaller than it would be if there were some better proxy to the long-term riskless rate. People have attempted to use the T-bill rate for R_F, but the T-bill rate embodies a different average inflation premium than stocks, and it is subject to random fluctuations caused by monetary policy, international currency flows, and other factors. Thus, many people believe that for cost of capital purposes, R_F should be based on long-term securities.

We did test to see how debt maturities would affect our calculated risk premiums. If a short-term rate such as the 30-day T-bill rate is used, measured risk premiums jump around widely and, so far as we could tell, randomly. The choice of a maturity in the 10- to 30-year range has little effect, as the yield curve is generally fairly flat in that range.

Malkiel. Malkiel [14] estimated equity risk premiums for the Dow Jones Industrials using the DCF model. Recognizing that the constant dividend growth assumption may not be valid, Malkiel used a nonconstant version of the DCF model. Also, rather than rely exclusively on historic data, he based his growth rates on Value Line's five-year earnings growth forecasts plus the assumption that each company's growth rate would, after an initial five-year period, move toward a long-run real national growth rate of four percent. He also used ten-year maturity government bonds as a proxy for the riskless rate. Malkiel reported that he tested the sensitivity of his results against a number of different types of growth rates, but, in his words, "The results are remarkably robust, and the estimated risk premiums are all very similar." Malkiel's is, to the best of our knowledge, the first risk-premium study that uses analysts' forecasts. A discussion of analysts' forecasts follows.

Security Analysts' Growth Forecasts

Ex ante DCF risk premium estimates can be based either on expected growth rates developed from time series data, such as Vandell and Kester used, or on analysts' forecasts, such as Malkiel used. Although there is nothing inherently wrong with time series-based growth rates, an increasing body of evidence suggests that primary reliance should be placed on analysts' growth rates. First, we note that the observed market price of a stock reflects the consensus view of investors regarding its future growth. Second, we know that most large brokerage houses, the larger institutional investors, and many investment advisory organizations employ security analysts who forecast future EPS and DPS, and, to the extent that investors rely on analysts' forecasts, the consensus of analysts' forecasts is embodied in market prices. Third, there have been literally dozens of academic research papers dealing with the accuracy of analysts' forecasts, as well as with the extent to which investors actually use them. For example, Cragg and Malkiel [7] and Brown and Rozeff [5] determined that security analysts' forecasts are more relevant in valuing common stocks and estimating the cost of capital than are forecasts based solely on historic time series. Stanley, Lewellen, and Schlarbaum [16] and Linke [13] investigated the importance of analysts' forecasts and recommendations to the investment decisions of individual and institutional investors. Both studies indicate that investors rely heavily on analysts' reports and incorporate analysts' forecast information in the formation of their expectations about stock returns. A representative listing of other work supporting the use of analysts' forecasts is included in the References section. Thus, evidence in the current literature indicates that (i) analysts' forecasts are superior to forecasts based solely on time series data, and (ii) investors do rely on analysts' forecasts. Accordingly, we based our cost of equity, and hence risk premium estimates, on analysts' forecast data.[5]

Risk Premium Estimates

For purposes of estimating the cost of capital using the risk premium approach, it is necessary either that the risk premiums be time-invariant or that there exists a predictable relationship between risk premiums and interest rates. If the premiums are constant over time, then the constant premium could be added to the prevailing interest rate. Alternatively, if there exists a stable relationship between risk premiums and interest rates, it could be used to predict the risk premium from the prevailing interest rate.

To test for stability, we obviously need to calculate risk premiums over a fairly long period of time. Prior to 1980, the only consistent set of data we could find came from Value Line, and, because of the work involved, we could develop risk premiums only once a year (on January 1). Beginning in 1980, however, we began collecting and analyzing Value Line data on a monthly basis, and in 1981 we added monthly estimates from Merrill Lynch and Salomon Brothers to our data base. Finally, in mid-1983, we expanded our analysis to include the IBES data.

Annual Data and Results, 1966–1984

Over the period 1966–1984, we used Value Line data to estimate risk premiums both for the electric utility industry and for industrial companies, using the companies included in the Dow Jones Industrial and Utility averages as representative of the two groups. Value Line makes a five-year growth rate forecast, but it also gives data from which one can develop a longer-term forecast. Since DCF theory calls for a truly long-term (infinite horizon) growth rate, we concluded that it was better to develop and use such a forecast than to

[5]Recently, a new type of service that summarizes the key data from most analysts' reports has become available. We are aware of two sources of such services, the Lynch, Jones, and Ryan's Institutional Brokers Estimate System (IBES) and Zack's Icarus Investment Service. IBES and the Icarus Service gather data from both buy-side and sell-side analysts and provide it to subscribers on a monthly basis in both a printed and a computer-readable format.

Exhibit 2. Estimated Annual Risk Premiums, Nonconstant (Value Line) Model, 1966–1984

January 1 of the Year Reported	Dow Jones Electrics			Dow Jones Industrials			
	k_{Avg}	R_F	RP	k_{Avg}	R_F	RP	(3) ÷ (6)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1966	8.11%	4.50%	3.61%	9.56%	4.50%	5.06%	0.71
1967	9.00%	4.76%	4.24%	11.57%	4.76%	6.81%	0.62
1968	9.68%	5.59%	4.09%	10.56%	5.59%	4.97%	0.82
1969	9.34%	5.88%	3.46%	10.96%	5.88%	5.08%	0.68
1970	11.04%	6.91%	4.13%	12.22%	6.91%	5.31%	0.78
1971	10.80%	6.28%	4.52%	11.23%	6.28%	4.95%	0.91
1972	10.53%	6.00%	4.53%	11.09%	6.00%	5.09%	0.89
1973	11.37%	5.96%	5.41%	11.47%	5.96%	5.51%	0.98
1974	13.85%	7.29%	6.56%	12.38%	7.29%	5.09%	1.29
1975	16.63%	7.91%	8.72%	14.83%	7.91%	6.92%	1.26
1976	13.97%	8.23%	5.74%	13.32%	8.23%	5.09%	1.13
1977	12.96%	7.30%	5.66%	13.63%	7.30%	6.33%	0.89
1978	13.42%	7.87%	5.55%	14.75%	7.87%	6.88%	0.81
1979	14.92%	8.99%	5.93%	15.50%	8.99%	6.51%	0.91
1980	16.39%	10.18%	6.21%	16.53%	10.18%	6.35%	0.98
1981	17.61%	11.99%	5.62%	17.37%	11.99%	5.38%	1.04
1982	17.70%	14.00%	3.70%	19.30%	14.00%	5.30%	0.70
1983	16.30%	10.66%	5.64%	16.53%	10.66%	5.87%	0.96
1984	16.03%	11.97%	4.06%	15.72%	11.97%	3.75%	1.08

use the five-year prediction.[6] Therefore, we obtained data as of January 1 from Value Line for each of the Dow Jones companies and then solved for k, the expected rate of return, in the following equation:

$$P_0 = \sum_{t=1}^{n} \frac{D_t}{(1 + k)^t} + \left(\frac{D_n(1 + g_n)}{k - g_n}\right)\left(\frac{1}{1 + k}\right)^n. \qquad (4)$$

Equation (4) is the standard nonconstant growth DCF model; P_0 is the current stock price; D_t represents the forecasted dividends during the nonconstant growth period; n is the years of nonconstant growth; D_n is the first constant growth dividend; and g_n is the constant, long-run growth rate after year n. Value Line provides D_t values for t = 1 and t = 4, and we interpolated to obtain D_2 and D_3. Value Line also gives estimates for ROE and for the retention rate (b) in the terminal year, n, so we can forecast the long-term growth rate as g_n = b(ROE). With all the values in Equation (4) specified except k, we can solve for k, which is the DCF rate of return that would result if the Value Line forecasts were met, and, hence, the DCF rate of return implied in the Value Line forecast.[7]

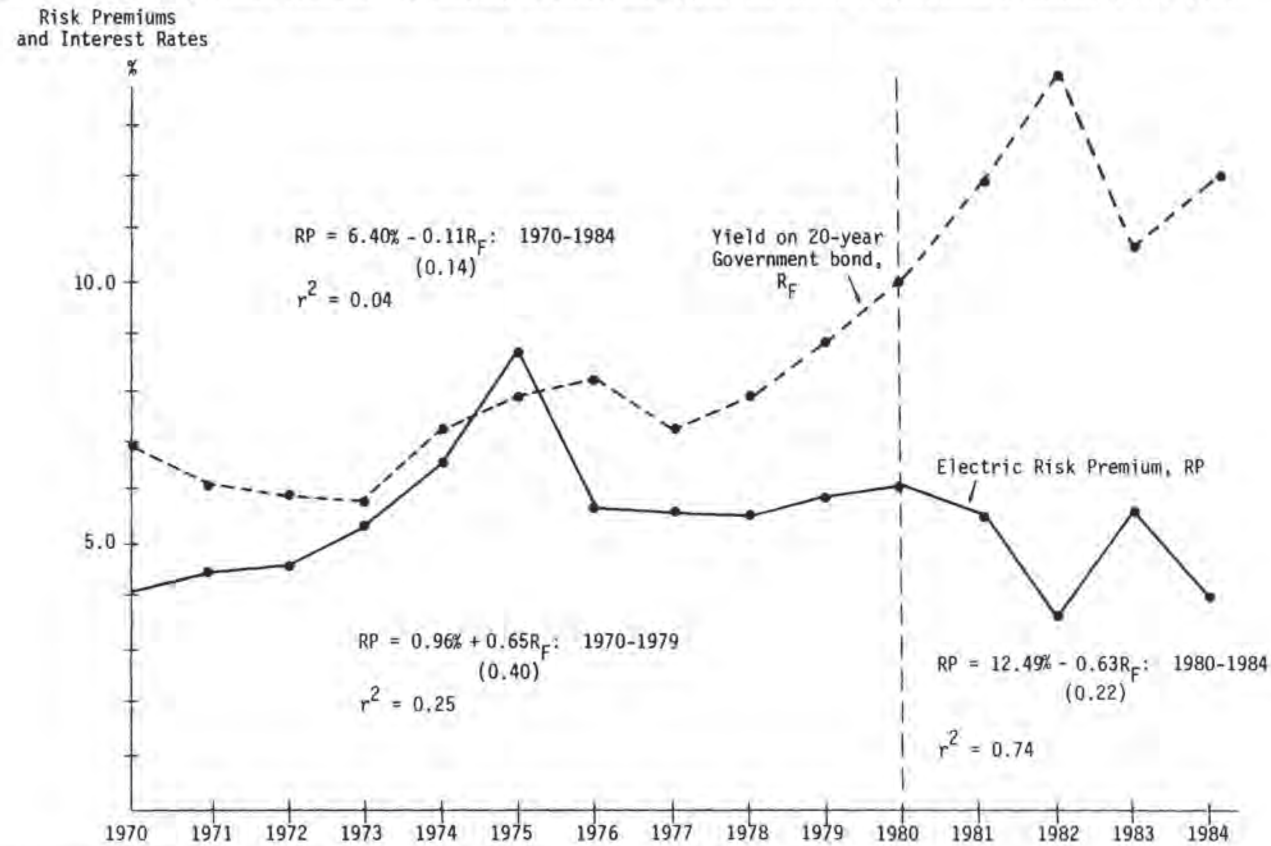
Having estimated a k value for each of the electric and industrial companies, we averaged them (using market-value weights) to obtain a k value for each group, after which we subtracted R_F (taken as the December 31 yield on twenty-year constant maturity Treasury bonds) to obtain the estimated risk premiums shown in Exhibit 2. The premiums for the electrics are plotted in Exhibit 3, along with interest rates. The following points are worthy of note:

1. Risk premiums fluctuate over time. As we shall see in the next section, fluctuations are even wider when measured on a monthly basis.
2. The last column of Exhibit 2 shows that risk premi-

[6] This is a debatable point. Cragg and Malkiel, as well as many practicing analysts, feel that most investors actually focus on five-year forecasts. Others, however, argue that five-year forecasts are too heavily influenced by base-year conditions and/or other nonpermanent conditions for use in the DCF model. We note (i) that most published forecasts do indeed cover five years, (ii) that such forecasts are typically "normalized" in some fashion to alleviate the base-year problem, and (iii) that for relatively stable companies like those in the Dow Jones averages, it generally does not matter greatly if one uses a normalized five-year or a longer-term forecast, because these companies meet the conditions of the constant-growth DCF model rather well.

[7] Value Line actually makes an explicit price forecast for each stock, and one could use this price, along with the forecasted dividends, to develop an expected rate of return. However, Value Line's forecasted stock price builds in a forecasted *change* in k. Therefore, the forecasted price is inappropriate for use in estimating current values of k.

Exhibit 3. Equity Risk Premiums for Electric Utilities and Yields on 20-Year Government Bonds, 1970–1984*



*Standard errors of the coefficients are shown in parentheses below the coefficients.

ums for the utilities increased relative to those for the industrials from the mid-1960s to the mid-1970s. Subsequently, the perceived riskiness of the two groups has, on average, been about the same.

3. Exhibit 3 shows that, from 1970 through 1979, utility risk premiums tended to have a positive association with interest rates: when interest rates rose, so did risk premiums, and vice versa. However, beginning in 1980, an inverse relationship appeared: rising interest rates led to declining risk premiums. We shall discuss this situation further in the next section.

Monthly Data and Results, 1980–1984

In early 1980, we began calculating risk premiums on a monthly basis. At that time, our only source of analysts' forecasts was Value Line, but beginning in 1981 we also obtained Merrill Lynch and Salomon Brothers' data, and then, in mid-1983, we obtained IBES data. Because our focus was on utilities, we restricted our monthly analysis to that group.

Our 1980–1984 monthly risk premium data, along with Treasury bond yields, are shown in Exhibits 4 and 5 and plotted in Exhibits 6, 7, and 8. Here are some comments on these Exhibits:

1. Risk premiums, like interest rates and stock prices, are volatile. Our data indicate that it would not be appropriate to estimate the cost of equity by adding the current cost of debt to a risk premium that had been estimated in the past. Current risk premiums should be matched with current interest rates.
2. Exhibit 6 confirms the 1980–1984 section of Exhibit 3 in that it shows a strong inverse relationship between interest rates and risk premiums; we shall discuss shortly why this relationship holds.
3. Exhibit 7 shows that while risk premiums based on Value Line, Merrill Lynch, and Salomon Brothers

Exhibit 4. Estimated Monthly Risk Premiums for Electric Utilities Using Analysts' Growth Forecasts, January 1980–June 1984

Beginning of Month	Value Line	Merrill Lynch	Salomon Brothers	Average Premiums	20-Year Treasury Bond Yield, Constant Maturity Series
Jan 1980	6.21%	NA	NA	6.21%	10.18%
Feb 1980	5.77%	NA	NA	5.77%	10.86%
Mar 1980	4.73%	NA	NA	4.73%	12.59%
Apr 1980	5.02%	NA	NA	5.02%	12.71%
May 1980	4.73%	NA	NA	4.73%	11.04%
Jun 1980	5.09%	NA	NA	5.09%	10.37%
Jul 1980	5.41%	NA	NA	5.41%	9.86%
Aug 1980	5.72%	NA	NA	5.72%	10.29%
Sep 1980	5.16%	NA	NA	5.16%	11.41%
Oct 1980	5.62%	NA	NA	5.62%	11.75%
Nov 1980	5.09%	NA	NA	5.09%	12.33%
Dec 1980	5.65%	NA	NA	5.65%	12.37%
Annual Avg.	5.35%			5.35%	11.31%
Jan 1981	5.62%	4.76%	5.63%	5.34%	11.99%
Feb 1981	4.82%	4.87%	5.16%	4.95%	12.48%
Mar 1981	4.70%	3.73%	4.97%	4.47%	13.10%
Apr 1981	4.24%	3.23%	4.52%	4.00%	13.11%
May 1981	3.54%	3.24%	4.24%	3.67%	13.51%
Jun 1981	3.57%	4.04%	4.27%	3.96%	13.39%
Jul 1981	3.61%	3.63%	4.16%	3.80%	13.32%
Aug 1981	3.17%	3.05%	3.04%	3.09%	14.23%
Sep 1981	2.11%	2.24%	2.35%	2.23%	14.99%
Oct 1981	2.83%	2.64%	3.24%	2.90%	14.93%
Nov 1981	2.08%	2.49%	3.03%	2.53%	15.27%
Dec 1981	3.72%	3.45%	4.24%	3.80%	13.12%
Annual Avg.	3.67%	3.45%	4.07%	3.73%	13.62%
Jan 1982	3.70%	3.37%	4.04%	3.70%	14.00%
Feb 1982	3.05%	3.37%	3.70%	3.37%	14.37%
Mar 1982	3.15%	3.28%	3.75%	3.39%	13.96%

Beginning of Month	Value Line	Merrill Lynch	Salomon Brothers	Average Premiums	20-Year Treasury Bond Yield, Constant Maturity Series
Apr 1982	3.49%	3.61%	4.29%	3.80%	13.69%
May 1982	3.08%	4.25%	3.91%	3.75%	13.47%
Jun 1982	3.16%	4.51%	4.72%	4.13%	13.53%
Jul 1982	2.57%	4.21%	4.21%	3.66%	14.48%
Aug 1982	4.33%	4.83%	5.27%	4.81%	13.69%
Sep 1982	4.08%	5.14%	5.58%	4.93%	12.40%
Oct 1982	5.35%	5.24%	6.34%	5.64%	11.95%
Nov 1982	5.67%	5.95%	6.91%	6.18%	10.97%
Dec 1982	6.31%	6.71%	7.45%	6.82%	10.52%
Annual Avg.	4.00%	4.54%	5.01%	4.52%	13.09%
Jan 1983	5.64%	6.04%	6.81%	6.16%	10.66%
Feb 1983	4.68%	5.99%	6.10%	5.59%	11.01%
Mar 1983	4.99%	6.89%	6.43%	6.10%	10.71%
Apr 1983	4.75%	5.82%	6.31%	5.63%	10.84%
May 1983	4.50%	6.41%	6.24%	5.72%	10.57%
Jun 1983	4.29%	5.21%	6.16%	5.22%	10.90%
Jul 1983	4.78%	5.72%	6.42%	5.64%	11.12%
Aug 1983	3.89%	4.74%	5.41%	4.68%	11.78%
Sep 1983	4.07%	4.90%	5.57%	4.85%	11.71%
Oct 1983	3.79%	4.64%	5.38%	4.60%	11.64%
Nov 1983	2.84%	3.77%	4.46%	3.69%	11.90%
Dec 1983	3.36%	4.27%	5.00%	4.21%	11.83%
Annual Avg.	4.30%	5.37%	5.86%	5.17%	11.22%
Jan 1984	4.06%	5.04%	5.65%	4.92%	11.97%
Feb 1984	4.25%	5.37%	5.96%	5.19%	11.76%
Mar 1984	4.73%	6.05%	6.38%	5.72%	12.12%
Apr 1984	4.78%	5.33%	6.32%	5.48%	12.51%
May 1984	4.36%	5.30%	6.42%	5.36%	12.78%
Jun 1984	3.54%	4.00%	5.63%	4.39%	13.60%

Exhibit 5. Monthly Risk Premiums Based on IBES Data

Beginning of Month	Average of Merrill Lynch, Salomon Brothers, and Value Line Premiums for Dow Jones Electrics	IBES Premiums for Dow Jones Electrics	IBES Premiums for Entire Electric Industry
Aug 1983	4.68%	4.10%	4.16%
Sep 1983	4.85%	4.43%	4.27%
Oct 1983	4.60%	4.31%	3.90%
Nov 1983	3.69%	3.36%	3.36%
Dec 1983	4.21%	3.86%	3.54%
Jan 1984	4.92%	4.68%	4.18%

Beginning of Month	Average of Merrill Lynch, Salomon Brothers, and Value Line Premiums for Dow Jones Electrics	IBES Premiums for Dow Jones Electrics	IBES Premiums for Entire Electric Industry
Feb 1984	5.19%	5.00%	4.36%
Mar 1984	5.72%	5.35%	4.45%
Apr 1984	5.48%	5.33%	4.23%
May 1984	5.36%	5.26%	4.30%
Jun 1984	4.39%	4.47%	3.40%
Average Premiums	4.83%	4.56%	4.01%

Exhibit 6. Utility Risk Premiums and Interest Rates, 1980–1984

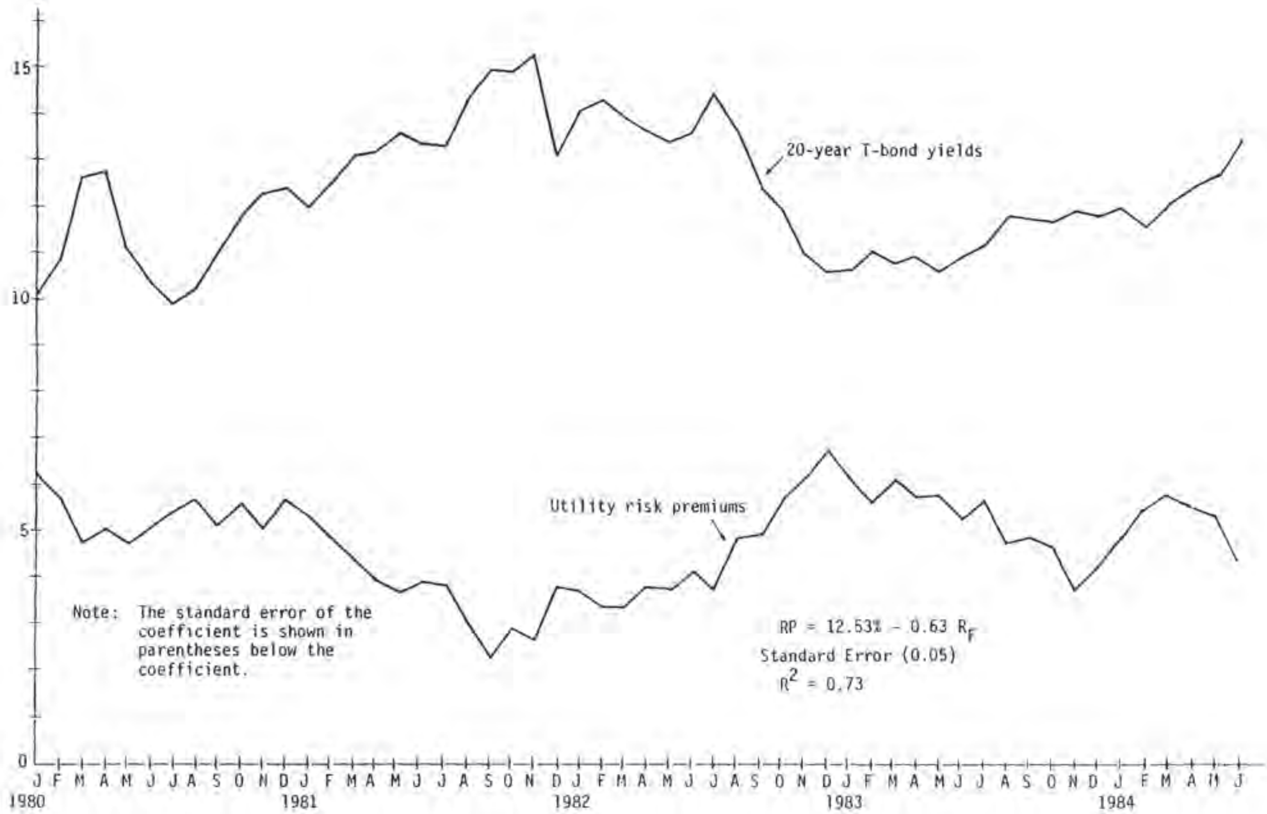


Exhibit 7. Monthly Risk Premiums, Electric Utilities, 1981–1984 (to Date)

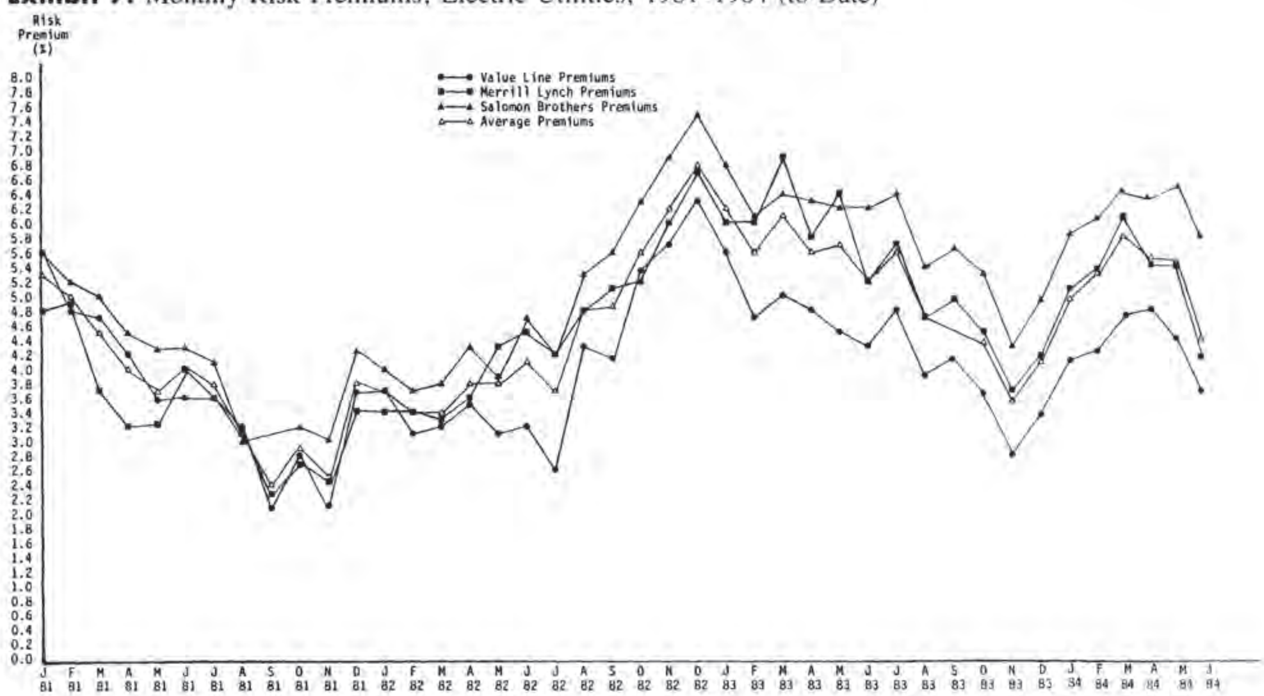
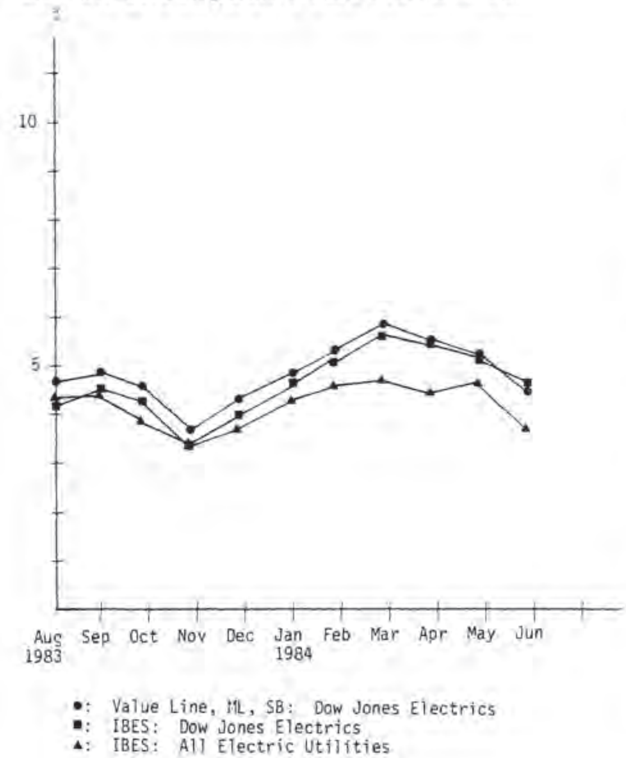


Exhibit 8. Comparative Risk Premium Data



do differ, the differences are not large given the nature of the estimates, and the premiums follow one another closely over time. Since all of the analysts are examining essentially the same data and since utility companies are not competitive with one another, and hence have relatively few secrets, the similarity among the analysts' forecasts is not surprising.

4. The IBES data, presented in Exhibit 5 and plotted in Exhibit 8, contain too few observations to enable us to draw strong conclusions, but (i) the Dow Jones Electrics risk premiums based on our three-analyst data have averaged 27 basis points above premiums based on the larger group of analysts surveyed by IBES and (ii) the premiums on the 11 Dow Jones Electrics have averaged 54 basis points higher than premiums for the entire utility industry followed by IBES. Given the variability in the data, we are, at this point, inclined to attribute these differences to random fluctuations, but as more data become available, it may turn out that the differences are statistically significant. In particular, the 11 electric utilities included in the Dow Jones Utility Index all have large nuclear investments, and this may cause them to be regarded as riskier than the industry average, which includes both nuclear and non-nuclear companies.

Tests of the Reasonableness of the Risk Premium Estimates

So far our claims to the reasonableness of our risk-premium estimates have been based on the reasonableness of our variable measures, particularly the measures of expected dividend growth rates. Essentially, we have argued that since there is strong evidence in the literature in support of analysts' forecasts, risk premiums based on these forecasts are reasonable. In the spirit of positive economics, however, it is also important to demonstrate the reasonableness of our results more directly.

It is theoretically possible to test for the validity of the risk-premium estimates in a CAPM framework. In a cross-sectional estimate of the CAPM equation,

$$(k - R_F)_i = \alpha_0 + \alpha_1\beta_i + u_i, \qquad (5)$$

we would expect

$$\hat{\alpha}_0 = 0 \text{ and } \hat{\alpha}_1 = k_M - R_F = \text{Market risk premium.}$$

This test, of course, would be a joint test of both the CAPM and the reasonableness of our risk-premium estimates. There is a great deal of evidence that questions the empirical validity of the CAPM, especially when applied to regulated utilities. Under these conditions, it is obvious that no unambiguous conclusion can be drawn regarding the efficacy of the premium estimates from such a test.[8]

A simpler and less ambiguous test is to show that the risk premiums are higher for lower rated firms than for higher rated firms. Using 1984 data, we classified the

[8]We carried out the test on a monthly basis for 1984 and found positive but statistically insignificant coefficients. A typical result (for April 1984) follows:

$$(k - R_F)_i = \underset{(0.91)}{3.1675} + \underset{(1.44)}{1.8031}\ \beta_i.$$

The figures in parentheses are standard errors. Utility risk premiums do increase with betas, but the intercept term is not zero as the CAPM would predict, and α_1 is both less than the predicted value and not statistically significant. Again, the observation that the coefficients do not conform to CAPM predictions could be as much a problem with CAPM specification for utilities as with the risk premium estimates.

A similar test was carried out by Friend, Westerfield, and Granito [9]. They tested the CAPM using expectational (survey) data rather than *ex post* holding period returns. They actually found their coefficient of β_i to be negative in all their cross-sectional tests.

Exhibit 9. Relationship between Risk Premiums and Bond Ratings, 1984*

Month	Aaa/AA	AA	Aa/A	A	A/BBB	BBB	Below BBB
January†	—	2.61%	3.06%	3.70%	5.07%	4.90%	9.45%
February	2.98%	3.17%	3.36%	4.03%	5.26%	5.14%	7.97%
March	2.34%	3.46%	3.29%	4.06%	5.43%	5.02%	8.28%
April	2.37%	3.03%	3.29%	3.88%	5.29%	4.97%	6.96%
May	2.00%	2.48%	3.42%	3.72%	4.72%	6.64%	8.81%
June	0.72%	2.17%	2.46%	3.16%	3.76%	5.00%	5.58%
Average	2.08%	2.82%	3.15%	3.76%	4.92%	5.28%	7.84%

*The risk premiums are based on IBES data for the electric utilities followed by both IBES and Salomon Brothers. The number of electric utilities followed by both firms varies from month to month. For the period between January and June 1984, the number of electrics followed by both firms ranged from 96 to 99 utilities.
†In January, there were no Aaa/AA companies. Subsequently, four utilities were upgraded to Aaa/AA.

utility industry into risk groups based on bond ratings. For each rating group, we estimated the average risk premium. The results, presented in Exhibit 9, clearly show that the lower the bond rating, the higher the risk premiums. Our premium estimates therefore would appear to pass this simple test of reasonableness.

Risk Premiums and Interest Rates

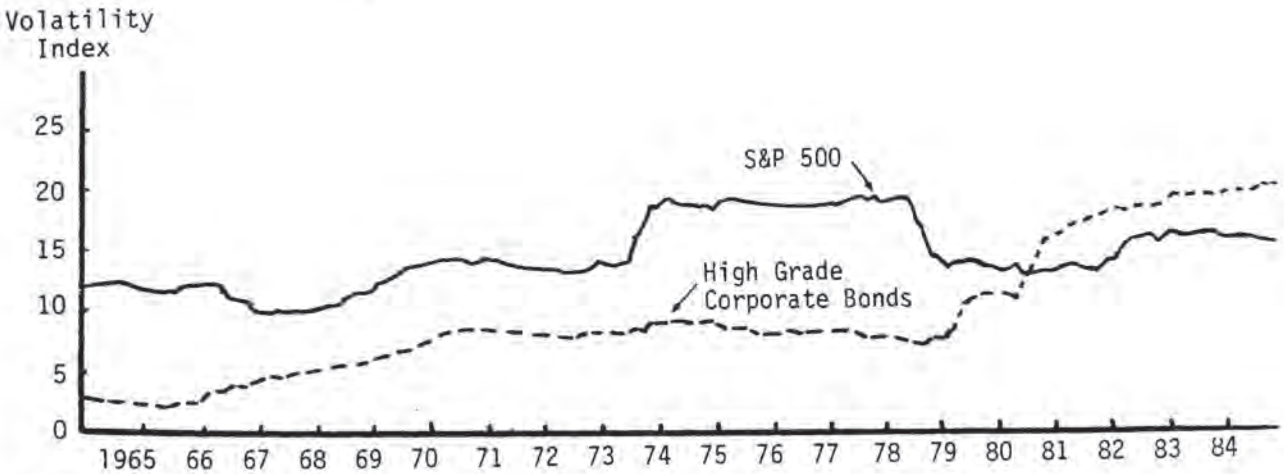
Traditionally, stocks have been regarded as being riskier than bonds because bondholders have a prior claim on earnings and assets. That is, stockholders stand at the end of the line and receive income and/or assets only after the claims of bondholders have been satisfied. However, if interest rates fluctuate, then the holders of long-term bonds can suffer losses (either realized or in an opportunity cost sense) even though they receive all contractually due payments. Therefore, if investors' worries about "interest rate risk" versus "earning power risk" vary over time, then perceived risk differentials between stocks and bonds, and hence risk premiums, will also vary.

Any number of events could occur to cause the perceived riskiness of stocks versus bonds to change, but probably the most pervasive factor, over the 1966–1984 period, is related to inflation. Inflationary expectations are, of course, reflected in interest rates. Therefore, one might expect to find a relationship between risk premiums and interest rates. As we noted in our discussion of Exhibit 3, risk premiums were positively correlated with interest rates from 1966 through 1979, but, beginning in 1980, the relationship turned negative. A possible explanation for this change is given next.

1966–1979 Period. During this period, inflation heated up, fuel prices soared, environmental problems surfaced, and demand for electricity slowed even as expensive new generating units were nearing completion. These cost increases required offsetting rate hikes to maintain profit levels. However, political pressure, combined with administrative procedures that were not designed to deal with a volatile economic environment, led to long periods of "regulatory lag" that caused utilities' earned ROEs to decline in absolute terms and to fall far below the cost of equity. These factors combined to cause utility stockholders to experience huge losses: S&P's Electric Index dropped from a mid-1960s high of 60.90 to a mid-1970s low of 20.41, a decrease of 66.5%. Industrial stocks also suffered losses during this period, but, on average, they were only one third as severe as the utilities' losses. Similarly, investors in long-term bonds had losses, but bond losses were less than half those of utility stocks. Note also that, during this period, (i) bond investors were able to reinvest coupons and maturity payments at rising rates, whereas the earned returns on equity did not rise, and (ii) utilities were providing a rising share of their operating income to debtholders versus stockholders (interest expense/book value of debt was rising, while net income/common equity was declining). This led to a widespread belief that utility commissions would provide enough revenues to keep utilities from going bankrupt (barring a disaster), and hence to protect the bondholders, but that they would not necessarily provide enough revenues either to permit the expected rate of dividend growth to occur or, perhaps, even to allow the dividend to be maintained.

Because of these experiences, investors came to regard inflation as having a more negative effect on utility stocks than on bonds. Therefore, when fears of inflation increased, utilities' measured risk premiums

Exhibit 10. Relative Volatility* of Stocks and Bonds, 1965–1984



*Volatility is measured as the standard deviation of total returns over the last 5 years.
Source: Merrill Lynch, *Quantitative Analysis*, May/June 1984.

also increased. A regression over the period 1966–1979, using our Exhibit 2 data, produced this result:

$$RP = 0.30\% + \underset{(0.22)}{0.73}\, R_F; \qquad r^2 = 0.48.$$

This indicates that a one percentage point increase in the Treasury bond rate produced, on average, a 0.73 percentage point increase in the risk premium, and hence a 1.00 + 0.73 = 1.73 percentage point increase in the cost of equity for utilities.

1980–1984 Period. The situation changed dramatically in 1980 and thereafter. Except for a few companies with nuclear construction problems, the utilities' financial situations stabilized in the early 1980s, and then improved significantly from 1982 to 1984. Both the companies and their regulators were learning to live with inflation; many construction programs were completed; regulatory lags were shortened; and in general the situation was much better for utility equity investors. In the meantime, over most of the 1980–1984 period, interest rates and bond prices fluctuated violently, both in an absolute sense and relative to common stocks. Exhibit 10 shows the volatility of corporate bonds very clearly. Over most of the eighteen-year period, stock returns were much more volatile than returns on bonds. However, that situation changed in October 1979, when the Fed began to focus on the money supply rather than on interest rates.[9]

In the 1980–1984 period, an increase in inflationary expectations has had a more adverse effect on bonds than on utility stocks. If the expected rate of inflation increases, then interest rates *will increase* and bond prices *will fall*. Thus, uncertainty about inflation translates directly into risk in the bond markets. The effect of inflation on stocks, including utility stocks, is less clear. If inflation increases, then utilities should, in theory, be able to obtain rate increases that would offset increases in operating costs and also compensate for the higher cost of equity. Thus, with "proper" regulation, utility stocks would provide a better hedge against unanticipated inflation than would bonds. This hedge did not work at all well during the 1966–1979 period, because inflation-induced increases in operating and capital costs were not offset by timely rate increases. However, as noted earlier, both the utilities and their regulators seem to have learned to live better with inflation during the 1980s.

Since inflation is today regarded as a major investment risk, and since utility stocks now seem to provide a better hedge against unanticipated inflation than do

[9]Because the standard deviations in Exhibit 10 are based on the last five years of data, even if bond returns stabilize, as they did beginning in 1982, their reported volatility will remain high for several more years. Thus, Exhibit 10 gives a rough indication of the current relative riskiness of stocks versus bonds, but the measure is by no means precise or necessarily indicative of future expectations.

bonds, the interest-rate risk inherent in bonds offsets, to a greater extent than was true earlier, the higher operating risk that is inherent in equities. Therefore, when inflationary fears rise, the perceived riskiness of bonds rises, helping to push up interest rates. However, since investors are today less concerned about inflation's impact on utility stocks than on bonds, the utilities' cost of equity does not rise as much as that of debt, so the observed risk premium tends to fall.

For the 1980–1984 period, we found the following relationship (see Exhibit 6):

$$RP = 12.53\% - \underset{(0.05)}{0.63}\, R_F; \qquad r^2 = 0.73.$$

Thus, a one percentage point increase in the T-bond rate, on average, caused the risk premium to fall by 0.63%, and hence it led to a 1.00 − 0.63 = 0.37 percentage point increase in the cost of equity to an average utility. This contrasts sharply with the pre-1980 period, when a one percentage point increase in interest rates led, on average, to a 1.73 percentage point increase in the cost of equity.

Summary and Implications

We began by reviewing a number of earlier studies. From them, we concluded that, for cost of capital estimation purposes, risk premiums must be based on expectations, not on past realized holding period returns. Next, we noted that expectational risk premiums may be estimated either from surveys, such as the ones Charles Benore has conducted, or by use of DCF techniques. Further, we found that, although growth rates for use in the DCF model can be either developed from time-series data or obtained from security analysts, analysts' growth forecasts are more reflective of investors' views, and, hence, in our opinion are preferable for use in risk-premium studies.

Using analysts' growth rates and the DCF model, we estimated risk premiums over several different periods. From 1966 to 1984, risk premiums for both electric utilities and industrial stocks varied widely from year to year. Also, during the first half of the period, the utilities had smaller risk premiums than the industrials, but after the mid-1970s, the risk premiums for the two groups were, on average, about equal.

The effects of changing interest rates on risk premiums shifted dramatically in 1980, at least for the utilities. From 1965 through 1979, inflation generally had a more severe adverse effect on utility stocks than on bonds, and, as a result, an increase in inflationary expectations, as reflected in interest rates, caused an increase in equity risk premiums. However, in 1980 and thereafter, rising inflation and interest rates increased the perceived riskiness of bonds more than that of utility equities, so the relationship between interest rates and utility risk premiums shifted from positive to negative. Earlier, a 1.00 percentage point increase in interest rates had led, on average, to a 1.73% increase in the utilities' cost of equity, but after 1980 a 1.00 percentage point increase in the cost of debt was associated with an increase of only 0.37% in the cost of equity.

Our study also has implications for the use of the CAPM to estimate the cost of equity for utilities. The CAPM studies that we have seen typically use either Ibbotson-Sinquefield or similar historic holding period returns as the basis for estimating the market risk premium. Such usage implicitly assumes (i) that *ex post* returns data can be used to proxy *ex ante* expectations and (ii) that the market risk premium is relatively stable over time. Our analysis suggests that neither of these assumptions is correct; at least for utility stocks, *ex post* returns data do not appear to be reflective of *ex ante* expectations, and risk premiums are volatile, not stable.

Unstable risk premiums also make us question the FERC and FCC proposals to estimate a risk premium for the utilities every two years and then to add this premium to a current Treasury bond rate to determine a utility's cost of equity. Administratively, this proposal would be easy to handle, but risk premiums are simply too volatile to be left in place for two years.

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Alternative rate of return concepts and their implications for utility regulation

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The rate of return on invested capital is a widely used concept in both regulated and unregulated sectors of the economy. It provides a measure of actual performance as well as required or expected performance (the latter is often termed the "cost of capital"). In the utility field, regulatory agencies often focus on the rate of return as a major instrument for assessing and controlling the performance of firms under their jurisdictions. Unfortunately, two altogether distinct units are employed for measuring rate of return: (1) book rate units and (2) discounted cash flow units. Rarely will the two produce the same result, and the use of one measure as a surrogate for the other may prove highly misleading. This paper indicates the relationship between the two measures and shows the impact of some variations in depreciation and expensing procedures, growth rate, etc. The object is to point out the potential hazards associated with the use of measures of different things in a context that requires the use of measures of the same thing.

■ The rate of return on invested capital is a central concept in financial analysis. It is widely used as a basis for decisions, both in the unregulated sector and in utility regulation. One essential process for both purposes is an intercomparison between two facets of the rate of return measure:

(1) One facet is a summary measure of actual or prospective performance i.e., a measure of the annual rate at which each unit of capital input generates net financial benefits.

(2) The second facet is a summary measure of a "required" annual rate i.e., the financial standard or target rate against which the performance of prospective or already committed capital inputs can be assayed. In this second form it is also called "the cost of capital" rate.

When factor prices (other than capital) and product prices are taken as given, (as in the competitive pricing model), an intercomparison of these two facets of rate of return determines changes in the level of capital inputs. If, on the other hand, the scale of existing and future investment and factor prices (other than capital) are taken as given (as in the administered pricing model), then an intercomparison of these two facets determines product pricing decisions.

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Thus, large companies may set prices in order to achieve a target rate of return,[1] and the thrust of utility price regulation is to provide utilities an opportunity to earn some "fair" rate of return on investment.

If the "rate of return on investment" were itself a single, unambiguous concept, the only difficulties we would encounter in using it for either purpose would be difficulties involving correct estimation of the measure. But the concept is not unambiguous: quite apart from trivial variants such as pre-tax vs. post-tax measures or a total capital vs. an equity capital basis for the concept,[2] there is a non-trivial problem which arises from the fact that "rate of return" is measured in terms of two altogether distinct units: book rate units, and discounted cash flow units.

☐ **Book rate units.** These are more properly called book-ratio units. The "rate" being measured is defined as the ratio of income during a given period of time (as defined by the usual accounting measure of this term) to the net book-value of invested capital outstanding during the period (as defined by the balance sheet corresponding to the income statement from which the numerator is derived).[3] This version of the rate of return will be symbolized as b, and it represents the most commonly used basis for reporting and analyzing "rate of return on invested capital."[4]

☐ **DCF units.** Unlike the book-ratio, this measures the return on capital in terms of the annual rate at which the "future" (actual or prospective) net funds flows (or cash flows as these are commonly called) from an investment have a discounted value equal to the value of the investment outlays required to bring about these funds flows. Hence the name DCF units, which refers to the "discounting cash flows" process required to calculate this version of rate of return on investment.

This basis for measuring rate of return is the most commonly used one for theoretical purposes. It will be symbolized by the letter r.[5]

Conceptual differences between the DCF rate and the book-ratio

■ There are three major conceptual differences between the two measures, b and r.

(1) The book-ratio, b, defines its flow variable (income) as "cash flow" (meaning funds flow) minus depreciation and minus the expensed portion of current period investment. In contrast, the DCF rate, r, defines the flow variable as "cash flow" before these two adjustments.

(2) The book-ratio, b, defines its stock variable (investment) as the net book value of capital as this would appear on the balance

[1] See [9].

[2] These are trivial in the sense that they are obvious and therefore lead to no confusion. To simplify the exposition, I shall ignore these two potential differences in definition by assuming, throughout most of this paper, that income taxes and long-term borrowing do not exist.

[3] Another potential, but trivial, ambiguity arises from the fact that we can measure the accounting net book value figure on a beginning-of-period basis, an ending-of-period basis, or somewhere in between.

[4] For reporting, see *Fortune's* 500 Largest Industrials Directory; *Fortune's* 50 Largest Firms in Merchandising, Banking and Transportation; FTC-SEC Quarterly Financial Report on Rates of Return in Manufacturing; First National City Bank of New York's Annual Return on Capital series; FPC and other regulatory agencies' Annual Reports on "Return on Investment."

For analysis, see [3], [8], [11], and [18].

[5] For prospective investments it is equal to the expected marginal productivity of capital (or the marginal efficiency of capital in Keynesian analysis), or the "initial rate of return." For investments in long-term bonds it is called the "effective yield to maturity."

sheet consonant with the definition of the income variable, i.e., the balance sheet number, which is linked by the inexorable rules of double-entry accounting to the income definition. In content, the DCF rate, r, defines the stock variable (investment) as the total initial outlay of funds required for generating the cash flows counted on the flow side of the equation.

(3) Finally, the book ratio, b, defines the rate of return in a given period of time, or over a period of time, as the arithmetic ratio of its flow variable to its stock variable. In contrast, the DCF rate, r, defines the rate of return as that rate of compound discount (or interest) at which the time adjusted (present) value of the flow variable (cash or funds flows) is equal to the time adjusted (present) value of the stock variable (investment outlays).

Given these basic differences in definition between b and r, it is highly unlikely that their numerical values will be equal. Yet both carry the same label "percent per annum rate of return on investment," and the two are frequently used as if they were freely congruent and interchangeable measures of the same thing. Some examples are:

1. For a single company or industry the rate, b, is often treated as if it were an unbiased measure of r;

2. When several companies or industries are analyzed it is generally assumed that differences in b reflect corresponding differences in r;

3. Estimates of fair or reasonable rates are often calculated in DCF units, i.e., in terms of the r measure, and applied to net book value estimates without regard to the essential differences between DCF units and book rate units. Alternatively, a company may set its required rate of return for *ex-ante* capital budgeting purposes in terms of DCF cost of capital units and then measure *ex-post* performance in terms of book rate units.

These, and other forms of confusion between the two conceptually and numerically different yardsticks, can and do lead to considerable confusion in many forms of investment analysis, both in the unregulated sector and, more particularly, in utility regulation.

The rest of this paper is an attempt to explore the nature and magnitude of the differences between the r version and the b version of rate of return measurement and, on the basis of this analysis, to examine potential uses and misuses of the two concepts for interpretive and regulatory purposes.

Measuring performance: the DCF rate of return

■ For a single investment project, the DCF rate, r, is defined as the rate at which net cash flows from the project, over its productive life, have a present value equal to the original investment outlay required by the project. Thus if:

$$C_0 = \text{investment outlay at time } t = 0,$$
$$F_t(t = 1 \cdots n) = \text{net cash flows per period},$$
$$n = \text{project life (zero salvage assumed)},$$

we have

$$C_0 = \sum_{t=1}^{n} F_t(1 + r)^{-t}, \qquad (1)$$

The DCF rate, r, is uniquely determined by the configuration of net cash inflows per unit of outlay, where configuration, in this context, refers to the volume, time-pattern, and duration of the net cash inflows F_t.[6]

In the general case, where the configuration of F_t is freely variable, the rate r has to be ascertained by trial and error calculations from compound discount tables. However for a pattern of level cash inflows, equation (1) can be restated more explicitly. Thus if the net cash inflows is a level stream of F a year for n years, we have

$$F = C_0\left[\frac{r(1+r)^n}{(1+r)^n - 1}\right]. \tag{2}$$

Regular tables exist for the bracketed items for various values of r and n, and hence the value of r for any ratio F/C_0 can be found readily by inspection. For example, assume

$$C_0 = \$1{,}000,$$
$$F = 229.61,$$
$$n = 6.$$

Then using annual end-of-period discount tables it can be shown that $r = 0.10$ or 10 percent per annum.

Although the DCF rate for a single project is a well known and widely used measure in capital analysis, the corresponding DCF measure for an ongoing company is not generally available. The reason for this is that the pattern and duration of net cash flows for a single project is known or estimated, either retrospectively or prospectively, whereas this is not true for a company, which is an ongoing collection of many projects. However, logic tells us that if a company holds many projects, each of which individually yields a DCF rate r, then the company as a whole will also be generating a DCF rate r on its total portfolio. This is true regardless of the pace at which the projects have been acquired over time and regardless of the practices used in accounting for capital and income.

To compare the results obtained by measuring return on investment in terms of the book ratio b against the underlying DCF rate r, we must therefore use the simulated model in which r itself is known.

Company profitability: *b* vs *r* in the steady state

■ In order to analyze the level of b relative to any given level of r, we take a hypothetical company or companies which acquire or can acquire only a single type of investment whose cash inflow characteristics are known. For illustrative purposes we can take the investment mentioned above: \$1,000 of outlay generates level cash inflows of \$229.61 a year for 6 years, after which the asset is scrapped at zero salvage value. The DCF rate of return on this investment is 10 percent, and hence any company which holds a portfolio con-

[6] More specifically, the configuration of cash inflows per unit of outlay uniquely determines the rate r only if the outlay value is set independently of the rate, r. This is clearly true in the point-input case being discussed. It also holds for investment outlays which themselves have a time duration if the discounted present value of such outlays is calculated through the use of some cost of capital rate, k, which is known or assumed independently of the rate, r, expected from an individual project. However, the rate, r, is frequently (though incorrectly) calculated as that rate, r^*, that equates the present value of inflows with the present value of outlays when both inflows and outlays are discounted at a common rate, r^*. For this method of computation multiple solutions for r^* can exist. For a more complete discussion of multiple solutions, see [15], ch. 10.

sisting exclusively of such projects must be earning a DCF rate of 10 percent per annum.

What book rate b will such a company show? As we shall see, the answer to this depends on several factors. Two factors which have a powerful effect on the size of b relative to r deserve detailed consideration. These are:

1. Accounting practices used in defining book income and net book capital, and
2. The pace at which the company acquires new investments over time.

In order to understand the effect of each of these factors, we will deal with them one at a time. Assume, to begin with, that the company acquires new investments (or projects) by investing an equal amount of money each year. This will be referred to as the "steady-state" condition (it could equally well be called the zero-growth case). Our hypothetical company which invests an equal amount each year in the basic type of project outlined will reach a "steady state" after six years. Beyond this point it will always hold six "investments." When it acquires its seventh investment, the first one it acquired is scrapped, when it acquires the eighth the second is scrapped, and so on.[7]

The book rate of return b. The book rate of return for a company in the steady state, which holds only investments identical to the basic project outlined, will depend on the accounting procedures used—in particular, on the fraction of each original investment outlay which is expensed for book purposes, and the specific depreciation formula which is used in deriving income, period by period, over each project's economic lifetime.

The book rate can be calculated by (1) defining the general value of b in algebraic terms and (2) solving such an equation for any given set of values of the accounting variables. However for any situation other than full capitalization of investment outlays and straight-line depreciation and zero growth, the algebraic expressions for the book rate of return can become exceedingly messy and sometimes complicated. Happily a graphical approach, even though partly intuitive, makes it possible to bypass explicit algebraic solutions and still make the relevant points.

To begin with the simplest situation, assume that the company capitalizes all of its investment outlays and uses a straight-line depreciation formula. The income statement of such a company after it reaches a steady state will show:

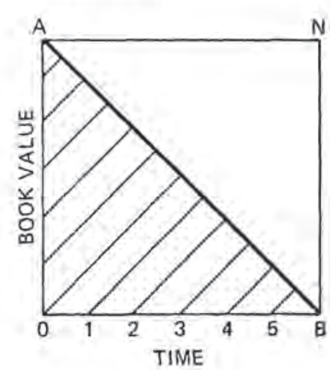
Net Cash Flow	$= 6 \times \$229.61$	$= \$1{,}377.66$
Depreciation	$= 6 \times 1/6 \times \$1{,}000$	$= \$1{,}000.00$
Net Book Income =		$= \$\ \ 377.66$

Its balance sheet, in the steady state, would show a net book value equal to one-half of the original outlay for the six "investments" it holds in its portfolio. This is shown in Figure 1. The original outlay is \$1,000. This is written-off continuously as time passes, i.e., the net book value of each asset is diminished along the line AB. After $t = 6$ the company holds six vintages of investment ranging from one 0.5

[7] Inflation is assumed to be zero in this portion of the analysis.

FIGURE 1
STRAIGHT-LINE
DEPRECIATION

\$1000 ORIGINAL
INVESTMENT



year old to one 5.5 years old, and together they have an undepreciated net book value equal to the area under the line *AB*. We can see by inspection and our knowledge of Euclid that this is $1,000 × 6/2 or $3,000.

Thus the book rate of return for this company is $377.66 ÷ $3,000 or 12.6 percent.

We now also have a tool which permits us to vary our accounting procedures and to discover the consequent effect on *b* of doing so *without* engaging in tedious algebraic expressions. (Meanwhile we still retain our basic assumption that all companies are in a "steady state," i.e., that our company acquires its investments through *equal* annual outlays.)

Variation in expensing procedures

■ We can begin our analysis by assuming again that all companies acquire only the one basic investment we have outlined ($1000 which generates $229.61 a year for six years) and that all use straight-line depreciation. However, now they are free to alter their expensing procedures, i.e., they may charge off any fraction of the $1000 as current expenses. (Recall that we are ignoring the tax-impact of expensing policies on net cash flows.)

As far as before-tax cash flows are concerned, there is no change if the company's accountant charges part of each year's $1000 outlay to current expenses rather than to book capital. Therefore accounting procedures do not affect the DCF yield *r*. It remains at 10 percent on each investment held, and hence at 10 percent for all of them collectively.

Do these accounting variations in the fraction of each year's $1000 outlay which is expensed affect the flow of company income? In the steady state (equal investment outlays each year) the answer is "No." This can be seen clearly in Table 1. Regardless of the amount expensed each year, the total annual charge of expensing plus depreciation adds up to $1000.

What Table 1 shows is that (in the steady state) the flow of reported income (after depreciation of non-expensed capital and the expensed portion of current investment) does not vary at all with the expensing policy adopted.

Although expensing policy has no effect on book income (ignoring taxes) it does have a profound effect on the net book value of capital. Returning to Figure 1, we see that with a zero expensing policy the straight-line depreciation function (Line *AB*) produces a

TABLE 1
STRAIGHT-LINE DEPRECIATION

EXPENSING POLICY	ANNUAL CASH FLOW	ANNUAL AMOUNT EXPENSED	ANNUAL DEPRECIATION	ANNUAL BOOK INCOME
0	$1377.66	$ 0	$1000	$377.66
20%	1377.66	200	800	377.66
50%	1377.66	500	500	377.66
100%	1377.66	1000	0	377.66

company net book value of $3000, i.e., the net book value figure is equal to the area under the depreciation curve (or line).

With a 100-percent expensing policy, the depreciation function will follow the right-angled line *AOB*. The area under this curve is zero. Such a company would have no net book capital. But, as we have seen in Table 1, its net income is $377.66. Its book rate of return b will therefore be infinity. The corresponding net book value and book rate of return for different expensing policies (straight-line depreciation) are shown in Table 2.

TABLE 2

EXPENSING POLICY	ANNUAL BOOK INCOME	COMPANY NET BOOK VALUE	b (PERCENT)
0	$377.66	$3000	12.6
20%	377.66	2400	15.4
50%	377.66	1500	25.2
90%	377.66	300	125.9
100%	377.66	0	∞

The effects of expensing policies on book rates of return are clearly powerful. What this means is that two companies which are in fact generating the same DCF rate r might in theory show book rates b_a, b_b, b_c, $\cdots$ b_z which range all the way from less than r percent at one extreme to ∞ percent at the other. The empirical question is: Do companies or divisions of companies, in fact, use different expensing ratios as far as investment outlays are concerned. The answer is that they do. Many companies capitalize all or almost all of their investment outlays. Others expense a high fraction. Companies with high research and development expenditures use a high expensing policy. Companies with high long-range advertising expenditures (i.e., expenditures which contribute little to current period cash flow but which contribute to future cash flow) do in effect use a high expensing policy. Producing departments of petroleum companies or primarily producing companies in the oil and gas industry also expense a high fraction of outlays in the form of exploratory, developmental, and intangible drilling costs.

Because our model, thus far, is confined to steady-state situations (equal or approximately equal investment outlays each year) it is premature to extrapolate our findings to the real world, but the results are suggestive. For example, the producing segment of the integrated oil industry, or oil and gas companies which are primarily producers rather than refiners and transporters, tend to have significantly higher book rates of return than the integrated companies. For example, Amerada earned an average book rate on equity capital of 21.6 percent during the period 1964–1968 as opposed to a corresponding rate of about 12.0 percent for the integrated petroleum industry as a whole. Likewise, pharmaceutical companies and cosmetic companies (which also follow a higher-than-typical expensing policy with respect to investment outlays) consistently show significantly higher rates than the rest of the manufacturing sector.

For example, according to the Fortune Directory, the pharmaceutical industry has shown the highest return on invested capital year after year. For 1968 it was again in first place with a median book rate of return of 17.9 percent (compared to the *all*-industry median rate of 11.7 percent). The soaps and cosmetics industry was in second place with a median book rate of return of 16.9 percent.

The conventional explanation for these higher-than-normal rates of return for companies or industries is that they are either:

(1) riskier (this is the standard explanation for the producing sector of the oil and gas industry),

(2) more efficient, or

(3) have monopoly powers (this is frequently applied to the pharmaceutical sector).

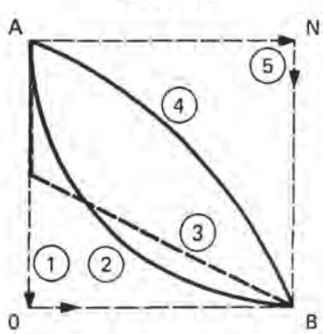
While these three conventional explanations may be correct in varying degrees, they all assume that the observable book rates accurately reflect commensurate DCF rates. The fact that many high-book-rate companies or industries also follow high "expensing" policies suggests strongly that a fourth potential explanation is too important to ignore: namely that the observable book rates significantly overstate the underlying DCF rates actually being earned.

Variations in depreciation methods

■ In addition to variations in accounting expensing policies, companies and industries use varying methods of depreciating the capitalized portion of their investment outlays. This is also a potential source of disturbance as far as the book rate of return is concerned. Since "depreciation" is a variant of "expensing" (which is instantaneous "depreciation") or vice-versa (depreciation is a form of "expensing" over time), we can deduce its effects without going through the mechanics of it in detail.

Depreciation, in itself, has no effect at all on before-tax net cash flows. Nor, in the steady state we are examining (equal annual investment outlays), does it affect net income flows. Any depreciation policy, like any expensing policy, or any combination of the two, must lead to a total annual charge equal to the annual outlay. In our arithmetic example this is \$1000. In short, for any combination of depreciation policy or expensing policy, reported income in the steady state will be equal to \$1377.66 less \$1000, or \$377.66.

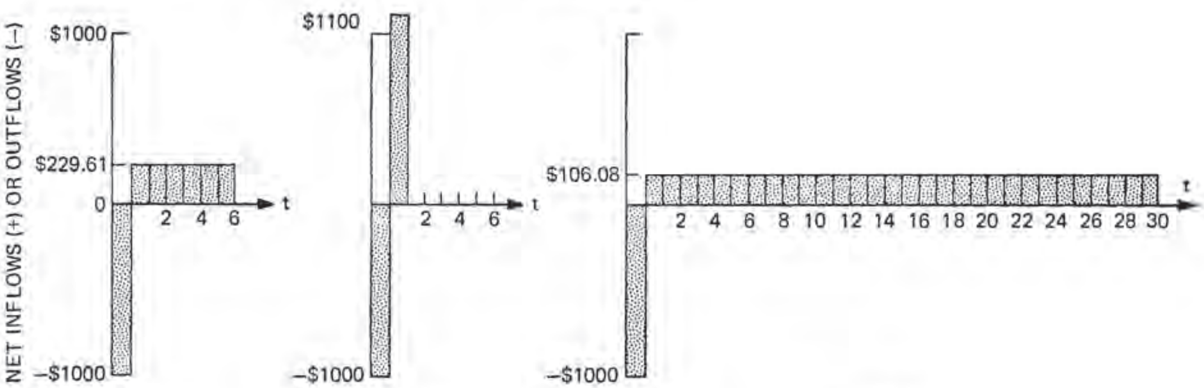
FIGURE 2



But, like expensing policy, the depreciation policy employed has a profound effect on the amount of net book capital, because this is measured by the area under the expensing-depreciation function. Various functions are shown in Figure 2.

In theory, there are infinitely many ways to go from point *A* to point *B* without going out of the rectangle on Figure 2. The five ways shown are not meant to imply that these are the most usual forms—rather they represent potential variants in accounting policy. Each leads to a different estimate of net book value. Given our basic numerical example (that \$1000 of outlay generates \$229.61 of cash flow per year for six years), the level of net income for the company (assuming equal annual investment) is \$377.66, but the level of net book value for the company will range from \$0 for Policy No. 1 to \$6000 for Policy No. 5. Thus the observable book rate of return will

FIGURE 3



(a) r = 10.0 b = 12.6 (b) r = 10.0 b = 10.0 (c) r = 10.0 b = 15.5

vary from a high of ∞ percent from Policy No. 1 to 6.3 percent for Policy No. 5. Together with expensing policy, depreciation policy produces wide variations in the observable book rate of return for any given DCF rate r (which in this example has been held fixed at 10.0 percent).

Other factors affecting the relation of b to r

■ Variations in accounting policies have a powerful effect on the size of rate of return measured in book rate units relative to the size of rate of return measured in DCF units. But they are not the only factors affecting the $(b \sim r)$ relationship. Three other influences are:

1. The economic duration of each investment outlay,
2. The time lag between outlays on the one hand and the commencement of net cash inflows on the other,
3. The time pattern of net cash inflows after they commence.

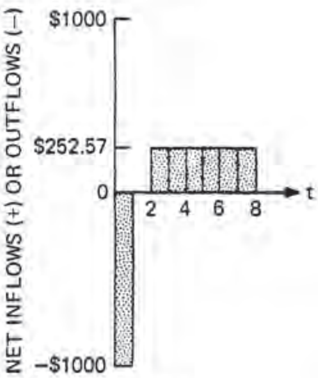
All three of these items can be summarized under a single caption—"The configuration of net cash outflows and inflows" from each investment.

□ *A*. Figure 3 shows three kinds of assets, all of which yield a DCF rate of 10 percent. Each of these shows outlays (below the horizontal line) and the size and duration of annual inflows (above the line). The first figure, 3a, is a depiction of the standard investment we have used for illustrative purposes thus far: $1000 buys $229.61 a year for 6 years. The DCF rate on this is 10 percent, but the book rate is 12.6 percent.

The second figure, 3b, is a short-duration investment in working capital. $1000 buys an inflow of $1100 in 1 year. The DCF rate (annual compounding basis) is 10 percent. So is the book rate. For this case $b = r$. And possibly this is how someone originated the idea that a rate could be measured accurately by taking the ratio of book income to book value of capital (or possibly it came from another favorite example in elementary commercial arithmetic—the case where $1000 produces a net inflow of $100 a year in perpetuity).

Finally the third figure, 3c, shows a long-duration investment, $1000 outlay producing a net cash inflow of $106.08 a year for 30

FIGURE 4



r=10.0
b=14.7

years. The DCF rate is still 10 percent. But the book rate for such a project, or for a "steady-state" company holding different vintages of such projects, would be 15.5 percent.

In short, in the steady state the longer the "duration" of each asset, the greater the discrepancy in the book rate unit measure relative to the DCF rate unit measure. Since, on working capital alone, the book rate is equal to the DCF rate, otherwise similar companies (with identical DCF rates) would show different book rates merely because each uses a different fraction of working capital relative to depreciable fixed capital.

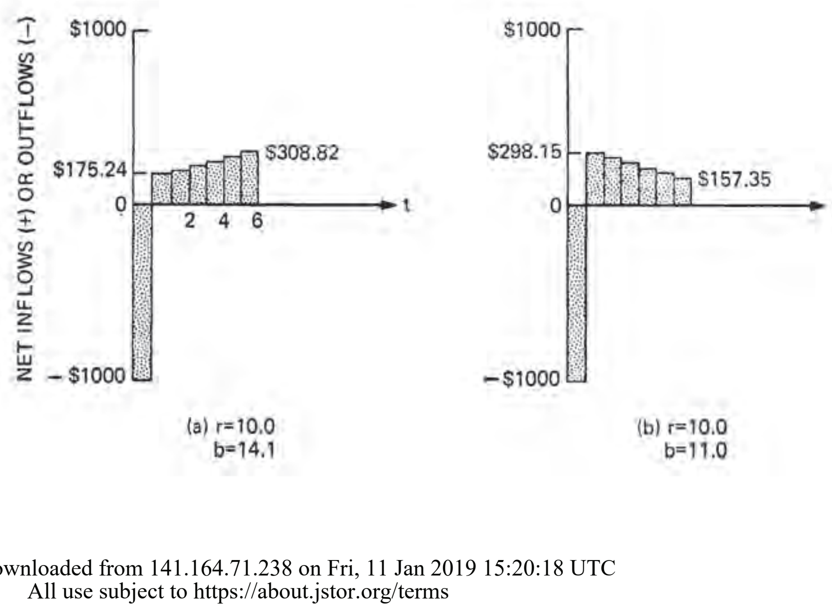
□ *B.* Figure 4 illustrates the effect of time lags. Beginning with the original $1000 outlay which produces $229.61 a year for 6 years starting one year after the outlay is made, (which has a DCF rate of 10 percent and a book rate of 12.6 percent), this is altered in Figure 4 both to introduce a further one-year lag and to retain, in spite of this, a DCF rate of 10 percent per annum. The annual net cash inflow now has to be larger, $252.57 a year, to compensate for the one-year lag in initial receipts. In book rate units the rate of return will rise from 12.6 percent to 14.7 percent.

In the real world, different assets involve different lags. A truck can be productive the minute it is bought. A hydro-electric plant may take years to build, and many manufacturing plants take time to become fully productive even after they are built. The book rate measure will vary because of these differences.

□ *C.* Figure 5 illustrates the effect of the time pattern of cash inflows. Even in the absence of inflation, all net inflows do not follow a level path over the assets' expected life. Some assets, especially those involving new products or processes, require time for full market penetration or de-bugging and are therefore likely to show rising net cash inflows. Others, especially new models of old products—like revised editions of automobiles, or college textbooks, or fashion products, or new detergents, or hula hoops—are likely to show a rapid "decay" pattern.

For any assumed DCF rate, the book rate will vary with the pattern. Thus the level pattern in Figure 3a shows a book rate of

FIGURE 5



(a) r=10.0
b=14.1

(b) r=10.0
b=11.0

12.6 percent as against the DCF rate of 10.0 percent. The rising pattern in Figure 5a, which starts at \$175.24 per annum and rises at 12 percent a year to \$308.82 in year 6, also has a DCF rate of 10 percent, but the book rate is 14.1 percent. Finally the "decay" pattern shown in Figure 5b starts at \$298.15 in year 1 and "decays" at 12 percent per annum to \$157.35 in year 6. The DCF yield is still 10 percent, but the book rate is 11 percent.

The effect of growth

■ We have shown that for a company in a steady-state situation (i.e., no growth) its book ratio or book rate of return is not an unbiased measure of the true DCF rate of return it is making. Instead we have:

$$b = f(r, x, d, n, w, l, \text{ and } c)$$

which says that the company's observable book rate is a function of many things,

r the DCF rate it is achieving
x its average expensing policy
d its depreciation policy
n average productive life of assets
w the fraction of working capital to total capital
l the average time lag between the outlay for each asset and the commencement of net cash inflows from its use and
c the time pattern of cash inflows.

In this section we lift the steady-state assumption to deal with another major factor which influences the level of the book rate for any given set of the variables outlined above: This is the pace at which the company invests over time. To keep the analysis straightforward we assume that these outlays increase (or decrease) steadily at a given rate g.[8]

If all of the assets it acquires generate a common DCF rate of return equal to r percent, then clearly a company will be earning a DCF rate of r percent regardless of its growth rate g.

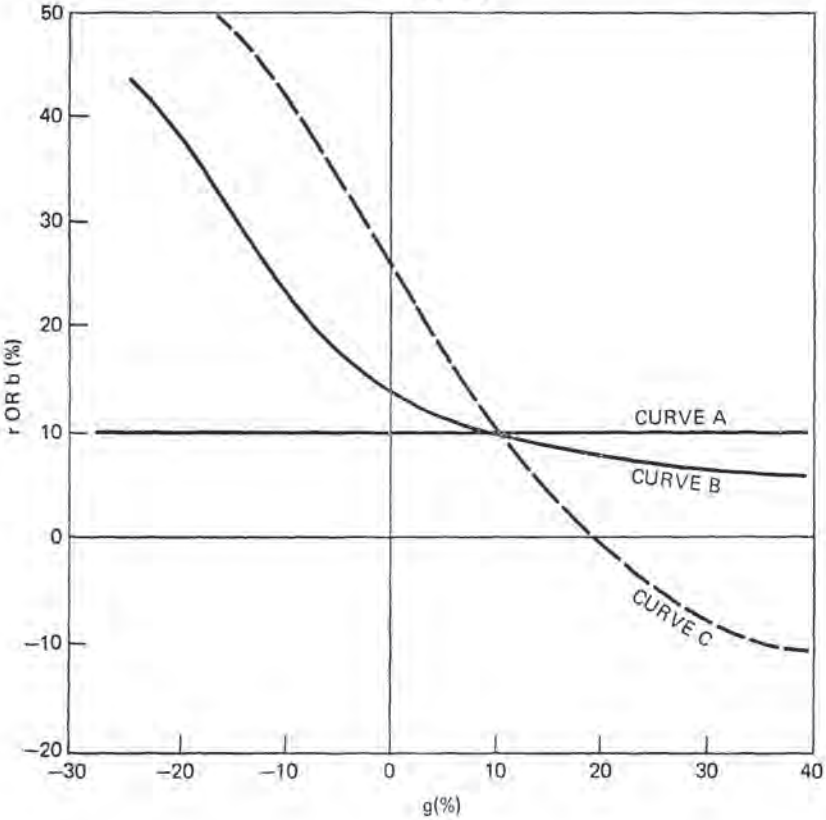
But unless the book rate b for such a company is equal to r in the steady state, variations in the pace of growth will cause changes in the observable book rate. The reason for this is simple and can be illustrated clearly in terms of our original "assumed" asset: namely the \$1000 outlay which generates a level net cash flow of \$229.61 for six years. Regardless of growth rate, a company holding only this form of asset holds six vintages of capital. In the steady state, the book rate earned on each vintage is a function of (a) the expensing and depreciation policy used and (b) the age of the vintage. With full capitalization and a straight-line depreciation policy, the net cash flow and net income attributable to each vintage is constant—at \$229.61 *less* \$166.66, or \$62.95.

But the midyear net book value of each vintage shrinks with age from [\$1000–83.33] for the latest vintage to [\$1000–3(83.33)] for the vintage acquired the preceding year, down to \$83.33 for the oldest producing asset.

Hence the book rates of return, by vintage, vary: Very low for the mostly undepreciated asset to very high for the almost fully de-

[8] Growth here is defined as real growth; i.e., inflation is still assumed to be zero.

FIGURE 6



preciated asset. The book rate for the company (earlier shown to be 12.6 percent) is simply a weighted average of the individual vintage book rates (with the net book values used as weights).

Introducing positive or negative growth into the analysis leaves the individual vintage book rates unaltered, but it changes the relative weights and, hence, the overall company rate (which is its weighted average). With positive growth, the "low yielding" newer vintages get a higher weight relative to the "high yielding" older vintages. Thus the company's overall book rate falls.

In contrast, when growth is negative (i.e., the company's new investment outlays shrink steadily over time), the opposite phenomenon occurs and the company's overall book rate rises.

The relationship of the book rate to the growth rate is shown in Figure 6. Curve A shows the company's DCF rate, i.e., 10 percent, which is of course invariant to the growth rate (since each asset held is earning 10 percent). Curve B shows what the company's book rate would be at various assumed rates of growth (positive and negative). As growth rates become very large the company's overall rate will be dominated by the newest "low yielding" vintage, i.e., curve *B* approaches the yield for the newest vintage. At very fast rates of decay (negative growth) curve *B* approaches the yield for the oldest vintage.

Curve *C* on the same chart shows the same company, but under the assumption that it expenses 50 percent of each investment outlay when the outlay is made and uses a straight-line depreciation policy for the remaining 50 percent. The individual vintage book rates will now be even further apart. The newest vintage, which has charges of

$500 of its acquistion price as an expense in its first year of life, will show a negative book rate of return, whereas the rate of return for the oldest vintage will now be more than twice as high as it was in the 100 percent capitalized situation. The effect of growth on curve C is therefore even more pronounced.

An interesting point on the growth axis is that at which the book rate b is exactly equal to the DCF rate r. This is the same for both curve B and curve C. And it will also hold for other curves D, $E \cdots Z$, which can be drawn for other combinations of the (x, d, n, w, l, and c) variables which affect the book rate of return. Why should this be so? A rigorous proof is beyond the scope of this paper, but one based on intuition runs as follows.

Taking very small intervals of time, we have by definition:

$$b_t = \frac{F_t - D_t}{B_t} \tag{3}$$

This says the book rate is equal to income (cash flow in period t less depreciation and expenses outlays in period t) divided by net book value. Also

$$g_t = \frac{I_t - D_t}{B_t}. \tag{4}$$

This says that the growth rate of investment (which is also the growth rate of net book value) is equal to the net additions to net book value (new investment outlay in period t less depreciation and expense outlays in period t) divided by the existing net book value.

Now the condition $g = r$ (the growth rate equal to the DCF rate) exists only when all of net cash flow generated is reinvested. (An easy way to see this is to think in terms of a barrel of wine increasing in value with age. The annual DCF rate of return on holding this barrel of wine is also the rate at which the barrel increases in value each year—but only if one does not drink part of the contents!) In short $b = r$ only if all the net cash flow is reinvested, i.e. only if $I_t = F_t$.

But if $I_t = F_t$ we can see from equations (3) and (4) above that the conditions $g = b$ must hold. Hence: If

$$g = r$$

we have

$$g = b$$

and thus

$$b = r.$$

In other words, the book rate is an unbiased and accurate measure of the DCF rate for a company which is growing steadily at a rate equal to r (or b).[9] This remarkable equality holds for all values of the extraneous variables x, d, n, w, l, and c.

Mixed assets, price-level changes and irregular growth

■ The introduction of steady real growth moves our explanatory model one step toward reality. The remaining steps would require the introduction and analysis of three other questions.

[9] The exact condition is that the company has been growing at this rate for at least n years, where n is the length of each underlying asset's productive life.

1. What is the effect on the $b \sim r$ relationship of mixtures of different assets (and associated variables) within a single company?
2. What is the effect of regular and irregular changes in the price-level of inputs and outputs?
3. Finally, what is the effect of cyclical or other irregular growth rates in investment outlays?

The algebra can be stretched to incorporate some of these real-world variables, at least in simplified form, but the exercise gets increasingly tedious at a faster rate than the rewards in understanding grow. It is easier to jump directly to a fully simulated computerized model in order to explore the relationship of b to r under any assumed set of all these variables. But this is a task for a whole new paper. For the present, it is sufficient to suggest that the points we started out to make have been made:

1. The rate of return in conventional book rate units is conceptually and numerically different from the rate of return in DCF units.
2. Two companies with similar DCF rates of return may well show widely differing book rates of return.

Cost of capital counterparts to b and r

■ So far we have dealt with rates of return as measures of performance of real assets and the two basically different units in which these rates can be, and are, counted. The same holds true for the other facet: Rate of return as a measure of the "required," "fair," or "target" standard, also known as the "cost of capital." This facet too can be, and is, measured in terms of the two units of account, namely in DCF units or book rate units.

For example, the concept of the embedded cost of debt capital so widely used in utility regulation is a book rate measure. Likewise the "comparative earnings" approach to setting "fair rate of return" which uses book rate information as its basis, is also a book rate measure.

In contrast, there are other methodologies for "measuring the cost of capital" or setting financial standards for capital usage which are clearly DCF type rates. The most obvious example of such a rate is the yield to maturity of actual outstanding or comparably risky bonds. Another is the current dividend yield plus dividend growth rate formula for calculating the cost of equity funds. A less obvious member of the DCF family is the earnings/stock price ratio (commonly called the E/p ratio). This "looks" like a book rate but only because it is measured as a simple ratio. However, close examination shows that it is a short-cut (and frequently unreliable) procedure for measuring a DCF cost of capital rate. The argument in support of this conclusion is as follows. (a) The cost or price of equity capital in any capital market is the DCF rate at which investors discount (or capitalize) future expected benefits from owning equity securities in order to set a current market price for these securities. (b) For non-level projections of benefit streams, the investors' discount rate can be found only by a trial and error process. For dividend streams that grow continuously at a constant rate the mathematics of the process reduces to a fairly simple form, generally expressed as

$$k = \frac{D_0}{P_0} + g$$

where k is the DCF discount rate being solved for, D_0 is the current rate of dividends per share, P_0 is the current price per share, and g is the rate at which dividends are expected to grow.[10]

With even more restrictive assumptions about future investor expectations, the mathematics of finding the discount rate can be simplified even further. Thus, if future earnings (E) from existing assets can be assumed to be a level, perpetual stream, the present value equation linking current price to future benefits simplifies to[11]

$$k = \frac{E}{p}.$$

In short (quite apart from the validity of the almost impossibly restrictive assumptions underlying this formulation), the E/p basis for estimating k is simply a reduced form of the equation used in solving for a DCF rate.

Thus on the "financial standard" side we are faced with the same kind of confusion as we have on the "performance" side: There are two distinct and numerically different units, one a DCF unit usually symbolized as k, and one a book rate unit, which I will here symbolize as β. Both are called "cost of capital," and both use the label "percent per annum required rate of return."

Uses and misuses of disparate "rates"

■ The rules for the "correct" usage of these concepts and measures are fairly simple. If the actual or prospective performance of any investment is measured in DCF units, and if this rate is being assayed against some target or "reasonable rate standard," it is clear that the relevant standard must itself be calculated in DCF units. In short, r must be matched against k in order to produce rational decisions and judgments. Sometimes adjustments may be required, either to r or to k to allow for perceived differences in riskiness between the kind of investment being assayed and the kind of investments from which the k measure has been derived.

By the same token, if book rate units, b, are used to measure actual or prospective performance, the proper standard of comparison is against β. Here too risk adjustments are legitimate. In addition, adjustments may be necessary if the investment or collection of investments being assayed differ significantly with respect to the set of variables (x,d,n,w,l,c, and g) from the collection of investments from whose performance the estimate of β has been derived.

The potential misuses of these tools of thought involve all the inconsistent comparisons which can be made among the four measures. What is surprising is that almost every conceivable form of misuse is being practiced today. Some examples are:

1. A regulatory authority measures the cost of capital in DCF units (k) and then translates this number into "required revenues" by multiplying it against a net book value estimate (or one based on net book value).
2. The same authority measures the cost of equity capital (k_e) in DCF units and the cost of debt in book rate units (embedded cost), and uses the weighted average of these two rates as the figure to be multiplied against a net book value rate base.

[10] For a proof, see [5].
[11] For a proof, see [15], p. 25, note 7.

But regulation is not the only arena in which the disparate units are used as if they were interchangeable estimates of a common concept. Companies which have moved toward the measurement of investment worth in terms of a promised DCF rate still use book rates as a basis for setting the financial standard rate against which this promised DCF can be compared.

In some cases, DCF rates are used for *ex-ante* capital budgeting purposes, but an unadjusted book rate measure is used for later (*ex-post*) audit purposes, to check whether or not the investment lived up to its promise.

Finally, there is still a great deal of implicit acceptance that widely differing observed book rates are unbiased measures of actual profitability.

Understanding and avoiding these potential misuses of "rates of return" will not in itself provide correct answers. Important differential effects of price level changes on all measures, and the random effects of estimating errors, remain as significant barriers to be overcome, both for regulators and for private managers. Meanwhile, understanding that book rate measures and DCF rate measures are not different estimates of the *same* thing but rather estimates of *different* things should eliminate at least part of the confusion surrounding "rates of return on investment."

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On the Misuse of Accounting Rates of Return to Infer Monopoly Profits

By FRANKLIN M. FISHER AND JOHN J. MCGOWAN*

Accounting rates of return are frequently used as indices of monopoly power and market performance by economists and lawyers.[1] Such a procedure is valid only to the extent that profits are indeed monopoly profits, accounting profits are in fact economic profits, and the accounting rate of return equals the economic rate of return.

The large volume of research investigating the profits-concentration relationship uniformly relies on accounting rates of return, such as the ratio of reported profits to total assets or to stockholders' equity as the measure of profitability to be related to concentration.[2] Many users of accounting rates of return seem well aware that profits as reported by accountants may not be consistent from firm to firm or industry to industry and may not correspond to economists' definitions of profits. Likewise, they recognize that accountants' statements of assets, hence also stockholders' equity, may fail to correspond to economically acceptable definitions, because accounting practices do not provide for the capitalization of certain activities such as research and development and do not incorporate allowances for inflation. This is to say they are well aware of certain measurement problems which arise in using available accounting information to measure profitability. They seem, however, totally unaware of a much deeper conceptual problem, namely, that accounting rates of return, even if properly and consistently measured, provide almost no information about economic rates of return.[3]

The economic rate of return on an investment is, of course, that discount rate that equates the present value of its expected net revenue stream to its initial outlay. Putting aside the measurement problems referred to above, it is clear that it is the economic rate of return that is equalized within an industry in long-run industry competitive equilibrium and (after adjustment for risk) equalized everywhere in a competitive economy in long-run equilibrium. It is an economic rate of return (after risk adjustment) above the cost of capital that promotes expansion under competition and is produced by output restriction under monopoly. Thus, the economic rate of return is the only correct measure of the profit rate for purposes of economic analysis.[4] Accounting rates of return are useful only insofar as they yield information as to economic rates of return.[5]

*Fisher is professor of economics, Massachusetts Institute of Technology. McGowan was Vice-President, Charles River Associates. He died on April 7, 1982. This paper is based on work done for Fisher's testimony as a witness for IBM in *U.S. v. IBM* (69 Civ. 200, U.S. District Court, Southern District of New York). We are indebted to Larry Brownstein, Steven Hendrick, and especially Karen Larson and Leah Hutten for computational and programming assistance. Any errors are our responsibility.

[1]Aside from *U.S. v. IBM*, see, for example, Joseph Cooper, p. 15; the various industry studies in Walter Adams; and the discussion in Philip Areeda and Donald Turner, Vol. II, pp. 331–41.

[2]See the comprehensive reviews of this literature by Leonard Weiss and more recently by F. M. Scherer, pp. 267–95. Additional accounting problems raised by attempting to measure profitability by line of business are discussed extensively in George Benston.

[3]A referee suggests that even the crudest accounting information tells us IBM is more profitable than American Motors (AMC), but we disagree. Surely accounting information tells us IBM generates more dollars of profits per dollar of assets than does AMC but, as the examples below demonstrate, that information alone does not tell us which firm is more profitable in the sense of having a higher economic rate of return.

[4]This is literally true only if the cost of capital is first subtracted. In what follows below, we follow the usual empirical practice of measuring all rates of return before such subtraction.

[5]The existence of a uniquely defined economic rate of return—which we now assume for the theoretical analysis below and which occurs in all the examples—is

Now, it should be obvious that only by the merest happenstance will the accounting rate of return on a given investment, taken as the ratio of net revenue to book value in a particular year,[6] be equal to the economic rate of return that makes the present value of the entire net revenue stream equal to the initial capital cost. Indeed, as we shall see below, accounting rates of return on individual investments generally vary all over the lot. Hence, only if such fluctuations are somehow averaged out by a firm's investment behavior over time will its accounting rate of return even be roughly constant—let alone approximate the economic rate of return.[7]

It is easy to show that such averaging requires that the firm grow exponentially, investing in the same mix of investment types each year—an investment type being defined by a time shape of net revenues. Even in such an unrealistically favorable case, the accounting rate of return will generally depend on the rate of growth, equalling the economic rate of return only by accident. Furthermore, the relationship between the accounting and economic rates of return depends on the time shape of net revenues.

Hence, only by accident will accounting rates of return be in one-to-one correspondence with economic rates of return. We show by example below that the effects involved cannot be assumed to be small—indeed, they can be large enough to account for the entire interfirm variation in accounting rates of return among the largest firms in the United States.

The plan of the paper is as follows. Section I summarizes the theoretical results which are proved and elucidated in the Appendix. These results establish the relationships among the various rates of return, time shapes, and rates of growth, and demonstrate in principle that accounting rates of return are not informative. The balance of the paper analyzes a series of relatively simple examples to show that the theoretical effects are not so small that they can be neglected in practice. Indeed, they are very large. A ranking of firms by accounting rates of return can easily invert a ranking by economic rates of return.

Before proceeding, we note that some of the theoretical results given below are not new. Ezra Solomon wrote a number of articles culminating in one dealing with the case of exponential growth in 1970. Thomas Stauffer published various theorems a year later (1971) and also attempted to make adjustments to accounting rates of return to correct for alternative cash flow profiles in testimony for the FTC in the Ready to Eat Cereal Litigation.[8] J. Leslie Livingstone and Gerald Salamon (1971) have also studied and attempted to determine a relationship between the accounting and internal rates of return. Yet, perhaps because Solomon's focus was on the correct concepts of rate of return and cost of capital for rate regulation, or perhaps because none of the studies cited makes clear just how large the effects involved can be, the importance of these matters for more general industrial organization research appears to have gone largely unnoticed. It is our hope that the self-contained discussion of the present paper and, especially, the mag-

guaranteed only if the net revenue stream stemming from an investment has any negative terms occurring before the positive ones. If the economic rate of return fails to be unique, then, while present value calculations using the cost of capital remain the correct method for analyzing profitability, profitability cannot be summarized correctly by *any* rate of return, including accounting rates of return.

[6] Throughout this paper we work with accounting rates of return defined as ratios of profits to book values of capital. Similar (but not identical in detail) results apply to accounting rates of return on stockholders' equity. The precise relations involved can, in principle, be inferred from the results given below. (Such results do apply directly to accounting rates of return on stockholders' equity even in detail if we consider the firms being analyzed to hold neither debt nor retained earnings.)

[7] For discussion purposes—and in our examples below—we assume that the firm achieves the same economic rate of return on all its investments, and thus speak of "the" economic rate of return for the firm without worrying about differences between average and marginal rates. This is, of course, the most favorable case for the accounting rate of return for the firm as a whole.

[8] The proofs given below are different from Stauffer's proofs, and, we think, more suitable for our present purposes than his where the propositions coincide.

nitudes of the effects exhibited in the examples below will remedy this.

I. Summary of Theoretical Results

The main theoretical results, which are proved and elucidated in the Appendix, are as follows:

(a) Unless depreciation schedules are chosen in a particular way, so that the value of the investment is calculated as the present value at the economic rate of return of the stream of benefits remaining in it[9]—a choice which is exceptionally unlikely to be made—the accounting rate of return on a particular investment will differ from year to year, and will not in general equal the economic rate of return on that investment in any year.

(b) The accounting rate of return for the firm as a whole will be an average of the accounting rates of return for individual investments made in the past. The weights in that average will consist of the book value of those different investments which in turn depend on the depreciation schedule adopted, and, particularly, on the amount and timing of such investments.

(c) Unless the proportion of investments with a given time shape remains fixed every year, and unless the firm simply grows exponentially, increasing investments in each and every type of asset[10] by the same proportion for every year, the accounting rate of return to the firm as a whole cannot even be expected to be constant, let alone be equal to the economic rate of return.

(d) Even where the firm does operate in such an unrealistic manner—the case most favorable to the accounting rate of return—the accounting rate of return will vary with the rate of growth of the firm, and will not generally equal the economic rate of return.

(e) The only reliable inferences concerning the economic rate of return that can be drawn (and only in such an unrealistically favorable case) from examination of the accounting rate of return stem from the fact that the accounting rate of return and the economic rate of return will be on the same side of the firm's exponential growth rate. If the accounting rate of return is higher than the growth rate, then the economic rate of return is also higher than the growth rate. If the accounting rate of return is lower than the growth rate, then the economic rate of return is lower than the growth rate. If the accounting rate of return equals the growth rate, and in this case *alone*, the economic rate of return is guaranteed to be equal to the accounting rate of return.[11]

(f) Even in the unrealistically favorable exponential growth case, the accounting rate of return depends *crucially* on the time shape of benefits, and the effect of growth on the accounting rate of return also depends on that time shape. In particular, it is not true that rapidly growing firms tend to understate their profits and slowly growing firms tend to overstate them. The effect can go the other way.[12]

(g) All these results apply both to before- and after-tax rates of return.

II. The Likely Size of the Effects

We now show by example that differences between the accounting and economic rates of return can be quite large indeed. For the sake of economy we examine only differences in after-tax rates of return. We as-

[9] Such a "natural" depreciation formula—which we shall term "economic depreciation"—was first suggested by Harold Hotelling in 1925. It is somewhat misleading, however, to say that the fundamental conceptual problems discussed in the present paper are basically matters of depreciation accounting. Rather, there exists a particular form of depreciation which will correct those problems which stem from a fundamental difference between the economic and accounting rates of return. These problems arise even where machines never wear out. An example is given in Fisher (1979).

[10] Two assets are said to be of the same "type" if they yield the same time shape of benefits.

[11] It is worth pointing out that these results apply to accounting rates of return on total assets, not directly to accounting rates of return on stockholders' equity. Further, they apply to accounting rates of return on beginning-of-year, not end-of-year or yearly average assets. As the examples below show, the problem of making inferences from accounting rates of return on end-of-year (or average) assets is even worse—if possible—than when beginning-of-year assets are used.

[12] Compare Cooper, pp. 132–33.

TABLE 1—AFTER-TAX ACCOUNTING RATES OF RETURN[a]
(Percent for the Q-Profile; Six-Year Life; No Delay)

Year	Gross Profits (Cash Flow Before-Tax)	Depreciation	After-Tax Profits	Beginning-of-Year Assets Net	Beginning-of-Year Assets Accounting Rate of Return	End-of-Year Assets Net	End-of-Year Assets Accounting Rate of Return
1	23.3	28.6	(5.3)	100.0	(5.3)	71.4	(7.4)
2	44.1	23.8	11.2	71.4	15.7	47.6	23.5
3	51.9	19.0	18.1	47.6	38.0	28.6	63.3
4	40.5	14.3	14.4	28.6	50.3	14.3	100.7
5	20.2	9.5	5.9	14.3	41.3	4.8	122.9
6	7.8	4.8	1.7	4.8	35.4	0	Infinite

[a]Tax rate: 45 percent; After-tax economic rate of return: 15 percent; Sum-of-the-years' digits depreciation.

sume a corporate tax rate of 45 percent, and (for most examples) fix the after-tax economic rate of return at 15 percent while varying growth rates and depreciation methods and the time shape of benefits.[13] Enormous variations in the accounting rates of return are readily generated.

A. *The "Q-Profile"*

We start with an investment whose benefits begin immediately and last for six years, and follow the time shape exhibited in column 2 of Table 1. For convenience we refer to this shape as the Q-profile.[14] The figures in column 2 are scaled to produce an after-tax economic rate of return of 15 percent on an initial investment of $100 when sum-of-the-years' digits depreciation over a six-year life is used. The remainder of the table shows the calculation of the corresponding accounting rate of return each year.

Plainly, the after-tax accounting rates of return vary substantially. They never equal the after-tax economic rate of return (15 percent), and exceed it in every year with positive net profits. Real-life firms do not generally exhibit such variation in their accounting rates of return because the averaging effects of growth, as it were, attribute profits from past investment to the book value of investments whose profit results are yet to come, rather than to the declining book value of such past investment.

While such an averaging effect tends to stabilize the accounting rate of return, it becomes a hodgepodge devoid of information about the economic rate of return. This point is illustrated by Table 2, which presents asymptotic accounting rates of return assuming constant exponential growth for three different versions of the Q-profile, each with the same tax rate (45 percent) and after-tax economic rate of return (15 percent).[15] The first version (the case of Table 1)

[13]Fifteen percent was roughly the average *accounting* rate of return in U.S. manufacturing corporations in 1978 (*Economic Report of the President*, 1979, pp. 279–91). If accounting and economic rates of return tended to coincide, 15 percent would be a reasonable choice for the economic rate of return. Since the rates do not generally coincide, the choice is immaterial. Choosing a lower economic rate of return would reduce the range of accounting rates of return in the results below (for the *same* examples), but would not affect the conclusions.

With a fixed capital investment, a given time shape of gross profits before depreciation and taxes results in different after-tax economic rates of return for different depreciation methods. To fix the after-tax economic rate of return for a given time shape, therefore, we adjust the height of the gross profit benefit stream proportionally to produce the desired after-tax economic rate of return.

[14]This shape was (erroneously) suggested during *U.S. v. IBM* as being typical of IBM's experience. We use it for convenience.

[15]In this context, exponential growth takes place by repeated investment in the same type of project; i.e., all investments have the same time-shape of benefits. This is obviously an unrealistic assumption, but one which is more likely to produce equality between accounting and economic rates of return than more realistic assumptions.

TABLE 2—ASYMPTOTIC ACCOUNTING RATES OF RETURN (%) ON THREE VERSIONS OF THE Q-PROFILE[a]

	Six-Year Life (No Delay)			Seven-Year Life (One-Year Delay)			Eight-Year Life (Two-Year Delay)		
Growth Rate	Straight Line	Declining Balance	Sum-of-Years' Digits	Straight Line	Declining Balance	Sum-of-Years' Digits	Straight Line	Declining Balance	Sum-of-Years' Digits
A. Beginning-of-Year Assets									
0	15.2	17.8	18.1	18.1	21.3	22.0	21.0	24.7	25.9
5	15.2	16.9	17.0	17.0	19.1	19.4	18.9	21.1	21.7
10	15.1	15.9	15.9	16.0	17.0	17.1	16.9	17.9	18.1
15	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
20	14.8	14.1	14.1	14.0	13.2	13.1	13.3	12.4	12.3
25	14.7	13.3	13.3	13.1	11.5	11.4	11.7	10.1	9.9
30	14.5	12.5	12.6	12.2	10.0	9.9	10.3	8.0	7.8
B. End-of-Year Assets									
0	15.2	17.8	18.1	18.1	21.3	22.0	21.0	24.7	25.9
5	14.5	16.1	16.2	16.2	18.1	18.5	18.0	20.1	20.7
10	13.7	14.5	14.5	14.6	15.4	15.5	15.3	16.3	16.5
15	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
20	12.4	11.8	11.8	11.7	11.0	10.9	11.1	10.3	10.2
25	11.7	10.6	10.7	10.5	9.2	9.2	9.4	8.1	7.9
30	11.1	9.6	9.7	9.4	7.7	7.6	7.9	6.2	6.0

[a]See Table 1.

has no delay between investment and the beginning of the benefit stream, and depreciation is taken over the resulting six-year life. The second version has a seven-year life including a one-year's delay between investment and initial return. The third has an eight-year life including a two-year delay between investment and initial return. Except for the lag at the beginning and differences in scale, the gross benefit stream is the same in each case. Panel A of the table gives accounting rates of return on beginning-of-year assets; Panel B gives those on end-of-year assets.

Several things are apparent from Table 2. First, the accounting rates of return only equal the economic rate of return of 15 percent when the growth rate is also 15 percent and when the accounting rate of return is measured on beginning-of-year assets. Otherwise, the accounting rates vary from seven points below to almost eleven points above the economic rate of return.

Second, it is not true (as is sometimes stated) that more rapid depreciation, other things equal, tends to understate accounting rates of return. In this example, when the rate of growth is below 15 percent, declining balance and sum-of-the-years' digits depreciation produces a higher accounting rate of return than straightline depreciation for given growth rates, time profiles, and economic rates of return. The effect is reversed when the growth rate exceeds the economic rate of return of 15 percent. This illustrates a general proposition: more rapid depreciation *increases* the accounting rate of return (measured on beginning-of-year assets) when the growth is less than the economic rate of return, and *decreases* the accounting rate of return when the growth rate exceeds the economic rate of return.[16] Since this is the only point about depreciation which we wish to demonstrate, we provide only results for sum-of-the-years' digits depreciation in the rest of this paper.[17]

In all the examples in Table 2, firms growing at rates greater than the economic rate of

[16]By Theorem 1, the changeover point is also where the growth rate equals the accounting rate of return on beginning-of-year assets.

[17]There is one additional point about depreciation which we shall not bother to exemplify. Since the depreciation method chosen affects the time shape of the after-tax benefit stream, the relationship of after-tax accounting rates to the growth rate is particularly sensitive to the depreciation method. It can even happen that faster growth increases accounting rates of return for one choice of depreciation method and decreases them for another—all for the same pre-tax benefit time shape and the same after-tax economic rate of return. This makes adjustments for growth even harder to make than appears from the examples below.

TABLE 3—ASYMPTOTIC ACCOUNTING RATES OF RETURN (%) ON FOUR VERSIONS OF THE Q-PROFILE[a]

Growth Rate	Ten-Year Life (No Delay, Last Year Spread)	Six-Year Life (No Delay)	Seven-Year Life (One-Year Delay)	Eight-Year Life (Two-Year Delay)
A. Beginning-of-Year Assets				
0	13.9	18.1	22.0	25.9
5	14.5	17.0	19.4	21.7
10	14.8	15.9	17.1	18.1
15	15.0	15.0	15.0	15.0
20	15.1	14.1	13.1	12.3
25	15.1	13.3	11.4	9.9
30	15.0	12.6	9.9	7.8
B. End-of-Year Assets				
0	13.9	18.1	22.0	25.9
5	13.8	16.2	18.5	20.7
10	13.5	14.5	15.5	16.5
15	13.0	13.0	13.0	13.0
20	12.6	11.8	10.9	10.2
25	12.0	10.7	9.2	7.9
30	11.5	9.7	7.6	6.0

[a]See Table 1.

return of 15 percent have accounting rates of return on beginning-of-year assets less than the economic rate of return, while those growing at rates less than the economic rate of return all have accounting rates of return on beginning-of-year assets greater than the economic rate of return.[18] Contrary to what might be expected, this qualitative relationship provides no practical basis for adjusting accounting rates of return so that they will accurately reflect economic rates of return.

Table 2, for example, shows that firms which use sum-of-the-years' digits depreciation and grow at 5 percent have accounting rates of return on beginning-of-year assets which range from 17.0 to 21.7 percent. Thus, even for firms with the same growth rate and depreciation method, the required adjustment varies from 2 to 6.7 percentage points depending upon the time profile. Clearly, the time profile, depreciation method, and growth rate must all be known before accounting rates of return can be adjusted to reflect economic rates of return.

In the foregoing examples, for a given time shape, faster-growing firms have lower accounting rates of return than slower-growing ones with the same economic rate of return. We have seen that even if this were a universal phenomenon, it would not provide a way to adjust accounting rates of return to reflect economic rates of return, since different firms will generally have different time shapes and therefore require different adjustments. The difficulties are even worse in practice, because the accounting rate of return can actually *rise* with the growth rate, causing *slower*-growing firms to have their economic rates of return *under*stated. Thus, even the strong assumption that firms have the same time profile is insufficient to permit adjustment of accounting rates of return; the specific profile must also be known in order to make inferences about the ranking of economic rates of return.

We demonstrate this phenomenon by taking the original Q-profile (six-year life and no delay) and spreading the last year's gross profits out evenly over five years (years 6–10) instead of having them all in year 6. Table 3 shows that this small change in the profile produces an increasing relationship between the growth rate and the accounting rate of return. The original results for sum-of-the-year's digits depreciation are reproduced for ease of comparison.

[18]So simple a relationship does not hold if the accounting rate of return is based on end-of-year assets.

Focusing on the first column (10-Year Life), we see that the accounting rate of return on beginning-of-year assets actually begins by rising with the growth rate, reaching the value of the economic rate of return (as it must) at a 15 percent growth rate, and then going slightly above it before falling back again. (It is a special feature of this particular example that these values are all close to the economic rate of return of 15 percent.) The behavior of the accounting rate of return on end-of-year assets is different. This magnitude falls with the growth rate (in this example), but it exhibits still another phenomenon. As opposed to the previous example, where the accounting rates of return on both beginning- and end-of-year assets were above the economic rate of return of 15 percent for low growth rates and below it for large ones, here the accounting rate of return on end-of-year assets starts *and finishes* below the economic rate of return of 15 percent. There is *no* rate of growth for which the accounting rate of return on end-of-year assets equals the economic rate of 15 percent.

The impossibility of making inferences about relative profit rates should be obvious even within the confines of these examples, all of which represent only relatively slight variations on the same profile. *Every one of the firms exhibited in Table 3 has the same underlying after-tax economic rate of return. Yet their after-tax accounting rates of return on end-of-year assets vary from* 6.0 *to* 25.9 *percent.*[19]

Further, it is impossible to infer anything about relative profitability by attempting to adjust for growth rates. For example, each row of Table 3 involves firms with the same growth rate, so that there is nothing to adjust for in comparing them; yet, except for the special row corresponding to the point where the growth rate is equal to the true after-tax economic rate of return, the after-tax accounting rates of return continue to vary. For the row corresponding to 5 percent growth, for example, after-tax accounting rates of return vary between 13.8 and 20.7 percent. For the row corresponding to 25 percent, they vary between 7.9 and 12.0 percent. Further, it is not correct to say that slow-growing firms have accounting rates of return that overstate their economic rate, while fast-growing firms have accounting rates of return that understate them. Continuing to use accounting rates of return on end-of-year assets, the firm just introduced (10-Year Life) has an accounting rate of return which understates its economic rate of return at all levels of growth. If one uses beginning-of-year assets, it has accounting rates of return which tend to understate its economic rate of return at low rates of growth and (slightly) overstate it at higher ones.

Moreover, the phenomenon of accounting rates of return increasing with the growth rate can be considerably more marked if we use other profiles. Table 4 shows the before-tax benefit stream (corresponding to an initial investment of $100, an economic rate of return of 15 percent, and sum-of-the-years' digits depreciation over a six-year life) for two other profiles (X firm and Y firm). Table 5 shows the after-tax accounting rates of return for these firms when they grow exponentially at various rates. The after-tax accounting rates of return on beginning-of-year assets rise rather rapidly with the growth rate. The after-tax accounting rate of return on end-of-year assets also rises with the growth rate. However, as was also the case for the variation on the Q-profile examined earlier, it does not rise by enough to get to the economic rate of return of 15 percent.

TABLE 4—BEFORE-TAX BENEFIT STREAMS FROM AN INVESTMENT OF $100[a]

Year	X Firm ($)	Y Firm ($)
1	90.2	107.0
2	27.1	10.7
3	18.0	10.7
4	9.0	10.7
5	9.0	10.7
6	9.0	10.7

[a]See Table 1.

[19]Here and later, the results for beginning-of-year assets are similar.

TABLE 5—ASYMPTOTIC ACCOUNTING RATES OF RETURN (%) FOR X-FIRMS AND Y-FIRMS[a]

Growth Rate	Beginning-of-Year Assets		End-of-Year Assets	
	X Firm	Y Firm	X Firm	Y Firm
0	12.9	12.5	12.9	12.5
5	13.6	13.3	13.0	12.7
10	14.3	14.2	13.0	12.9
15	15.0	15.0	13.0	13.0
20	15.7	15.8	13.0	13.2
25	16.3	16.6	13.0	13.3
30	16.9	17.3	13.0	13.3

[a]See Table 1.

III. Conclusions

That the accounting rate of return—after tax as well as before tax—is a misleading measure of the economic rate of return is evident from examining cases of single projects such as in Table 1. The cases shown in later tables are unduly *favorable* to the accounting rate of return in that they mask its behavior by averaging. That averaging effect is achieved by the quite unrealistic assumption that investment by the firm always brings in the same time shape of returns, and that the firm grows each year by increasing its investments at the same percentage rate. Even on such favorable terms, it is impossible to infer either the magnitude or direction of differences in economic rates of return from differences in accounting rates of return. This is because such inferences require not only correction for growth rates, but *also* knowledge of the time shapes of returns.

The level and behavior of the accounting rate of return are both sensitive to the type of time shape used. Even within the Q-profile example, the rates vary depending on when the time shape begins and how the last few years are spread out. There is every reason to suppose that firms differ in the time shapes of their investments, and that a particular firm's investments will also differ among themselves. Thus, comparisons of accounting rates of return to make inferences about monopoly profits is a baseless procedure.

This conclusion can be most dramatically demonstrated by juxtaposing accounting rates of return for firms with different time shapes and *different* economic rates of return. When this is done, it is easy to see that firms with *higher* accounting rates of return can have *lower* economic rates of return. Table 6 gives after-tax economic rates of return and after-tax accounting rates of return on end-of-year assets for three growth rates (0, 5, and 10 percent), and for each of the six time shapes already discussed as well as two other "one-hoss shay" time shapes.[20] For *each* growth rate, the examples are chosen so that the eight firms represented are ranked in *ascending* order of economic rates of return and in *descending* order of accounting rates of return—a complete reversal even with growth rates constant.

Examination of Table 6 shows again that no inference about relative after-tax economic rates of return is possible from after-tax accounting rates of return. For example, the lowest after-tax economic rate of return in the table is that for the Q-profile with an eight-year life at a zero growth rate. For that firm, the after-tax economic rate of return is 13 percent. Yet, its after-tax accounting rate

[20]The one-hoss shay time shapes have a constant return (no lag) for four and six years, respectively, and zero returns thereafter.

TABLE 6—AFTER-TAX ECONOMIC RATES OF RETURN (E) AND ASYMPTOTIC ACCOUNTING RATES OF RETURN ON END-OF-YEAR ASSETS (A) FOR EIGHT TIME SHAPES[a]

	Growth Rate					
	0 Percent		5 Percent		10 Percent	
Growth Rate	E	A	E	A	E	A
Q-Profile						
8-Year Life (2-year delay)	13.0	21.6	16.0	22.6	17.8	21.2
7-Year Life (1-year delay)	14.0	20.2	17.0	21.6	18.8	20.9
One-Hoss Shay						
6-Year Life (no delay)	15.0	20.0	18.1	21.4	19.7	20.7
4-Year Life (no delay)	16.0	19.8	19.0	21.3	20.0	20.289
Q-Profile						
6-Year Life (no delay)	16.1	19.6	19.05	21.2	20.05	20.287
10-Year Life (no delay; last year spread)	18.0	16.9	20.0	18.5	22.0	19.8
X Firm	19.0	16.2	21.0	17.8	23.0	19.2
Y Firm	19.2	15.8	21.2	17.4	23.2	18.9

[a]Tax rate: 45 percent; Sum-of-the-years' digits depreciation.

of return on end-of-year assets is 21.6 percent, the second *highest* accounting rate of return in the table, and a value well above that of 15.8 percent for the Y firm at zero growth, corresponding to a 19.2 percent economic rate of return. The 21.6 percent accounting rate of return so encountered is even above the 18.9 percent figure obtained for the Y firm at 10 percent growth—a figure which corresponds to an economic rate of return of 23.2 percent, the highest in the table, and more than 10 percentage points above the economic rate of return of 13 percent for the Q-profile with an eight-year life at zero growth. Similar examples of reversals occur throughout the table.

Nor can one eliminate these effects by correcting somehow for differences in rates of growth. The table as constructed exhibits a reversal of the ordering of economic and accounting rates of return with the rate of growth held constant. Rate of growth effects have thus *already* been removed from each pair of columns to an extent beyond that which one could hope to achieve in practice. Moreover, it is not true that faster-growing firms should have their accounting rates of return adjusted upwards relative to slower growing ones. Consider the comparison between the Q-profile with a ten-year life at zero growth and the Q-profile with an eight-year life at 5 percent growth. The faster-growing firm has an accounting rate of return (22.6 percent) already greater than that of the slower-growing firm (16.9 percent), but its economic rate of return (16.0 percent) is *below* that of the slower-growing firm (18.0 percent). Adjusting the faster-growing firm's accounting rate of return *upwards* relative to that of the slower-growing one will make things *worse*, not better.

As all of this makes clear, there is no way in which one can look at accounting rates of return and infer anything about relative economic profitability or, a fortiori, about the presence or absence of monopoly profits. The economic rate of return is difficult—perhaps impossible—to compute for entire firms. Doing so requires information about both the past and the future which outside observers do not have, if it exists at all.[21] Yet it is the economic rate of return which is the magnitude of interest for economic propositions. Economists (and others) who believe that analysis of accounting rates of return will tell them much (if they can only overcome the various definitional problems which separate economists and accountants) are deluding themselves. The literature which supposedly relates concentration and economic profit rates does no such thing, and examination of absolute or relative accounting rates of return to draw conclusions about monopoly profits is a totally misleading enterprise.

APPENDIX
I: BEFORE-TAX ANALYSIS

A. *The Accounting Rate of Return on Individual Investments*

We begin our analysis of the problem by considering the before-tax accounting and economic rates of return on a single investment. Later we shall consider the firm as being made up of a series of such investments which may be (but need not always be) of the same type. The after-tax case is treated below and shown to be isomorphic, although more complex.

An investment may be thought of for heuristic purposes as a "machine" costing one dollar. If this is invested at time 0, the firm experiences a stream of net benefits as a result. Such benefits include all changes in revenues and costs (other than the initial capital cost) which accrue to the firm as a result of making the investment. The flow of such benefits at time θ is denoted by $f(\theta)$.[22]

[21] If one made the strong assumption that the same time shape of returns held for all investments made by a given firm throughout its life, then it might be possible to recover that time shape by regression of gross returns on a distributed lag of past investment. We are indebted to Zvi Griliches for this suggestion.

[22] The time origin is arbitrary. The flow of benefits is assumed to depend on the age of the machine only. Thus an investment at time t brings in benefits of $f(\theta - t)$ at time $\theta \geq t$. Time dependence of the benefit stream can be handled below by thinking of it as equivalent to investment in different kinds of machines at different times.

The economic rate of return on a machine, r, is that discount rate which makes the discounted value of the benefit stream equal to the capital costs of the investment. In other words, r satisfies

$$\text{(A1)} \qquad \int_0^\infty f(\theta)\, exp(-r\theta)\, d\theta = 1.$$

We assume that the integral in (A1) is monotonically decreasing in r so that (A1) has a unique positive solution. This will be true if the negative portion of the net benefit stream (if any) precedes the positive portion. This is the usual case.[23]

Now the firm adopts a depreciation schedule for this machine. Let $V(\theta)$ denote the book value of the machine as of time θ. Then $-V'(\theta)$ is the rate of depreciation at θ, where the prime denotes differentiation. Plainly, $V(0)=1$, and it makes sense to suppose that $V(\infty)=0$, although this latter condition is not really needed.

Accounting profits attributable to this machine at time θ will be equal to net benefits less depreciation. We can think of the accounting rate of return for this machine as the accounting rate of return which the firm would have if this were its only asset. Denoting that rate by $b(\theta)$,

$$\text{(A2)} \quad b(\theta) = (f(\theta) + V'(\theta))/V(\theta).$$

The first question which comes immediately to mind is that of when $b(\theta) = r$ for all θ within the life of the machine. We prove this will occur if and only if the depreciation schedule adopted by the firm always values the machine as the discounted value of the future benefit stream, discounting at the economic rate of return, r (see Hotelling).

THEOREM 1: *$b(\theta) \equiv r$ if and only if*

$$\text{(A3)} \quad V(\theta) = \int_\theta^\infty f(u)\, exp(-r(u-\theta))\, du.$$

[23] If (A1) has more than one solution, then the economic rate of return is ill-defined and there is even less point in considering whether the accounting rate of return yields information about it.

PROOF:

(a) Suppose (A3) holds. Differentiating with respect to θ, we obtain

$$(A4) \qquad V'(\theta) = -f(\theta) + rV(\theta),$$

which when substituted in equation (A2) yields $b(\theta) = r$.

(b) Suppose $b(\theta) \equiv r$. Then, from (A2),

$$(A5) \qquad V'(\theta) \equiv rV(\theta) - f(\theta).$$

This is a linear differential equation with an additive forcing function $(-f(\theta))$. Its solution is therefore in the form

$$(A6) \qquad V(\theta) = C\,exp(r\theta) + z(\theta),$$

where $z(\theta)$ is any particular solution of (A5) and C is a constant to be determined by the initial conditions. However, by part (a) of the proof, the integral on the right-hand side of (A3) is a particular solution of (A5). Hence $z(\theta)$ can be taken as that integral. Do this and note that $z(0) = 1$ by (A1), the definition of the economic rate of return. Since we have $V(0) = 1$, setting $\theta = 0$ in (A6) yields $C = 0$, and the theorem is proved.

Thus even where the firm has a single simple investment with no ambiguity about marginal vs. economic rates of return, the accounting rate of return will not equal the economic rate of return except for a particular choice of a depreciation schedule—which choice we may term "economic depreciation."

The reason for this is not hard to find. The book value of the firm's assets reflects the investment expenditures made in the past less the depreciation already taken on them. The benefits for which such investments were made are at least partly in the future. Yet the accounting rate of return takes gross profits before depreciation as the benefit flow which happens to be currently occurring. Unless depreciation is chosen so as to reflect the change in *future* benefits in the appropriate way, there is no reason to suppose that such a calculation should equal the economic rate of return, and Theorem 1 shows that the two will generally not be equal.

Will firms tend to adopt an "economic depreciation" schedule yielding book value as in equation (A3)? This is pathologically unlikely. Except in the simple "Santa Claus" case of $f(\theta) = k\,exp(-\lambda\theta)$ which corresponds to exponential depreciation or other similarly special cases corresponding to straightline or other standard depreciation methods, the benefit stream from investment when plugged into (A3) will not yield depreciation schedules anything like those used by real-life firms to optimize after-tax profits given IRS rules or those schedules used for nontax purposes. Real investments will almost invariably have complicated time shapes for their benefit streams. Further, even relatively simple shapes yield economic depreciation schedules which are quite far from actual ones. To see this, one need only observe that if $V(\theta)$ satisfies equation (A3), there is no reason that $V'(\theta)$ must always be negative. Indeed, if the time stream of benefits starts low and then has a hump a few years out, taking economic depreciation would require writing up the value of assets for the first few years. Yet there is nothing bizarre about such an example.

We must, therefore, with pathologically unlikely exceptions, expect that the accounting rate of return on a particular machine, $a(\theta)$, will generally not equal the economic rate of return r. (How far off it can be is demonstrated by examples.) This should make us suspect that the same thing will generally be true of the firm as a whole, and we now go on to explore that question.

B. *The Accounting Rate of Return for the Firm as an Average*

It is fairly plain that the best hope for an accounting rate of return equal to the economic rate of return will occur if all investments made by the firm are exactly alike, since otherwise (as shown below), changes in the mix of investment types will change the accounting rate. So we begin by considering the case in which all machines are like the machine above.

It now becomes necessary to distinguish calendar time, denoted by t, from the age of a machine, denoted by θ. We let $I(t)$ be the value of investment made at t (equals the number of machines purchased). Let $K(t)$ denote the book value of the firm's assets at t and $\pi(t)$ the value of its accounting profits at t. Then,

$$\text{(A7)} \quad K(t) = \int_{-\infty}^{t} I(u)V(t-u)\,du = \int_{0}^{\infty} I(t-\theta)V(\theta)\,d\theta,$$

where $\theta = t - u$. Similarly,

(A8)

$$\pi(t) = \int_{-\infty}^{t} I(u)\{f(t-u)+V'(t-u)\}\,du = \int_{0}^{\infty} I(t-\theta)\{f(\theta)+V'(\theta)\}\,d\theta = \int_{0}^{\infty} I(t-\theta)V(\theta)b(\theta)\,d\theta,$$

using (A2).

Hence, letting $a(t)$ be the firm's accounting rate of return at t:

$$\text{(A9)} \quad a(t) \equiv \pi(t)/K(t) = \left[\int_0^\infty \{I(t-\theta)V(\theta)\}b(\theta)\,d\theta\right] / \left[\int_0^\infty \{I(t-\theta)V(\theta)\}\,d\theta\right];$$

so that we have proved

LEMMA 1: *At any time t, the accounting rate of return for the firm as a whole is a weighted average of the individual accounting rates for its individual past investments, the weights being the book values of those past investments.*

It should be obvious that this result would also be true if machines were not always of one type.

We now ask whether such an average will equal the economic rate of return. First consider whether the average can even be independent of t. This can happen in two ways. First, $b(\theta)$ might be independent of θ. We know from Theorem 1 that this will happen for $b(\theta) \equiv r$ only for the cases of economic depreciation already discussed which we rule out. It is easy to show that $b(\theta) \equiv q \neq r$ is impossible.[24]

The other way in which $a(t)$ might be independent of t would be if the relative weights in the average did not change over time.[25]

$$\text{(A10)} \qquad \frac{I(t_1-\theta)V(\theta)}{I(t_2-\theta)V(\theta)} = k,$$

whence

$$\text{(A11)} \qquad \frac{I'(t_1-\theta)}{I(t_1-\theta)} = \frac{I'(t_2-\theta)}{I(t_2-\theta)},$$

for all (t_1, t_2). Evidently it must then be the case that

$$\text{(A12)} \qquad I(t) = M exp(gt)$$

for some constant growth rate g.

The remainder of our investigation will concern the case of exponential growth with the scale factor, M, set equal to unity. This case is the most favorable to accounting rates of return approximating economic rates of return, since in its absence accounting rates of return will not even be constant, even though the economic rate of return is well defined and constant.

C. *The Effect of the Growth Rate in Exponential Growth*

We are now dealing with a case in which the accounting rate of return is (at least

[24] To see this, observe that a proof essentially the same as that of Theorem 1 would show that $b(\theta) \equiv q$ if and only if

$$\text{(a)} \qquad V(\theta) = C\,exp(q\theta) + z(\theta),$$

where

$$\text{(b)} \qquad z(\theta) = \int_{\theta}^{\infty} f(u)\,exp(-q(u-\theta))\,du,$$

but $V(0) = 1$ so that $C = 1 - z(0) \neq 0$ if $q \neq r$. Then (A4) yields $V(\infty) = \pm\infty$ depending on $q \gtrless r$ and this is not possible.

[25] For a *given* distribution of $b(\theta)$ there might be other possibilities, but these would be even more special than the case of economic depreciation already discussed. The statement in the text is true if $a(t)$ is to be constant despite unknown variations in $b(\theta)$ with θ.

asymptotically) constant and given as

$$\text{(A13)} \quad a = \frac{\int_0^\infty \{exp(g(t-\theta))V(\theta)\} b(\theta)\, d\theta}{\int_0^\infty \{exp(g(t-\theta))V(\theta)\}\, d\theta}$$

where a denotes the (asymptotic) constant value. This is still a weighted average of the accounting rates of return on individual investments. Plainly, the growth rate g affects the weights. Since the accounting rates of return on individual investments will almost always not be constant in view of Theorem 1, changes in the weights will usually affect the average.

The present section studies such effects and asks, in particular, what inferences can be drawn concerning the economic rate of return r, from knowledge of the accounting rate of return a, and the growth rate g, without information on the time shape of benefits, $f(\cdot)$, since the latter information is plainly never available from the books of the firm—even assuming it is known in detail to the firm's forecasters.

The first thing to say in this regard is that while (as we shall show) there exist values of g for which $a = r$, these values will be the exception. One cannot expect accounting and economic rates of return to coincide even in the most favorable case of exponential growth and a single investment type except by the merest accident. What information *can* be gleaned from the accounting rate of return is analyzed in this section.

It will be convenient to set up the problem a little differently from the analyses above. Let $\pi^*(t)$ denote the gross profits of the firm before depreciation. Let $\delta(t)$ denote total depreciation taken at time t. Let $K^*(t)$ denote the *undepreciated* value of the firm's capital stock. Let $D(t)$ denote the total depreciation already taken on that stock. Finally, let $a^* = \pi^*(t)/K^*(t)$, so that a^* is the accounting rate of return which would be observed if there were no depreciation. The following relationships hold:

$$\text{(A14)} \qquad a = \frac{\pi^*(t) - \delta(t)}{K^*(t) - D(t)},$$

$$\begin{aligned} \text{(A15)} \quad \pi^*(t) &\equiv \int_{-\infty}^{t} exp(gu) f(t-u)\, du \\ &= \int_0^\infty exp(g(t-\theta)) f(\theta)\, d\theta \\ &= exp(gt) \int_0^\infty exp(-g\theta) f(\theta)\, d\theta \\ &= exp(gt)\pi^*(0), \end{aligned}$$

$$\begin{aligned} \text{(A16)} \qquad K^*(t) &\equiv \int_{-\infty}^{t} exp(gu)\, du \\ &= exp(gt)/g \end{aligned}$$

$$\begin{aligned} \text{(A17)} \quad \delta(t) &= \int_{-\infty}^{t} exp(gu) V'(t-u)\, du \\ &= \int_0^\infty exp(g(t-\theta)) V'(\theta)\, d\theta \\ &= exp(gt)\delta(0), \end{aligned}$$

$$\begin{aligned} \text{(A18)} \quad D(t) &= \int_{-\infty}^{t} \delta(u)\, du \\ &= \int_{-\infty}^{t} exp(gu)\delta(0)\, du \\ &= \delta(0) exp(gt)/g. \end{aligned}$$

Evidently, we have proved:

LEMMA 2: $\delta(t)/D(t) = g$.

We now study the effects of g on a^*.

LEMMA 3: (a) *If* $g = r$, *then* $a^* = r = g$.

(b) $d \log a^* / d \log g < 1$.

(c) a^* *and* r *are always on the same side of* g. *That is,* $a^* < g \leftrightarrow r < g$; $a^* = g \leftrightarrow r = g$; $a^* > g \leftrightarrow r > g$.

PROOF:

(a) Using equations (A15) and (A16),

$$\begin{aligned} \text{(A19)} \quad a^* &= g\pi^*(0) \\ &\equiv g \int_0^\infty exp(-g\theta) f(\theta)\, d\theta. \end{aligned}$$

If $g = r$, then $\pi^*(0) = 1$ by the definition of the economic rate of return (A1), whence $a^* = g = r$.

(b) From (A19),

$$\text{(A20)} \quad \log a^* = \log g + \log \pi^*(0),$$

but examination of $\pi^*(0)$ shows that it is necessarily decreasing in g since it is the discounted integral of future benefits from a single machine discounted at the rate g. Thus $d \log a^* / d \log g < 1$.

(c) These statements follow directly from (a) and (b).

Using Lemmas 2 and 3, we can now proceed to the main result of this section for the magnitude of interest, the accounting rate of return a, itself.

THEOREM 2: *a and r are always on the same side of g. That is,*

$$a < g \leftrightarrow r < g; \qquad a = g \leftrightarrow r = g;$$
$$a > g \leftrightarrow r > g.$$

PROOF:

By definition, $\pi^*(t) = a^* K^*(t)$. By Lemma 2, $\delta(t) = gD(t)$. Substituting in (A14)

$$\text{(A21)} \quad a = \frac{a^* K^*(t) - gD(t)}{K^*(t) - D(t)} \gtreqless g,$$

accordingly as $a^* \gtreqless g$. The desired result now follows from Lemma 3.

A diagram may be illuminating here. In Figure 1, the growth rate is measured on the horizontal axis and rates of return on the vertical axis. The 45° line indicates where growth rates and rates of return are equal. Theorem 2 states that the accounting rate of return must be above the 45° line to the left of the dashed line at $g = r$; it must pass through H, the point of intersection of the dashed line and the 45° line; and it must be below the 45° line to the right of the dashed line.

Can we say more than this? The answer is in the negative without information on the time shape of benefits $f(\cdot)$. In particular, it is

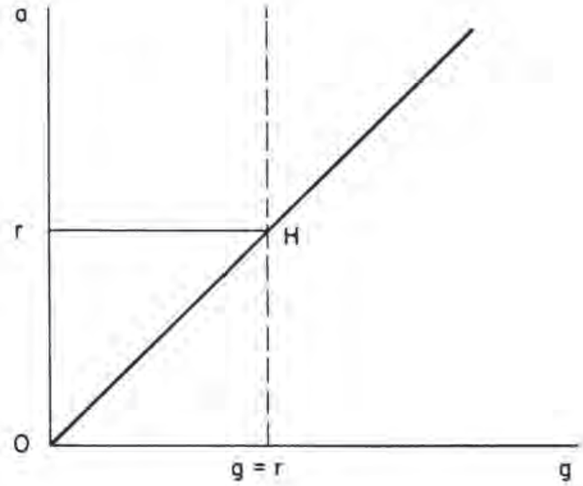

FIGURE 1

not the case that the direction of change of a with respect to g is signed. Nor is it true that r must lie between a and g. These facts are exemplified in the text.

II. After-Tax Analysis

These same results apply to the analysis of the relationship between the after-tax economic rate of return and the after-tax accounting rate of return. This is obvious if the depreciation schedule used is not that used for tax purposes; in that case, the effect of taxes is just to change the benefit profile with the analysis the same as before, given the new benefit profile $f(\cdot)$. Moreover, the same thing is true if tax depreciation is used. To see this, let α be the tax rate $0 < \alpha < 1$ (assumed constant for simplicity). Let r' denote the after-tax economic rate of return. Then r' satisfies

$$\text{(A22)} \quad \int_0^\infty \{(1-\alpha) f(\theta) + \alpha d(\theta)\} \times \exp(-r'\theta)\, d\theta = 1,$$

where $d(\theta)$ denotes depreciation on an asset of age θ and $f(\theta)$ denotes its *before*-tax benefits, as before.

This reflects the fact that the choice of a depreciation schedule, $d(\cdot)$, affects after-tax returns. Define

$$\text{(A23)} \quad f^*(\theta) \equiv \{(1-\alpha)f(\theta)+\alpha d(\theta)\}.$$

We now show that the analysis of the before-tax case applies directly to the after-tax case with $f^*(\cdot)$, the after-tax benefit schedule, replacing $f(\cdot)$, the before-tax benefit schedule.[26]

To see this, observe that the denominator of the accounting rate-of-return (whether total capitalization or stockholder's equity) will be the same before and after taxes. The numerator in the after-tax case, after-tax profits less depreciation, will be:

(A24)

$$\int_{-\infty}^{t}(1-\alpha)\{f(t-\theta)-d(t-\theta)\}I(\theta)\,d\theta,$$

$$=\int_{-\infty}^{t}\{(1-\alpha)f(t-\theta)+\alpha d(t-\theta)\}I(\theta)\,d\theta$$

$$-\int_{-\infty}^{t}d(t-\theta)I(\theta)\,d\theta,$$

$$=\int_{-\infty}^{t}f^*(t-\theta)I(\theta)\,d\theta-\int_{-\infty}^{t}d(\theta)I(\theta)\,d\theta.$$

But this is the *same* numerator as would be encountered in the before-tax analysis for a firm with the same depreciation schedule, but *before*-tax benefits $f^*(\cdot)$. For such a firm, r' would be the before-tax economic rate of return. Hence analysis of the after-tax case is identical to that of the before-tax case with an appropriate adjusted definition of the benefit schedule. All previous results apply to it.[27]

[26] A word about the treatment of inflation seems appropriate here. In the before-tax analysis it does not matter whether we work in real or nominal dollars (so long as we are consistent). In the after-tax case, however, the fact that depreciation which is deductible for tax purposes must be in nominal terms appears to raise some difficulty. That difficulty is only apparent however. Suppose that we begin by working in real terms. The nominal nature of the depreciation deduction plus the effects of inflation affect the depreciation schedule measured in real terms. We show, however, that any after-tax case with *any* depreciation schedule is isomorphic to a before-tax case. The effects being considered will, of course, influence *what* that before-tax case is, but they will not alter the existence of such a case. Hence, while the nominal nature of depreciation (like any other factor affecting the depreciation schedule) will affect what the numerical value of the real after-tax accounting rate of return is, it will not change our results.

[27] It is interesting (and revealing of the full unity of the before- and after-tax analyses) to note what happens in the case of "economic depreciation" examined above. In that case, it turns out that the (pathologically unlikely) choice of an economic depreciation schedule involves the *same* depreciation schedule whether economic depreciation is chosen before or after tax. Assets are valued at the present value of all remaining benefits either before or after tax; it makes no difference. Further, that choice of depreciation schedule makes the after-tax economic rate of return r' relate to the before-tax economic rate of return r, in the natural (but—except with this depreciation schedule—not inevitable) way: $r'=r(1-\alpha)$. To show these things, return to the differential equation (equation (A5)) from which we derived the formula for economic depreciation in the before-tax case.

$$\text{(a)} \qquad V'(\theta)=rV(\theta)-f(\theta).$$

Consideration of the before-tax analysis shows that if and only if $V(\cdot)$ satisfies this and $V(0)=1$, then

$$\text{(b)} \qquad V(\theta)=\int_{\theta}^{\infty}f(u)\exp(-r(u-\theta))\,du$$

the present value of future benefits. Now, choose $V(\cdot)$ and hence $d(\cdot)$ to satisfy (b) and therefore (a). Then

$$\text{(c)} \quad (1-\alpha)V'(\theta)=r(1-\alpha)V(\theta)-(1-\alpha)f(\theta),$$

$$\text{(d)} \quad V'(\theta)=r(1-\alpha)V(\theta)$$
$$-\{(1-\alpha)f(\theta)+\alpha d(\theta)\}=r(1-\alpha)V(\theta)-f^*(\theta),$$

since $d(\theta)\equiv -V'(\theta)$. But this is in the same form as (a). Hence, as in (A6):

(e)

$$V(\theta)=\int_{\theta}^{\infty}f^*(u)\exp(-r'(u-\theta))\,du+C\exp(r'\theta),$$

with $r'\equiv r(1-\alpha)$. Here, C is a constant of integration; however $C=0$, since (b) shows that $V(\infty)$ is finite. Since $V(0)=1$, we have

$$\text{(f)} \qquad 1=\int_{0}^{\infty}f^*(u)\exp(-r'u)\,du,$$

which shows that r' is the after-tax economic rate of return. From (b) and (e) with $C=0$, $V(\theta)$ is both the before- and the after-tax present value of the remaining benefit stream at θ, whence economic depreciation is the same in both cases. See Paul Samuelson.

Thus, in after-tax analysis as in before-tax analysis, there is no reason to believe that differences in the accounting rate of return correspond to differences in economic rates of return. Our computer examples show the effects can be very large; the belief that they are small enough in practice to make accounting rates useful for analytic purposes rests on nothing but wishful thinking.

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Advertising and Profitability: A Reappraisal

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Previous empirical studies of the relationship between profitability, market structure, and advertising intensity have consistently found a strong positive relationship between profit rates and advertising intensity. The profit rates used in these studies are based on treating advertising expenditures as a current expense. Much evidence exists that advertising has a long-lasting effect on sales, so that the treatment of advertising as a current expense is inappropriate. In this paper, corrected profit rates are calculated by treating advertising expenditures as an investment in a capital asset. The corrected profit rates are then used in a multivariate regression analysis of the relationship between profitability, market structure, and advertising intensity. No significant relationship between corrected profit rates and advertising intensity is found in the regressions. This finding suggests that the positive relationships between uncorrected profit rates and advertising intensity in previous studies are due solely to the inappropriate expensing of advertising.

Beginning with a study by Comanor and Wilson (1967), there have been a number of studies using multivariate regression analysis to investigate the relationship between profit performance, advertising intensity, and market structure. The general method of the studies is to use profit rates equal to reported profit divided by reported net worth as the dependent variable and measures of advertising intensity and market structure as independent variables. The conclusion which is reached consistently is that there is a strong positive relationship between profit rates and advertising intensity.

The measures of profit rate used in the studies are subject to error due to inappropriate accounting treatment of advertising in the calculation of reported profit and net worth. Advertising expenditures are treated

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as a current expense, even though they are generally believed to have a long-lasting impact on sales and should therefore be treated as an investment. The presence of errors in the measures of profit rate used can cause the results of regressions of the above type to be misleading.

Weiss (1969), finds that adjusting the profit rates of a sample of industries to correct for the expensing of advertising does not much change the strong positive relationship between profit rates and advertising intensity (pp. 428–29). However, there is evidence that his adjustments are inaccurate. We argue below that the questionable accuracy of the adjustments is due to aggregation problems encountered in the use of industry data. We find that when corrections for the expensing of advertising are made to the profit rates of a sample of firms, the strong positive relationship between profit rates and advertising intensity disappears. This finding supports the view that the strong positive relationships found in previously reported studies are due merely to the expensing of advertising.

I. The Effects of Expensing Advertising

Studies which demonstrate that advertising has a long-lasting effect on sales have been done by Nerlove and Waugh (1961), Telser (1962), Palda (1964), Lambin (1970), and Peles (1971). Yet, normal accounting practice is to treat advertising expenditures as a current expense in the calculation of reported profit and net worth. The assets on the balance sheets of firms exclude the value of undepreciated advertising expenditures, so that the reported net worth of the firms is understated. Also, when firms have current expenditures on advertising which differ from the amount of depreciation of their advertising asset, the reported profit of the firms is misstated.

The effect that the expensing of advertising has on a measure of profit rate equal to reported profit divided by reported net worth can be stated in terms of the difference between measured and "true" profit rates. The "true" profit rate is defined for our purposes as the rate which would prevail if advertising expenditures were treated as an investment and capitalized over their full economic lives.[1] Understatement of reported net worth causes the measured profit rate to be above the true profit rate. However, this effect can be partially or totally offset by positive net

[1] The "true" profit rate which we use is not corrected for all inappropriate accounting. In addition to advertising, expenditures on research and development, product promotion, and on-the-job training are treated as current expenses, even though they can be expected to have long-lasting effects. No explicit treatment is given to the inappropriate accounting of these additional classes of expenditure because of insufficient data to calculate the effect on profit rates. Thus, our true profit rate is still subject to error, but our purpose is merely to remove spurious correlation between advertising and profitability due to the inappropriate expensing of advertising expenditures.

investment in advertising, which causes the measured rate to be below the true rate.[2]

The general method of studies which have investigated the relationship between profit performance, advertising intensity, and market structure is to calculate regressions of the following type:

$$\pi/E = a_0 + \sum_{i=1}^{n} a_i X_i + e, \qquad (1)$$

where π/E is the measured profit rate equal to reported profit divided by reported net worth, the a's are estimated coefficients, the X_i's are measures of advertising intensity and market structure, and e is a residual term. The above discussion suggests that the measured profit rate used is composed of a true profit rate component and an error term component. The presence of an error term in the dependent variable can cause regression coefficients to reflect inaccurately the relationships between the independent variables and profitability.[3] In particular, the coefficient of advertising intensity is likely to be affected, because advertising intensity can be expected to be correlated with the amount of advertising asset and net investment in advertising. Telser (1969) has suggested that advertising intensity may serve as a proxy for omitted intangible capital in the form of advertising, so that the coefficient of advertising intensity in regressions of type (1) is biased upward (pp. 122–23). A positive coefficient of advertising intensity in regressions of type (1) can indicate a positive relationship between advertising intensity and the error term, rather than indicating that advertising increases profitability. To determine the relationship between advertising and true profitability, it is necessary to correct for the expensing of advertising in the calculation of measured profit rates.

II. Weiss's Study

Weiss (1969) investigates the effect that the expensing of advertising has on coefficients in regressions of type (1). He does this by comparing coefficients obtained from regressions of type (1) to coefficients obtained from regressions of the following type:

$$\pi^*/E^* = a_0' + \sum_{i=1}^{n} a_1' X_i + e', \qquad (2)$$

[2] If we assume that advertising expenditures grow at a constant rate over time, we can solve for the difference between measured and true profit rates in terms of the rate of growth of advertising expenditures, the rate of depreciation of advertising expenditures, and the level of the measured profit rate. A derivation of this relationship given by Telser (1968, p. 167) and by Weiss (1969, pp. 421–23).

[3] For a discussion of the effects of errors in the measurement of the dependent variable on the coefficients in classical least-squares regressions, see Johnston (1963, pp. 148–62) or Goldberger (1964, pp. 282–84).

where π^*/E^* is an estimate of the true profit rate derived from the measured profit rate, π/E, by treating advertising expenditures as an investment rather than a current expense; and the X_i's are the same independent variables used in the corresponding regression of type (1). He finds the regression coefficients in (2) are close to the corresponding coefficients in (1). The coefficients of advertising intensity are only moderately lower in the regressions of type (2), and they are still greater than zero at the 1 percent significance level using a one-tailed t-test. These findings suggest that the expensing of advertising does not affect the relationship between profit rates and advertising intensity, and that the coefficient of advertising intensity in regressions of type (1) provides an accurate indication of the relationship between advertising and profitability.

In calculating estimates of true profit rates for use in regressions of type (2) it is necessary to make assumptions regarding the manner in which advertising expenditures depreciate over time. In studies which have attempted to estimate the pattern of depreciation of advertising expenditures, the estimated pattern varies substantially with the type of product advertised and the method used in estimation.[4] This disparate evidence on depreciation patterns and problems of aggregation which are explained below make it important to check the accuracy of estimated true profit rates.

A test of the accuracy of the estimate of true profit rates used in regressions of type (2) is possible by making use of the relationship between measured and true profit rates. Weiss's estimates of true profit rates are derived from calculations of the following form: $\pi^*/E^* = (\pi + \Delta Z)/(E + Z)$, where π^*/E^* = the true profit rate for a period of time; π = the reported profit for the period; ΔZ = net investment in advertising during the period; E = reported net worth at the end of the period; Z = accumulated undepreciated advertising expenditures at the end of the period.[5] Using this expression, the measured profit rate, π/E, can be expressed as $\pi/E = (\pi^*/E^*)(1 + Z/E) - \Delta Z/E$. If the relationship between the X_i's and true profit rates is properly specified in regres-

[4] By calculating regressions involving current and lagged market shares, Telser (1962) estimated that the advertising expenditures of cigarette firms depreciated at a constant annual rate varying between 15 and 20 percent (p. 498). By calculating regressions involving current and lagged absolute sales, Palda (1964) estimated that the advertising expenditures for Lydia Pinkham Vegetable Compound depreciated at a constant annual rate of 33 percent (pp. 60–68). By calculating regressions of similar form to Telser's. Lambin (1970) estimated that the advertising expenditures for an unspecified consumer durable depreciated at a constant annual rate between 29 and 60 percent (p. 475).

[5] Weiss's formula for calculating true profit rates is as follows:

$$\frac{\pi_t^*}{E_t^*} = \frac{\pi_t + A_t - (1 - \lambda) \sum_{i=0}^{4} (\lambda^i A_{t-i}) - \lambda^5 A_{t-5}}{E_t + \sum_{i=0}^{4} \lambda^{i+1} A_{t-i}},$$

where A_t is advertising expenditures in year t and λ is one minus the annual rate of depreciation of advertising expenditures. The values of Z and ΔZ implied by this formula sions of type (2), the relationship between measured profit rates and the same X_i's is properly specified in regressions of the following type:

$$\pi/E = a_0''(1 + Z/E) + \sum_{i=1}^{n} a_i''(X_i(1 + Z/E)) + a_{n+1}(\Delta Z/E) + e''. \quad (3)$$

The dependent variable in regressions of type (3) is the same as in regressions of type (1), but the independent variables are altered to correct for the expensing of advertising. If altering the independent variables in a regression of type (3) reduces errors associated with the expensing of advertising, the corrected R^2 for the regression should be higher than the corrected R^2 for a corresponding regression of type (1). Thus, a comparison of the corrected R^2 provides a test of the accuracy of the adjustments made in calculating estimates of the true profit rates.[6] A further test of the accuracy of the adjustments is given by the value of the coefficient a_{n+1} in the regressions of type (3). The assumed value of this coefficient in Weiss's calculation of estimates of the true profit rates is -1, so that a_{n+1} should have a value of -1.

We calculate regressions of type (3) with the data on measured profit rates, advertising intensity, and market structure which Weiss uses in his regressions and with values of Z/E and $\Delta Z/E$ implied by his calculations of true profit rates. The results of these regressions are listed on lines 5 and 6 of table 1. Also listed in table 1 are the results presented by Weiss for the corresponding regressions of type (2), listed on lines 3 and 4, and the corresponding regressions of type (1), listed on lines 1 and 2. The corrected R^2 for each of the regressions of type (3) is below the corrected R^2 for the corresponding regression of type (1), and the values of the coefficient of $\Delta Z/E$ differ substantially from -1.[7] Thus, Weiss's estimates of true profit rates do not pass the test of accuracy established above.

are as follows:

$$\Delta Z = A_t - (1 - \lambda) \sum_{i=0}^{4} (\lambda^i A_{t-i}) - \lambda^5 A_{t-5},$$
$$Z = \sum_{i=0}^{4} \lambda^{i+1} A_{t-i}.$$

[6] If measured profit rates are subject to error due to inappropriate expensing of advertising, regressions of type (1) are improperly specified. The independent variables are altered in regressions of type (3) to correct for this improper specification. The improper specification will not be corrected if inaccurate values of Z/E and $\Delta Z/E$ are used in regressions of type (3). The size of the residual variances provides a test for an improvement in specification in going from (1) to (3). If a regression of type (3) is properly specified while the corresponding regression of type (1) is improperly specified, the residual variance for the regression of type (3) should be smaller according to Theil (1971, p. 543). As the total variance is the same in corresponding regressions of types (1) and (3), the corrected R^2 calculated according to the formula in n. 7 below is inversely related to the residual variance.

[7] The corrected R^2 listed on lines 1 through 4 of table 1 are not those given by Weiss (1969, p. 429). Rather, to obtain equivalent values of R^2 for all the regressions in table 1, all the R^2 were calculated using the following conventional formula for corrected R^2: $\bar{R}^2 = 1 - (1 - R^2)(n - 1)/(n - k - 1)$, where n is the number of observations and k is the number of explanatory variables.

TABLE 1

Regressions Relating π/E and π^*/E^* to Various Explanatory Variables for 37 Consumer-Goods Industries (t-Ratios in Parentheses)

Regression	Intercept	Advertising-to-Sales Ratio	High Advertising Dummy	Capital Requirements (logs)	Demand Growth (logs)	Regional Industry Dummy	Ratio of Advertising Investment to Net Worth ($\Delta Z/E$)	R^2	Corrected R^2
Type (1) from Weiss (1969): 1963–64 π/E dependent:									
1. Eq. (3) of table 6	−0.0283	0.4496	. . .	0.0091	0.0295	−0.0071	. . .	.35	.27
		(2.75)		(2.36)	(1.19)	(0.40)			
2. Eq. (4) of table 6	0.0227	. . .	0.0411	0.0052	0.0160	−0.0086	. . .	.39	.31
			(3.20)	(1.33)	(1.11)	(0.50)			
Type (2) from Weiss (1969): 1963–64 π^*/E^* dependent:									
3. Eq. (5) of table 6	−0.0155	0.3859	. . .	0.0077	0.0371	−0.0096	. . .	.32	.24
		(2.40)		(2.03)	(1.52)	(0.55)			
4. Eq. (6) of table 6	0.0380	. . .	0.0382	0.0041	0.0332	−0.0112	. . .	.38	.30
			(3.07)	(1.07)	(1.42)	(0.67)			
Type (3): 1963–64 π/E dependent:									
5. Corresponding to eqq. (1) and (3).	−0.0236	0.0784	. . .	0.0085	0.0299	−0.0061	0.2385	.32	.21
		(0.41)		(2.30)	(1.27)	(0.39)	(0.42)		
6. Corresponding to eqq. (2) and (4).	0.0032	. . .	0.0219	0.0062	0.0260	−0.0083	−0.0300	.38	.27
			(1.68)	(1.63)	(1.16)	(0.56)	(0.07)		

The data used in calculating the regressions in table 1 consist of observations on 37 U.S. consumer-goods industries. Weiss measures the industry level value of Z by the sum of current and past advertising expenditures of all firms in an industry minus the accumulated depreciation of these expenditures. He measures the industry-level value of ΔZ by the sum of current advertising expenditures by all firms in an industry minus current depreciation of Z. These procedures are equivalent to taking the sum, for all firms in an industry, of each firm's Z and ΔZ, valued as the firm's own advertising expenditures minus depreciation. Values of Z and ΔZ calculated in this manner tend to overstate an industry's advertising asset and net investment in advertising whenever firm advertising expenditures have long-lasting negative effects on the demand facing other firms in the industry.[8] The limited amount of evidence available indicates that these negative effects are substantial, which implies that there is a serious aggregation problem in calculating industry-level advertising assets and net investments in advertising.[9] Improper aggregation of firm advertising expenditures could explain the apparent inaccuracy of Weiss's estimates of industry true profit rates.[10] In any event, the possibilities of improper aggregation add to the difficulties of obtaining accurate estimates of true profit rates at the industry level.

III. Results Using Firm Data

The aggregation problems encountered in obtaining accurate estimates of true profit rates for industries can be lessened by using estimates of true profit rates for firms.[11] Firm profit-rate data are used in three

[8] When a firm's advertising has long-lasting negative effects on its competitors, the firm's advertising creates a negative asset for the competitors as well as a positive asset for the firm itself. This means that the addition to an industry's advertising assets from each firm's advertising is smaller than the addition to the firm's own advertising asset. Thus, when the values of Z and ΔZ for the firms in an industry are appropriately measured, and when each firm's advertising has negative effects on its competitors, values of Z and ΔZ for the industry calculated as the simple sum of the values of Z and ΔZ for firms in the industry overstate the industry's advertising asset and net investment in advertising.

[9] Telser (1962) supplies evidence on the negative effects of cigarette-firm advertising on other cigarette firms (pp. 483–87). Peles (1971) supplies similar evidence for the advertising of cigarette, beer, and automobile firms (pp. 39–43, 72–73). Finally, Lambin (1970) supplies evidence of the negative effects of competitors' advertising on the demand for an unspecified consumer durable (pp. 479–80).

[10] Another explanation of the apparent inaccuracy is that it is due to assuming the wrong rate of depreciation of advertising expenditures. Attempts to improve the accuracy of the estimates of true profit rates by using alternative assumptions about the rate of depreciation met with no success.

[11] Even when a firm's advertising has long-lasting negative effects on its competitors, the value of the advertising asset created for the firm will usually include only the positive effects on the firm's own future profits. An exception is where the firm's advertising leads its competitors to increase their advertising, and this induced advertising has a long-lasting negative effect on the first firm's future profits.

studies of the relationship between profit rates, advertising intensity, and market structure: Federal Trade Commission (1969), Imel and Helmberger (1971), and Shepherd (1972). However, a sufficient amount of data on advertising expenditures over time, to allow reasonable calculations of values of Z and ΔZ, are available only for the firms in the study by the Federal Trade Commission, and even so for only some of the firms. Our investigation of the effect of inappropriate expensing of advertising on the coefficients in regressions of type (1) is therefore based on a subsample of the FTC firms.

In the FTC study, regressions of type (1) are calculated using data for 97 U.S. food manufacturing firms. The profit rates used in the regressions are simple averages of annual profit rates for each of the 5 years from 1949 to 1953. Two profit rates are used: a profit rate P_1 which is equal to reported net income after taxes plus interest on long-term debt divided by reported net worth plus long-term debt, and a profit rate P_2 which is equal to reported net income after taxes divided by reported net worth. For each profit rate, linear and nonlinear regressions of type (1) in both unweighted and weighted form are calculated, using as independent variables advertising-to-sales ratios, concentration ratios, relative market shares, percentage changes in industry demand, one over the log of firm assets, and alternatively, three-digit-, four-digit-, and five-digit-firm diversification ratios. For the purpose of investigating the effect of the expensing of advertising on the regression coefficients, we use unweighted linear regressions with five-digit diversification ratios.[12] The results listed by the FTC for the regressions in this form are repeated here on lines 1 and 2 of table 2.

The data used in the calculation of the FTC regressions are listed in appendix C to their study. To check if the data are consistent with the regression results listed on lines 1 and 2 of table 2, regressions of identical form are calculated using the data. The results of these latter regressions are listed on lines 3 and 4 of the table. While the results of corresponding regressions of identical form differ, the strong positive relationship between profit rates and advertising-to-sales ratios is not much affected.

The advertising-to-sales ratios used by the FTC are found by taking averages of the advertising-to-sales ratios for all the industries in which a firm operates. Because the implied measures of advertising expenditure do not reflect the actual expenditures of the firms, they are not appropriate

[12] The choice of linear rather than nonlinear regressions was based on a desire to avoid the multicolinearity which arises when several different powers of the same explanatory variable are used in a regression. Regressions with five-digit-firm diversification ratios were chosen because these regressions had R^2s which were uniformly higher than the R^2s for the corresponding regression with a three- or four-digit-firm diversification ratio. Finally, unweighted regressions were chosen because heteroscedasticity was not present in the residuals of the regressions using the 40-firm subsample on which the conclusions of this study are based.

TABLE 2

REGRESSIONS RELATING MEASURED PROFIT RATES TO VARIOUS EXPLANATORY VARIABLES FOR 97 FOOD MANUFACTURING FIRMS AND SUBSAMPLES OF 57 AND 40 FIRMS (t-RATIOS IN PARENTHESES)

Regression	Profit Rate	Intercept	Four-Firm Concentration Ratio (%)	Relative Market Share (%)	Advertising-to-Sales Ratio (%)	Change in Industry Demand (%)	Five-Digit-Firm-Diversification Ratio (%)	$\frac{1}{\text{Log Assets}}$	R^2	Corrected R^2
From FTC (1969) for full 97-firm sample:										
1. Eq. (3a) of table 3-2 .	P_1	8.56	0.039	0.074	1.07	0.014	−0.069	−5.34	.410	.371
			(1.06)	(2.05)	(2.47)	(1.01)	(3.04)	(1.41)		
2. Eq. (3b) of table 3-2 .	P_2	13.60	0.049	0.053	1.16	0.020	−0.093	−12.3	.397	.357
			(1.10)	(1.22)	(2.20)	(1.17)	(3.37)	(2.67)		
For full 97-firm sample:										
3.	P_1	7.18	0.040	0.084	1.16	−0.005	−0.056	−3.69	.420	.381
			(1.08)	(2.82)	(2.73)	(0.32)	(2.49)	(1.03)		
4.	P_2	12.18	0.050	0.065	1.25	0.001	−0.081	−10.5	.396	.356
			(1.11)	(1.79)	(2.41)	(0.05)	(2.91)	(2.39)		
For 57-firm subsample:										
5.	P_1	4.10	0.083	0.107	0.503	−0.019	−0.054	−1.09	.329	.249
			(1.21)	(1.82)	(0.65)	(0.86)	(1.51)	(0.18)		
6.	P_2	10.35	0.087	0.087	0.844	−0.014	−0.080	−9.71	.325	.244
			(0.99)	(1.16)	(0.86)	(0.52)	(1.78)	(1.27)		
For 40-firm subsample:										
7.	P_1	3.98	0.027	0.086	1.67	0.010	−0.042	0.280	.629	.562
			(0.69)	(2.56)	(3.33)	(0.50)	(1.35)	(0.04)		
8.	P_2	6.68	0.039	0.070	1.44	0.014	−0.056	−1.85		
			(0.93)	(1.93)	(2.67)	(0.67)	(1.67)	(0.25)	.585	.510

for calculating estimates of true profit rates for the firms. For 40 out of the 97 firms in the FTC regression sample, data on firm advertising expenditures in six major media were available for the period 1936 through 1950 inclusive, and for the individual years, 1950, 1951, 1952, and 1953.[13] Our investigation for the effects of the expensing of advertising on the coefficient of advertising intensity in regressions of type (1) is therefore based on the 40-firm subsample. To check whether use of the 40-firm subsample distorts the results of the investigation, regressions in the same form as the regressions on lines 1–4 of table 2 are calculated for both the 40-firm subsample of included firms and the 57-firm subsample of excluded firms. The results of the 57-firm regressions are listed on lines 5 and 6 of table 2, and the results of the 40-firm regressions are listed on lines 7 and 8. The coefficients of the advertising-to-sales ratio are higher in the 40-firm regressions than in either the 57-firm regressions or the 97-firm regressions.

The data on advertising expenditures in six major media for the 40-firm subsample are used to calculate measures of Z and ΔZ by firm for each of the years 1950 through 1953.[14] These calculations assume a 5 percent per annum rate of depreciation of advertising capital. This rate of depreciation is chosen because it implies values of Z capable of explaining variations in the relationship between the market value and book value of the stock of firms in the regression sample.[15] The calculated measures

[13] The data on advertising expenditures in the six media for the years 1951, 1952, and 1953 are given in the October 29, 1954 issue of *Printer's Ink*, while the data on advertising expenditures for the year 1950 and for the period 1936–50 inclusive are given in the November 23, 1951 issue. The six media for which advertising expenditures are included are network television, network radio, magazines, newspapers, national farm papers, and Sunday magazine supplements.

[14] The first step in calculating measures of Z and ΔZ was to solve for values of r, the compounded ratio of advertising expenditures in year $t - 1$ to advertising expenditures in year t. These values were found using the following formula:

$$\sum_{t=1936}^{1950} A_t = \frac{[(1 - r)^{15}]A_{1950}}{1 - r},$$

where A_t is advertising expenditures in year t. Using the derived values of r, measures of Z and ΔZ were then calculated from the following formulas, where λ is one minus the annual rate of depreciation of advertising expenditures: $Z_{1950} = [\lambda/(1 - \lambda r)]A_{1950}$; $Z_t = \lambda(A_t + Z_{t-1})$ for $t = 1951$, 1952, and 1953; $\Delta Z_t = A_t - [(1 - \lambda)/\lambda)]Z_t$ for $t = 1950$, 1951, 1952, and 1953.

[15] The treatment of advertising as a current expense means that the amount of undepreciated advertising expenditures is not included as an asset on balance sheets, so that the value of a firm's advertising asset is not reflected in the book value of the firm's stock. The value of the firm's advertising asset does, however, tend to be reflected in the market value of the firm's stock. Thus, accurate measures of Z for firms should be highly correlated with the difference between the book value and market value of the firms' stock. We calculate regressions of the following form for 37 of the firms in the 40-firm subsample: $\log (M/E) = b_1 + b_2 \log [(E + Z)/E] + b_3 \log [\pi/(E + Z)] + e$, where M is the market value of the firm's stock. The values of Z used in the regressions are calculated using, alternatively, 5, 10, 20, and 33 percent annual rates of depreciation of advertising expenditures. The R^2s for the regressions decreased continually from .679 for

of Z and ΔZ are used to find estimates of the two average true profit rates, P_1^* and P_2^*, corresponding to the measured profit rates, P_1 and P_2. Because advertising expenditure data are not available for the year 1949, the period over which the average profit rates are calculated is limited to the 4 years 1950 through 1953, rather than the 5 years 1949 through 1953 used in the FTC study. The formulas used in finding the estimates of true profit rates are equivalent to those used by Weiss, except for the treatment of net investment in advertising.[16] Weiss adds the full amount of net investment in advertising to the numerator of his estimates of true profit rates. We add only the portion of net investment in advertising which is not offset by a reduction in taxes. Our purpose is to have estimates of true profit rates which reflect what profits would have been if advertising had been treated as an investment rather than expensed.[17] Our estimates of P_1^* and P_2^* for the 40 firms are listed in table A1, along with the corresponding values of P_1 and P_2.

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the regression with the 5 percent depreciation rate to .674 for the regression with the 33 percent depreciation rate. The t-ratio for the coefficient b_2 decreased continually from 4.79 for the 5 percent regression to 1.62 for the 33 percent regression.

[16] The average profit rates were calculated using the following formulas:

$$P_1 = \left(\sum_{t=1950}^{1953} \pi_{1t}\right) \Big/ \left(\sum_{t=1950}^{1953} E_{1t}\right);$$

$$P_2 = \left(\sum_{t=1950}^{1953} \pi_{2t}\right) \Big/ \left(\sum_{t=1950}^{1953} E_{2t}\right);$$

$$P_1^* = \frac{\sum_{t=1950}^{1953} [\pi_{1t} + (1 - m_t)\,\Delta Z_t]}{\sum_{t=1950}^{1953} (E_{1t} + Z_t)};$$

$$P_2^* = \frac{\sum_{t=1950}^{1953} [\pi_{2t} + (1 - m_t)\,\Delta Z_t]}{\sum_{t=1950}^{1953} (E_{2t} + Z_t)};$$

where π_{1t} = reported net income after taxes plus interest on long-term debt in year t; E_{1t} = reported net worth plus long-term debt in year t; π_{2t} = reported net income after taxes in year t; E_{2t} = reported net worth in year t; and m_t = the marginal corporate income tax rate in year t. The values of m_t used in the calculations include all income tax surcharges and excess profits taxes in effect during the years 1950 through 1953. To allow for the fact that the fiscal years of the firms ended at various times between June 30 of year t and June 29 of year $t + 1$, the values of m_t were calculated by taking a simple average of the marginal corporate income tax rates in effect at the end of each month from June of year t to May of year $t + 1$, as indicated by the Internal Revenue's Service's *Statistics of Income* (Washington: Government Printing Office), for the years 1950 through 1954: $m_{1950} = 0.57$, $m_{1951} = 0.80$, $m_{1952} = 0.82$, and $m_{1953} = 0.79$. Values of reported net income after taxes, interest on long-term debt, and reported net worth were taken from *Moody's Industrials* for the years 1950 through 1954.

[17] In the numerator of the estimates of true profit rates ΔZ_t is multiplied by $(1 - m_t)$ because the profit rates are calculated on an after-tax basis. The expensing of advertising results in reported profits before taxes being lower by one dollar for each dollar of net investment in advertising. When reported profits are lower, so are income taxes. Hence, the expensing of advertising has the effect of lowering reported profits after taxes by the amount of net investment in advertising times one minus the applicable income tax rate.

The 4-year average measured profit rates, P_1 and P_2, are used in calculating regressions of type (1) identical with those on lines 7 and 8 of table 2, except for the slightly shorter period over which the profit rates are averaged. The results of these regressions are listed on lines 1 and 2 of table 3. On lines 3 and 4 of table 3, are listed the results of regressions of type (2) which have the estimated true profit rate, P_1^* or P_2^*, substituted for the corresponding measured profit rate as the dependent variable. The coefficient of the advertising-to-sales ratio is substantially lower in the regressions of type (2) than in the corresponding regression of type (1): This result provides evidence that the coefficient of the advertising-to-sales ratio in regressions of type (1) overstates the relationship between advertising and profitability. Furthermore, the fact that the coefficients of the advertising-to-sales ratio in the regressions of type (2) are not greater than zero at the 5 percent significance level using a one-tailed t-test indicates that there is actually no measurable relationship between advertising and profitability.

The reliability of the above evidence depends on the accuracy of the estimates of true profit rates used in the regressions of type (2). According to the analysis of section II above, the accuracy of the estimates can be checked by calculating regressions of type (3) corresponding to the regressions of types (1) and (2). The results of such regressions of type (3) are listed in lines 5 and 6 of table 3. The corrected R^2 for these regressions of type (3) are higher than the corrected R^2 for the corresponding regressions of type (1). Also, the coefficients of $\Delta Z/E$ have values close to those assumed in the calculation of the estimates of true profit rates, although these coefficients do not differ from zero at the 5 percent significance level using a two-tailed t-test.[18] These results conform reasonably well to what would be expected from accurate estimates of true profit rates.

The advertising-to-sales ratios used in the regressions of table 3 are computed by the FTC from industry average advertising-to-sales ratios. These computed advertising-to-sales ratios do not reflect the actual ratios of advertising expenditure to sales for the individual firms in the regression sample, and may therefore be viewed as inappropriate. An alternative measure of the advertising-to-sales ratio is computed by dividing firm advertising expenditures in six major media for the years 1950 through 1953 inclusive by firm sales for the same period.[19] The alternative advertising-to-sales ratios are used in calculating regressions of types (1)–(3) identical with those in table 3, except for the change in

[18] The average value of $(1 - m_t)$ used in calculating true profit rates according to n. 16 above is 0.255. In regressions of type (3), this implies a coefficient $\Delta Z/E$ of -0.255.

[19] The data on advertising expenditures in the six media was taken from *Printer's Ink* issues of October 29, 1954 and November 23, 1951, and the data on net sales after excise taxes was taken from *Moody's Industrials* for the years 1950 through 1954.

the measure of the advertising-to-sales ratio. The results of these regressions, which are listed in table 4, do not differ in any consistent way from the results of the regressions listed in table 3, except for the somewhat lower coefficients of the advertising-to-sales ratio in table 4.

The regressions in tables 3 and 4 are calculated based on the assumption that advertising expenditures depreciate at a rate of 5 percent per annum. Given that there is uncertainty regarding the actual depreciation rate, it is important to check the sensitivity of our results to changes in the assumed depreciation rate. In his study, Weiss assumes advertising expenditures depreciate at 33.3 percent per annum. We calculate values of Z, ΔZ, P_1^*, and P_2^* for the subsample of 40 food manufacturing firms assuming a 33.3 percent advertising depreciation rate and then use these values to calculate regressions similar to those in table 4. The results of these regressions are listed in table 5. The regressions are numbered with primes, so that each regression corresponds to the unprimed regression of the same number in table 4.

The higher assumed advertising depreciation rate in the regressions of table 5 is associated with substantially higher coefficients for the advertising-to-sales ratio. However, these coefficients are not greater than zero at the 5 percent significance level using a one-tailed t-test. Also the corrected R^2 for the regressions of type (3) in table 5 are below the corrected R^2 for the corresponding regressions in table 4. In section II above, we show that the corrected R^2 in regressions of type (3) provides a test of the accuracy of the adjustments made in calculating true profit rates. Hence, we have evidence that calculations of true profit rates based on an assumed 33.3 percent annual advertising depreciation rate are less accurate than calculations based on an assumed 5 percent rate, at least for the firms in the 40-firm subsample.

In both table 3 and table 4 there are substantial differences between the coefficient of the advertising-to-sales ratio in the regressions of type (1) and the coefficient of the advertising-to-sales ratio in the corresponding regressions of type (2) or (3). This finding provides evidence that the coefficient of the advertising-to-sales ratio in regressions of type (1) overstates the relationship between advertising and profitability. While a strong positive relationship between profit rates and advertising intensity is found in the regressions of type (1), the relationship disappears in the regressions of types (2) and (3) when corrections are made for the expensing of advertising. Switching from the use of measured profit rates as the dependent variable in regressions of type (1) to the use of true profit rates as the dependent variable in regressions of type (2) affects the coefficient of no other variable as strongly or persistently as it affects the coefficient of the advertising-to-sales ratio. Therefore, it is appropriate to view the advertising-to-sales ratio in the regressions of type (1) as a proxy for errors in measured profit rates resulting from the expensing of advertising.

TABLE 3

Regressions Relating Measured and True Profit Rates to Various Explanatory Variables for 40 Food Manufacturing Firms, Using Advertising-to-Sales Ratios Computed by the FTC (t-Ratios in Parentheses)

Regression	Profit Rate	Intercept	Four-Firm Concentration Ratio (%)	Relative Market Share (%)	Advertising-to-Sales Ratio (%)	Change in Industry Demand (%)	Five-Digit Firm Diversification Ratio (%)	Ratio of Advertising Investment to Net Worth ($\Delta Z/E$) (%)	$\frac{1}{\text{Log Assets}}$	R^2	Corrected R^2
Type (1): 1950–53 average measured profit rate dependent:											
1.	P_1	2.45	0.020	0.078	1.45	0.003	−0.028	. . .	3.87	.628	.560
			(0.59)	(2.74)	(3.39)	(0.17)	(1.06)		(0.66)		
2.	P_2	5.29	0.026	0.065	1.23	0.007	−0.041	. . .	1.95	.585	.510
			(0.75)	(2.15)	(2.75)	(0.39)	(1.44)		(0.32)		
Type (2): 1950–53 average "true" profit rate dependent:											
3.	P_1^*	3.33	0.030	0.064	0.202	0.001	−0.025	. . .	2.96	.576	.500
			(1.33)	(3.34)	(0.71)	(0.06)	(1.39)		(0.76)		
4.	P_2^*	5.03	0.034	0.058	0.064	0.002	−0.031	. . .	1.46	.536	.452
			(1.43)	(2.87)	(0.21)	(0.14)	(1.62)		(0.35)		
Type (3): 1950–53 average measured profit rate dependent:											
5.	P_1	3.43	0.023	0.066	0.277	0.0003	−0.025	−0.172	2.52	.703	.638
			(1.05)	(3.24)	(1.14)	(0.03)	(1.38)	(0.76)	(0.62)		
6.	P_2	5.09	0.028	0.062	0.094	0.002	−0.031	−0.102	0.759	.631	.550
			(1.19)	(2.73)	(0.37)	(0.19)	(1.65)	(0.49)	(0.17)		

TABLE 4

Regressions Relating Measured and True Profit Rates to Various Explanatory Variables for 40 Food Manufacturing Firms, Using Advertising-to-Sales Ratio Equal to 1950–53 Advertising Expenditures Divided by 1950–53 Sales (t-Ratios in Parentheses)

Regression	Profit Rate	Intercept	Four-Firm Concentration Ratio (%)	Relative Market Share (%)	Advertising-to-Sales Ratio (%)	Change in Industry Demand (%)	Five-Digit-Firm-Diversification Ratio (%)	Ratio of Advertising Investment to Net Worth ($\Delta Z/E$) (%)	$\frac{1}{\text{Log Assets}}$	R^2	Corrected R^2
Type (1): 1950–53 average measured profit rate dependent:											
1.	P_1	4.17	0.050	0.073	0.881	0.022	−0.043	. . .	0.211	.569	.491
			(1.50)	(2.39)	(2.32)	(1.27)	(1.51)		(0.03)		
2.	P_2	7.01	0.047	0.062	0.897	0.024	−0.053	. . .	−1.91	.564	.486
			(1.43)	(2.01)	(2.37)	(1.37)	(1.86)		(0.29)		
Type (2): 1950–53 average true profit rate dependent:											
3.	P_1^*	3.41	0.037	0.062	0.030	0.003	−0.027	. . .	2.93	.570	.492
			(1.78)	(3.23)	(0.13)	(0.29)	(1.53)		(0.71)		
4.	P_2^*	5.02	0.036	0.057	−0.014	0.002	−0.032	. . .	1.57	.536	.451
			(1.68)	(2.84)	(0.06)	(0.21)	(1.69)		(0.36)		
Type (3): 1950–53 average measured profit rate dependent:											
5.	P_1	3.61	0.034	0.062	0.018	0.005	−0.030	−0.108	2.20	.691	.624
			(1.57)	(3.02)	(0.06)	(0.49)	(1.65)	(0.34)	(0.53)		
6.	P_2	4.98	0.037	0.060	−0.154	0.004	−0.034	0.010	0.760	.632	.552
			(1.61)	(2.68)	(0.50)	(0.41)	(1.83)	(0.04)	(0.18)		

TABLE 5

REGRESSIONS RELATING MEASURED AND TRUE PROFIT RATES TO VARIOUS EXPLANATORY VARIABLES FOR 40 FOOD MANUFACTURING FIRMS, USING ADVERTISING-TO-SALES RATIO EQUAL TO 1950–53 ADVERTISING EXPENDITURES DIVIDED BY 1950–53 SALES, 33.3% ANNUAL RATE OF DEPRECIATION OF ADVERTISING EXPENDITURES ASSUMED (t-RATIO IN PARENTHESES)

Regression	Profit Rate	Intercept	Four-Firm Concentration Ratio (%)	Relative Market Share (%)	Advertising-to-Sales Ratio (%)	Change in Industry Demand (%)	Five-Digit-Firm Diversification Ratio (%)	Ratio of Advertising Investment to Net Worth (Z/E) (%)	$\frac{1}{\text{Log Assets}}$	R^2	Corrected R^2
Type (2): 1950–53 average true profit rate dependent:											
3′. . . .	P_1^*	4.01	0.048	0.070	0.534	0.015	−0.038	. . .	0.952	.586	.510
			(1.75)	(2.73)	(1.69)	(1.05)	(1.62)		(0.17)		
4′. . . .	P_2^*	6.47	0.047	0.062	0.509	0.016	−0.047	. . .	−0.954	.573	.495
			(1.68)	(2.39)	(1.59)	(1.08)	(1.95)		(0.17)		
Type (3): 1950–53 average measured profit rate dependent:											
5′. . . .	P_1	4.06	0.050	0.072	0.402	0.015	−0.040	0.441	0.296	.626	.545
			(1.73)	(2.63)	(0.96)	(1.01)	(1.61)	(0.52)	(0.01)		
6′. . . .	P_2	6.37	0.050	0.064	0.394	0.017	−0.047	0.241	−1.45	.610	.525
			(1.69)	(2.30)	(0.95)	(1.12)	(1.90)	(0.33)	(0.25)		

IV. Conclusions

Previous studies investigating the relationship between measured profit rates, advertising intensity, and market structure have consistently found a strong positive relationship between profitability and advertising intensity. Advertising intensity has generally been treated as a proxy for the degree of product differentiation, indicating that product differentiation is associated with high profitability. An alternative explanation for finding a strong positive relationship between measured profitability and advertising intensity is that advertising intensity is a proxy for errors in measured profit rates resulting from the expensing of advertising. The evidence presented above supports the latter explanation rather than the former. Although the evidence is based on only one relatively small sample of firms, it clearly indicates the need for caution in interpreting the results of regressions using measured profit rates as the dependent variable.

The relationship between advertising and profitability has attracted attention from policymaking bodies such as the FTC because of the implications for a public policy aimed at maintaining the maximum degree of competition. If advertising by differentiating products acts as a barrier to entry, a positive relationship between advertising and profitability can be expected. The strong positive relationship between measured profit rates and advertising intensity found in previous studies of the relationship between advertising and profitability has lent support to the view that a corrective policy toward advertising is needed to maintain competition. The evidence presented above indicates that a strong positive relationship between measured profit rates and advertising intensity disappears when the profit rates are adjusted to correct for the expensing of advertising. Thus, the view that a positive relationship between measured profit rates and advertising intensity indicates the need for corrective policy toward advertising seems unwarranted.

It is interesting to note that, while adjusting measured profit rates to correct for the expensing of advertising casts doubt on the need for a corrective policy toward advertising to maintain competition, the need for a different kind of corrective policy toward advertising is clearly indicated. The treatment of advertising expenditures as a current expense rather than as an investment in the calculation of reported profits reduces the reported profits of firms that make positive net investments in advertising. The tax payments of such firms are reduced because the level of tax payments varies directly with the level of reported profits.[20] The

[20] The reduction in current tax payments gives rise to a deferred tax liability which is incurred when the firm subsequently reduces its investment in advertising. For a firm which continually increases its advertising expenditures there is never a subsequent reduction in its advertising investment, so the deferred tax liability is never incurred.

data on net investments in advertising and marginal corporate income tax rates used in calculating estimated true profit rates for 40 food manufacturing firms imply that over the 4 years, 1950 through 1953, the 40 firms were able to avoid a total of \$373 million of taxes due to the expensing of advertising for tax purposes.[21] The average annual tax avoidance over the 4 years for each of the 40 firms is listed in table A1. The tax avoidance amounts to an average of more than \$2 million per firm per year. The ratio of tax avoidance to advertising expenditures is 0.46, which is the equivalent of a 46 percent subsidy on advertising expenditures.[22]

Weiss (1969) proposes that to eliminate the implicit subsidy on advertising the capitalization of advertising expenditures for tax purposes should be enforced in cases where the advertising expenditures have long-lasting effects (pp. 429–30). The size of the implicit subsidy on the advertising of the 40 food manufacturing firms indicates the importance of the subsidy for firms that have large amounts of long-lasting advertising, and thus provides evidence in support of Weiss's proposal for tax reform.

[21] The amount of tax avoidance was calculated by multiplying total net investment in advertising for the 40 firms in each year by the prevailing marginal corporate income tax rate and then summing over the 4 years. For the marginal tax rates used, see n. 16 above.

[22] The amount of tax avoidance during the years 1950 through 1953 was to a degree uncharacteristically high due to the imposition of excess profits taxes after the beginning of the Korean war. Assuming that the corporate income tax rate had been a normal 52 percent during the period and that the same level of advertising expenditures prevailed, the total tax avoidance for the firms would have been \$249 million and the ratio of tax avoidance to advertising expenditures would have been 0.31. Thus, even with normal income tax rates the 40 food manufacturing firms would have been receiving the equivalent of a 31 percent subsidy on their advertising expenditures.

Appendix

TABLE A1

Profit Rates, Advertising-to-Sales Ratios, Advertising Assets, and Tax Avoidance from Expensing of Advertising, for 40 Food Manufacturing Firms

Company	Average Profit Rates (%)				Advertising-to-Sales Ratio (%)	Average Advertising Asset ($ Millions)	Average Annual Tax Avoidance ($ Millions)
	P_1	P_2	P_1^*	P_2^*			
Swift & Co.	6.5	7.2	5.8	6.3	0.37	63.6	4.32
Armour & Co.	5.1	5.8	4.9	5.4	0.27	34.0	2.87
Schenley Industries	6.4	8.6	5.7	7.0	2.50	79.2	5.31
National Dairy Products	9.9	13.0	8.8	10.9	0.92	59.3	5.19
Jos. Seagram & Sons	11.3	14.2	9.1	10.5	2.06	101.6	6.92
General Foods	10.7	12.5	7.2	7.7	4.03	182.0	13.34
National Distillers Prod.	6.4	8.0	5.8	6.9	1.96	59.6	4.40
Borden Co.	9.0	10.9	8.1	9.4	0.60	33.4	1.98
Coca-Cola Co.	16.6	16.8	12.5	12.6	2.23	60.4	1.50
National Biscuit Co.	12.3	12.5	10.7	10.8	1.28	29.6	1.99
Hiram Walker & Sons	13.7	14.0	11.3	11.4	1.14	37.2	1.32
Corn Products Refining	12.4	12.4	11.0	11.0	1.32	21.2	1.01
California Packing	8.1	9.2	7.5	8.2	1.13	16.6	1.18
Wilson & Co.	4.3	4.4	4.1	4.2	0.11	8.5	0.30
General Mills	9.4	9.7	6.0	6.1	3.24	107.0	7.17
Publicker Industries	4.1	4.1	4.1	4.1	1.57	12.3	1.41
H. J. Heinz	6.5	6.7	4.9	4.8	1.45	41.1	0.66
Standard Brands	8.3	8.4	5.3	5.3	1.94	80.8	2.09
Libby, McNeil, & Libby	6.5	7.8	5.2	5.8	1.11	24.0	0.70
Wesson Oil & Snowdrift	7.0	7.0	6.5	6.5	1.02	11.4	0.93
Pillsbury Mills	6.1	7.1	5.4	5.9	2.49	34.8	4.30
Pabst Brewing	11.1	12.1	9.6	10.3	1.75	17.2	1.45
Quaker Oats Co.	11.3	13.0	7.9	8.4	3.23	50.2	3.52
Ralston Purina Co.	10.6	12.3	8.4	9.3	0.63	27.6	0.93
Carnation Co.	10.5	12.4	9.0	10.1	1.01	18.8	1.52
Wm. Wrigley, Jr. Co.	15.8	15.8	11.4	11.4	5.73	30.5	2.05
Continental Baking Co.	9.8	12.3	7.6	8.9	1.16	19.4	0.77
Stokely–Van Camp	8.1	8.1	7.1	7.0	1.26	9.6	0.73
Sunshine Biscuits	15.2	15.2	13.0	13.0	1.07	8.5	0.56
Brown-Forman Distillers	9.3	12.4	8.0	9.6	3.68	12.8	1.40
Kellogg Co.	23.5	23.5	10.7	10.7	5.04	55.8	3.08
Pet Milk Co.	7.8	7.8	6.4	6.4	1.38	13.4	1.14
Best Foods	13.8	13.8	9.4	9.4	2.85	21.2	0.91
Geo. Hormel & Co.	8.7	10.0	7.3	8.0	0.46	9.5	0.62
Canada Dry Ginger Ale	8.5	9.6	6.1	6.4	3.70	18.4	1.01
Glenmore Distillers Co.	7.9	9.7	6.4	7.1	3.89	14.8	1.17
Hunt Foods	9.5	9.9	8.8	9.0	3.64	7.1	1.45
Pepsi-Cola Co.	11.4	12.4	8.3	8.6	4.13	16.1	0.92
Gerber Products Co.	15.1	16.9	12.0	12.7	2.32	7.4	0.75
Green Giant Co.	8.6	10.2	7.1	7.7	3.61	8.7	0.78

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ADVERTISING AND RATE OF RETURN*

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I. Introduction and Summary

Following the work of Comanor and Wilson[1] a growing number of studies,[2] have found a positive relation across firms between rate of return and advertising intensity, as measured by firms' advertising to sales ratios. With the exception of Weiss, all these studies treat advertising as a current expense, in accordance with current accounting procedures, in calculating rates of return. The Weiss study treats advertising as an investment.

This paper analyzes the bias in rate of return which arises if a firm's advertising expenditures are depreciated incorrectly. Then, employing a set of empirically derived advertising depreciation rates, rates of return are recalculated for a group of heavy advertisers by capitalizing their past advertising expenditures. In contrast to previous findings, these corrected rates of return are found to be unrelated to the firms' advertising intensities.

II. Barriers to Entry

The direct relation between advertising to sales ratios and rates of return is commonly interpreted as evidence that advertising creates barriers to entry. Reflecting a strong implicit belief in the power of market processes generally to equate rates of return among firms, this positive relationship has supported the idea that advertising must be preventing the entry of new competition and the resultant equalization of profit rates.

There is little theoretical support for this view of advertising. To my knowledge the only rigorous attempt to explain how advertising creates a

* This paper is based on my doctoral dissertation. I am indebted to Professor Harold Demsetz for suggesting this area of inquiry to me, and to Professors Demsetz and Peltzman for numerous valuable suggestions.

[1] William S. Comanor & Thomas S. Wilson, Advertising, Market Structure and Performance, 49 Rev. of Econ. & Stat. 423 (1967).

[2] Louis Esposito & Frances Ferguson Esposito, Foreign Competition and Domestic Industry Profitability, 53 Rev. Econ. & Stat. 343 (1971); Federal Trade Commission (F.T.C.), Economic Report on the Influence of Market Structure on the Profit Performance of Food Manufacturing Companies (1969); William G. Shepherd, The Elements of Market Structure, 54 Rev. Econ. & Stat. 25 (1972); Leonard W. Weiss, Advertising, Profits, and Corporate Taxes, 51 Rev. Econ. & Stat. 722 (1969).

barrier to entry (as opposed to assertions that it has and does) is presented by Comanor and Wilson. They construct a model in which they claim that new firms have higher costs than established firms at every level of output. The reason for this is that in addition to production costs and advertising costs faced by established firms, new entrants also have "market penetration" advertising costs. In identifying the average market penetration cost schedule faced by the new entrant Comanor and Wilson state:

> This schedule therefore denotes the required rate of return on capital invested in market penetration times the total expenditure required to establish a given volume of sales, all divided by the number of units sold.[3]

I interpret this as saying that market penetration expenditures are an investment with infinite life and zero depreciation rate. That is, the only cost of market penetration is foregone interest on penetration expenditures. Now since each firm in the market must have at one time entered the market all firms in the market must have had penetration expenditures. But since in this model penetration capital does not depreciate all established firms must have all their penetration capital intact and, *certeris paribus,* be incurring interest costs equal to those faced by the new entrant. Thus in Comanor and Wilson's model there is no cost differential between new and established firms and thus no barrier to entry by new firms.

III. Accounting Bias

An alternative explanation of the positive relation between advertising intensity and rates of return has been suggested in the literature by Telser, and earlier noted by Backman.[4] Simply put, it states that advertising is in fact a long-lived investment which creates "advertising capital." Accounting practices, which treat advertising as a current expense, systematically exclude this intangible asset from the firm's assets thereby understating the firm's equity and, in general, misstate the firm's net revenue by substituting current advertising outlays for actual depreciation of the firm's advertising capital. If this is the case, accounting rate of return is generally biased; and further, it is possible it is biased upward by an amount which is positively related to the firm's advertising intensity. In this situation part, or all, of the positive relation between accounting profit rates and advertising intensity is spurious. It was this possibility which prompted Weiss to treat advertising as an investment.

[3] William S. Comanor & Thomas S. Wilson, *supra* note 1, at 427.

[4] L. G. Telser, Some Aspects of the Economics of Advertising, 41 J. Bus. 166 (1968); Jules Backman, Advertising and Competition (1967).

IV. The Rate of Return Model

A common denominator of the above noted advertising—rate of return studies is an *assumed* advertising depreciation rate. The studies employing accounting rates of return implicitly assumed annual advertising depreciation rates of 1. The Weiss study,[5] using a geometric depreciation pattern, assumed an annual advertising depreciation rate of .333.

It is possible that none of these assumed advertising depreciation rates closely correspond to the actual advertising depreciation rates of all the firms or industries to which they have been applied. To ascertain the possible biases in calculated profit rates arising from the use of incorrect advertising depreciation rates, and to see how these biases are affected by various attributes of the firm, let us develop a model of the type presented by Weiss.

Let:

λ = an assumed annual advertising retention rate ($0 \leq \lambda < 1$).

λ^* = the firm's true annual advertising retention rate ($0 \leq \lambda^* < 1$).

π = accounting profits, or net revenue.

π' = calculated profits obtained by replacing current advertising outlays with advertising depreciation calculated using annual advertising depreciation rate $(1 - \lambda)$.

π^* = true profits obtained by replacing current advertising outlays with advertising depreciation calculated using annual advertising depreciation rate $(1 - \lambda^*)$.

C = calculated beginning of year advertising capital, obtained using λ.

C* = true beginning of year advertising capital, obtained using λ^*.

E = end of year accounting equity, hereinafter referred to as "equity".

E′ = calculated end of year equity obtained by adding calculated end of year advertising capital to equity.

E* = true end of year equity obtained by adding true end of year advertising capital to equity.

(π/E) = accounting rate of return.

$(\pi'/E') = (\pi/E)'$ = calculated rate of return.

$(\pi^*/E^*) = (\pi/E)^*$ = true rate of return.

t = time

ρ = annual advertising growth rate, assumed constant.

Then

$$A(t) = A(0)\,(1 + \rho)^t = \text{advertising expenditures at beginning of t.} \quad \text{(IV.1)}$$

[5] Leonard W. Weiss, *supra* note 2.

A sufficient condition for calculated values to equal true values is for λ^* to be used in calculation.

From the above assumptions and definitions it follows that current advertising capital, as the sum of all past undepreciated advertising, is:

$$C(t) = \sum_{i=0}^{\infty} \lambda^i A(t - i) \tag{IV.2}$$

Substituting (IV.1) for A(t − i) and simplifying we have:

$$C(t) = A(t)\left\{\frac{1 + \rho}{1 + \rho - \lambda}\right\} \qquad (\lambda < 1 + \rho) \tag{IV.3}$$

And,

$$C(t)^* = A(t)\left\{\frac{1 + \rho}{1 + \rho - \lambda^*}\right\} \tag{IV.4}$$

Since to correct net revenue we must replace current advertising expenditures with advertising depreciation

$$\pi' = \pi + A(t) - (1 - \lambda)C(t)$$

So

$$\pi' = \pi + A(t)\left\{\frac{\lambda\rho}{1 + \rho - \lambda}\right\} \tag{IV.5}$$

and

$$\pi^* = \pi + A(t)\left\{\frac{\lambda^*\rho}{1 + \rho - \lambda^*}\right\} \tag{IV.6}$$

Also, when $\lambda = 0$, $\pi' = \pi$.

Similarly, correcting equity by adding in end-of-year advertising capital, we have:

$$E' = E + \lambda\, C(t)$$

So

$$E' = E + A(t)\left\{\frac{(1 + \rho)\lambda}{1 + \rho - \lambda}\right\} \tag{IV.7}$$

and

$$E^* = E + A(t)\left\{\frac{(1 + \rho)\lambda^*}{1 + \rho - \lambda^*}\right\} \tag{IV.8}$$

Also, when $\lambda = 0$, $E' = E$.

From (IV.5) and (IV.7) we see that, dropping t,

$$(\pi/E)' = \frac{\pi(1 + \rho - \lambda) + A\lambda\rho}{E(1 + \rho - \lambda) + A\lambda(1 + \rho)} \tag{IV.9}$$

Dividing the numerator and denominator on the right in (IV.9) by E, letting the accounting rate of return, (π/E), equal R and the advertising to equity ratio, (A/E), equal Q, (IV.9) becomes

$$(\pi/E)' = \frac{R(1 + \rho - \lambda) + Q\rho\lambda}{1 + \rho - \lambda + Q(1 + \rho)\lambda} \tag{IV.10}$$

Using this expression for calculated rate of return it can be shown (see Appendix A) that a calculated rate of return diverges from the true rate of return as an assumed advertising retention rate, λ, diverges from the true advertising retention rate, λ^*; as the advertising to equity ratio, Q, becomes larger; and as the accounting rate of return, (π/E), diverges from $\rho/(1 + \rho)$.

The meanings of the first two of these factors affecting a bias in calculated rate of return are readily apprehended. Obviously, when a bias exists, it will be greater, the greater is the difference between the actual advertising depreciation rate and the assumed advertising depreciation rate, and the greater are advertising expenditures relative to stockholders' equity, other things equal.

An understanding of the last factor affecting the bias may be obtained by focusing on the ratio of the change in calculated profits to the change in calculated equity which occurs as λ is increased from zero. This ratio is just the marginal calculated rate of return.

From (IV.5), the change in calculated profits is:

$$\frac{\partial \pi'}{\partial \lambda} = \frac{(1 + \rho - \lambda)\, A\rho + A\lambda\rho}{(1 + \rho - \lambda)^2}$$

From (IV.7), the change in calculated equity is:

$$\frac{\partial E'}{\partial \lambda} = \frac{(1 + \rho - \lambda)\, A(1 + \rho) + A\lambda(1 + \rho)}{(1 + \rho - \lambda)^2}$$

So the marginal calculated rate of return is, upon simplification:

$$\left(\frac{\partial \pi'}{\partial \lambda} \Big/ \frac{\partial E'}{\partial \lambda}\right) = \frac{\rho}{1 + \rho} \tag{IV.11}$$

The marginal calculated rate of return is just the constant $\rho/(1 + \rho)$. Exploiting our knowledge of the relation between marginals and averages it is easy to see what happens to calculated rate of return as the advertising retention rate used in calculation is increased from zero (depreciation rate decreased from one). There are three general cases.

If the accounting rate of return, (π/E), equals the marginal rate of return, $\rho/(1 + \rho)$, the calculated rate of return will remain unchanged as λ increases. Since the possible values of λ included λ^*, and since the calculated rate of return is independent of λ in this case, any advertising depreciation rate—including one—will yield a calculated rate of return equal to the true rate of return. Thus there will be no accounting bias in this case.

When the accounting rate of return is less than $\rho/(1 + \rho)$ increases in λ will result in an increase in calculated rate of return.

When the accounting rate of return is greater than $\rho/(1 + \rho)$ increases in λ will result in a decrease in calculated rate of return.

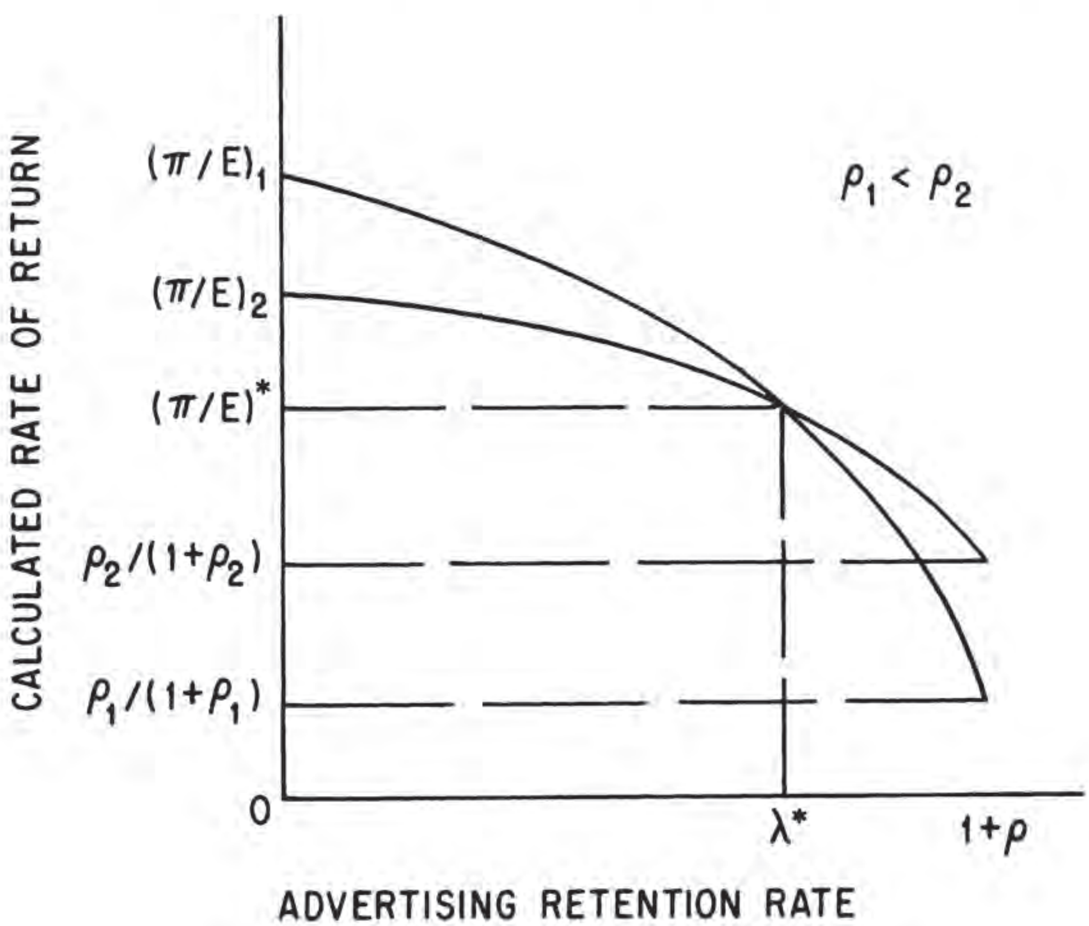
In these latter two cases we can see from equation (IV. 10) that as λ approached $(1 + \rho)$, $(\pi/E)'$ approaches $\rho/(1 + \rho)$. Thus a curve showing calculated rate of return as a function of λ ranges from the accounting rate of return, (π/E), to the constant marginal calculated rate of return, $\rho/(1 + \rho)$.

Figure I shows two hypothetical $(\pi/E)'$ curves for a firm under two differ-

FIGURE I

CALCULATED RATE OF RETURN AS A FUNCTION OF ADVERTISING RETENTION RATE

(TWO DIFFERENT ADVERTISING GROWTH RATES)



ent advertising growth rates, each fulfilling $(\pi/E) > \rho/(1 + \rho)$, and other things equal.[6] This case $\{(\pi/E) > \rho/(1 + \rho)\}$ is of particular interest since it is the situation for thirty-eight of the thirty-nine firms in my sample, and since it is the core of Telser's objection to the studies employing accounting rates of return. We can see from Figure I that in this case, if $\lambda^* > 0$, a firm's accounting rate of return is biased upwards.

It is easy to see in Figure I that for any $\lambda \neq \lambda^*$ the divergence of a calculated rate of return from the true rate of return is greater the greater is the spread between (π/E) and $\rho/(1 + \rho)$—which was the assertion on p. 483.

Figure II shows "typical" $(\pi/E)'$ curves relating calculated rate of return to advertising retention rate for the cases $(\pi/E) = \rho/(1 + \rho)$, and $(\pi/E) < \rho/(1 + \rho)$.

Figures III and IV show additional "typical" $(\pi/E)'$ curves for the case when $(\pi/E) > \rho/(1 + \rho)$. Figure III shows the relations between calculated rate of return and advertising retention rate for two different true retention rates, other things equal. Figure IV shows the relations between calculated rate of return and advertising retention rate for two different advertising to equity ratios, other things equal. Picking a $\lambda \neq \lambda^*$ in each of these figures and comparing $(\pi/E)_1'$ to $(\pi/E)_2'$ shows that the absolute bias in calculated rate of return increases as $|\lambda - \lambda^*|$ and the advertising to equity ratio increase, other things equal.

Schematics analogous to Figures I, III, and IV easily may be sketched by the reader for the case $(\pi/E) < \rho/(1 + \rho)$. Doing so readily confirms the generality of the conclusion that as $|\lambda - \lambda^*|$, Q and $|(\pi/E) - \rho/(1 + \rho)|$ increase calculated rate of return diverges from the true rate of return.

As an example of the kind of problem a bias in calculated rate of return could lead to, let us briefly consider the FTC study of the food industry.[8] In this study the FTC regressed accounting profit rates on advertising to sales ratios and some other variables. As noted above, a statistically significant positive relation between the rates of return and the advertising to sales ratios was found. Suppose that these firms, all being in the same industry, had the same λ^* and that it was greater than zero. Further suppose that their advertising growth rates were the same and that $(\pi/E) > \rho/(1 + \rho)$. Then the relation between the firms' accounting profit rates and advertising to equity ratios would be like that shown in Figure IV, if they all had the same

[6] The shape of these curves is for usual values of Q and ρ since, denoting the denominator of (IV.10) by D, $\frac{\partial^2(\pi/E)'}{\partial\lambda^2} = \frac{Q(1 + \rho)^2}{D^4}\{\rho/(1 + \rho) - R\}\{1 - Q(1 + \rho)\}$ and $(\pi/E) < \rho/(1 + \rho)$.

[7] Federal Trade Commission (F.T.C.), Economic Report on the Influence of Market Structure on the Profit Performance of Food Manufacturing Companies (1969).

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FIGURE II

CALCULATED RATE OF RETURN AS A FUNCTION OF ADVERTISING RETENTION RATE

$\{(\pi/E) = \rho/(1+\rho) \text{ and } (\pi/E) < \rho/(1+\rho)\}$

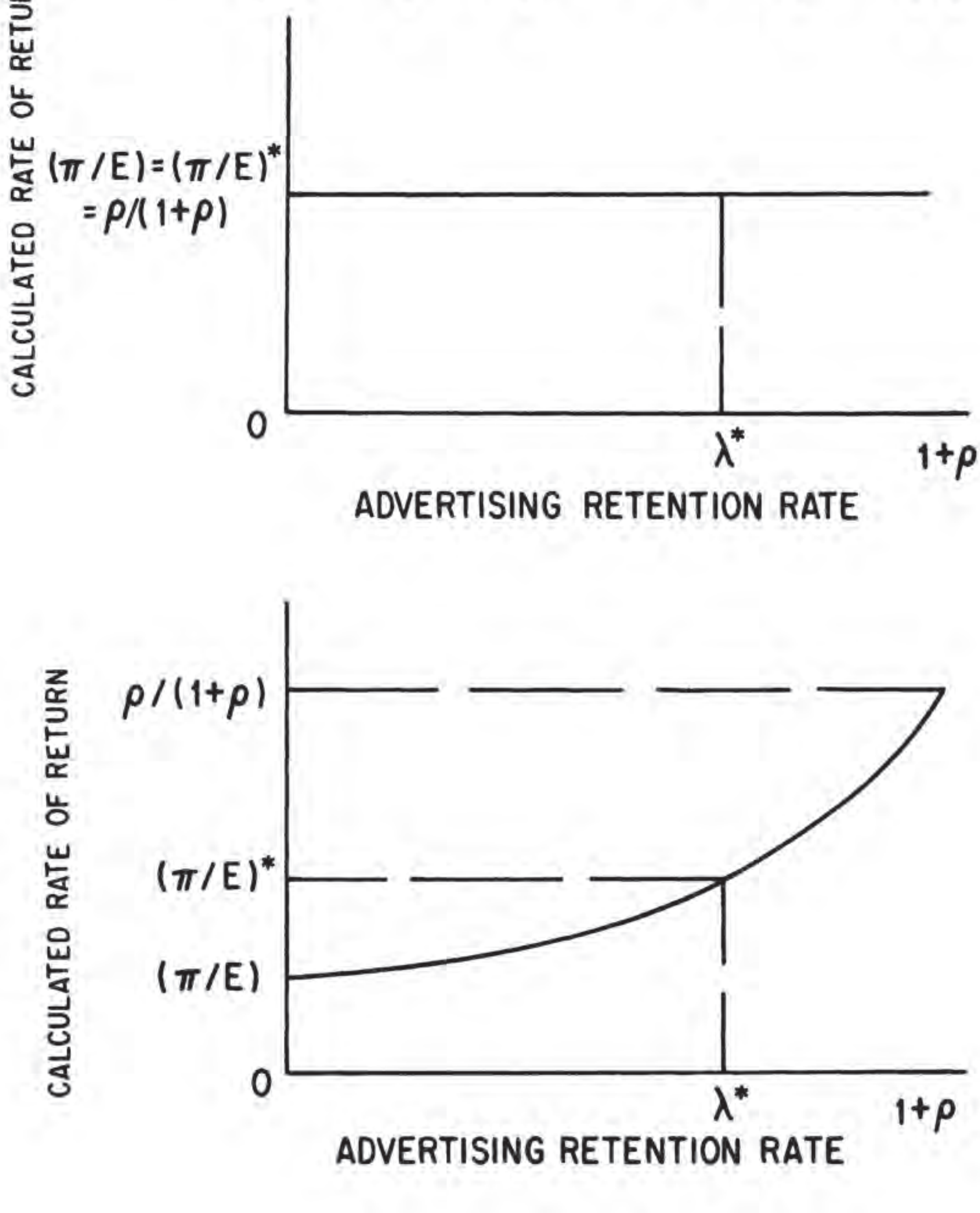
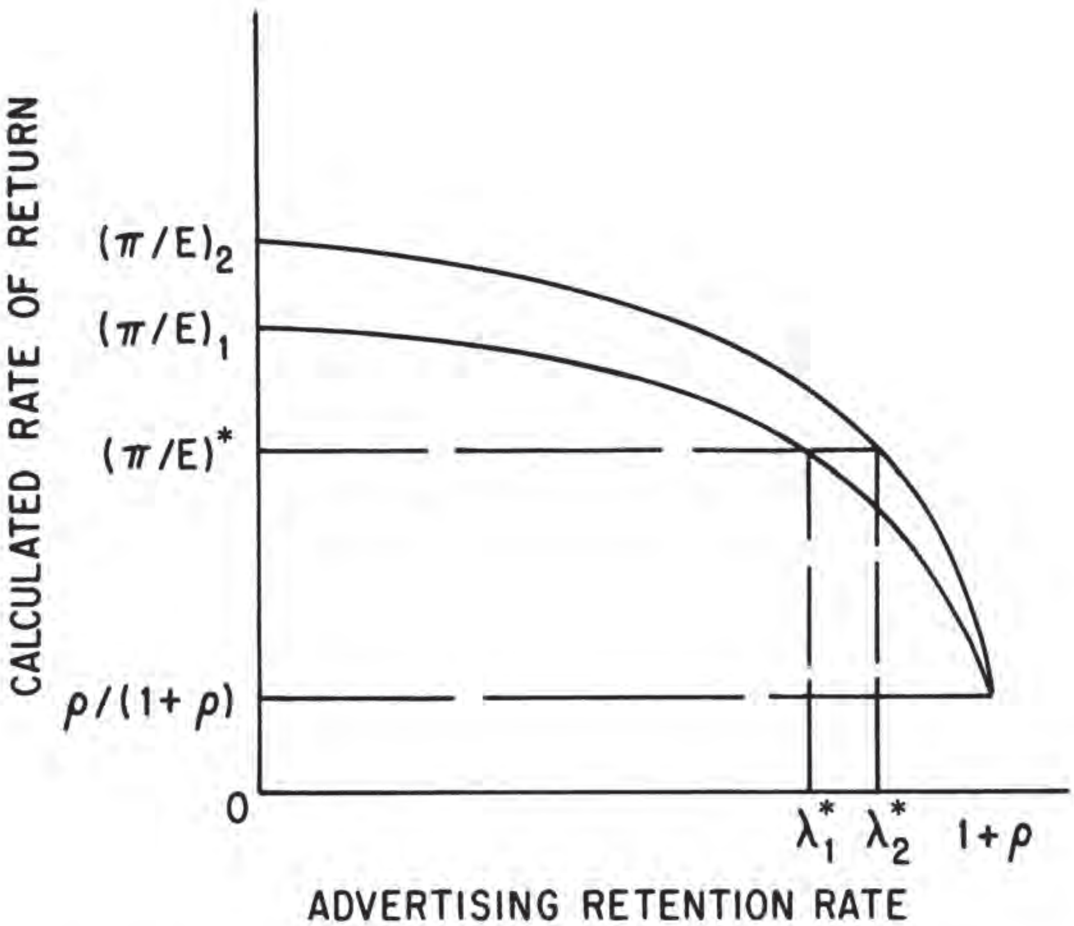


FIGURE III

CALCULATED RATE OF RETURN AS A FUNCTION OF ADVERTISING RETENTION RATE (TWO DIFFERENT TRUE RETENTION RATES)



true rate of return. In this case, if firms' advertising to equity and advertising to sales ratios were positively related, one would obtain the FTC results even though advertising intensity and true rates of return were independent.

Of course the above situation is sufficient, not necessary, to get biases in calculated rates of return positively related to advertising intensity. Variation in the above factors could dampen, swamp or reinforce the systematic biasing. Similar though more complicated possibilities exist for each of the other studies in this area. The point to be made here is that such possibilities

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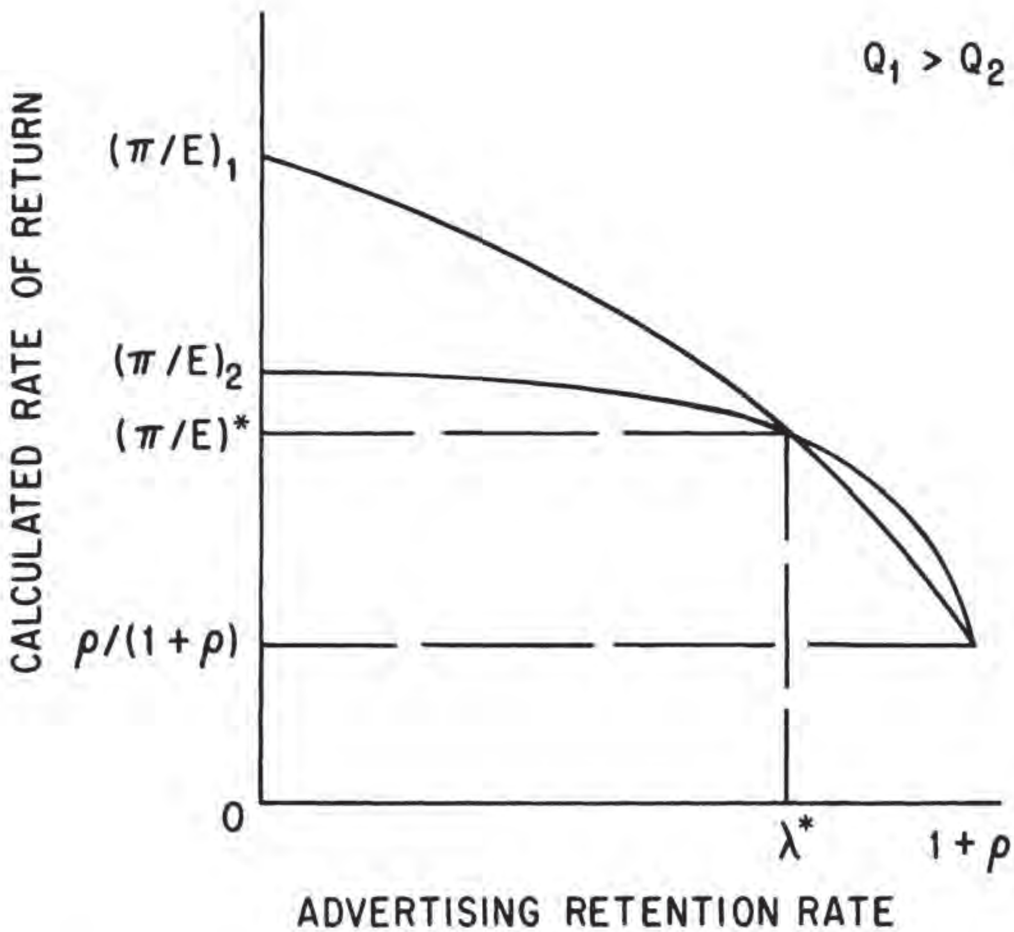
FIGURE IV

CALCULATED RATE OF RETURN AS A FUNCTION OF ADVERTISING RETENTION RATE (TWO DIFFERENT ADVERTISING TO EQUITY RATIOS)



exist. Incorrect values of λ yield generally incorrect rates of return; and one of the factors to which the biases are systematically related is firms' advertising to equity ratios.

V. Advertising Depreciation Rate Model

It is clear that if a more reliable determination is to be made of the relation between advertising intensity and profitability we must have advertising depreciation rates based more on fact and less on assumption. It is likely that actual advertising expenditures depreciate at rates which vary across firms, products, media, messages, consumers, rates and volumes of advertising, and time. Most of these dimensions of variation have already been assumed away in the preceding analysis, and will continue to be ignored subsequently. The variation in advertising depreciation rate which will be allowed below is variation among product groups, under the assumed geometric depreciation pattern of the model of section IV. That is, a single λ^* will be estimated for each of several product groups and applied to each of several firms in that product group.

As discussed in Appendix C, I did not wish to estimate advertising retention rates using a Koyck-type regression approach. What I desired as an estimator of λ^* was a simple procedure which could be applied uniformly across product groups, thereby hopefully imparting credibility to the estimates.

In the broadest terms, my approach to the retention rate estimation problem evolved to using economic theory and known attributes of firms to infer a factor of proportionality between the amounts of advertising capital of two firms in a product group. Then, given this factor of proportionality, an assumed geometric depreciation pattern, and the two firms having differing advertising histories it is the case that there is only one advertising retention rate which, when applied to the past advertising expenditure of the two firms, will give each firm an amount of advertising capital such that the estimated factor of proportionality holds. This advertising retention rate I take as my estimate of "the" advertising retention rate.

Derivation of this estimator begins with the assumption that, within an industry, a firm's sales rate can be described as a Cobb-Douglas type function of advertising capital, tangible capital, and "all other inputs". Thus:

$$S(t) = \beta_0 C(t)^{\beta_1} T(t)^{\beta_2} Z(t)^{\beta_3} \tag{V.1}$$

where:

t = time
S = \$ sales rate of the firm
C = \$ advertising capital
T = \$ tangible capital, hereinafter referred to as "assets"
Z = \$ all other inputs
$\beta_i (i = 0 \ldots 3)$ are positive constants specific to the industry

and

$$\sum_{i=1}^{3} \beta_i = 1 \tag{V.2}$$

Alternately assume

$$Z(t) = \gamma T(t) \tag{V.3}$$

or

$$Z(t) = \delta C(t) \tag{V.4}$$

or

$$Z(t) = \epsilon S(t) \tag{V.5}$$

where γ, δ, ϵ are constants specific to the industry. That is, assume that the ratio of "other inputs" to assets, or to advertising capital, or to sales is the same for all firms in an industry. Consecutively using each of these three assumptions it is easy to show that (dropping t):

$$(S/T) = \beta_0 \gamma^{\beta_3} (C/T)^{\beta_1} \tag{V.6}$$

or,

$$(S/T) = \beta_0 \delta^{\beta_3} (C/T)^{1 - \beta_2} \tag{V.7}$$

or

$$(S/T) = \{\beta_0 \epsilon^{\beta_3}\}^{1/(1 - \beta_3)} (C/T)^{\beta_1/(1 - \beta_3)} \tag{V.8}$$

respectively.

Now consider two firms, 1 and 2, in the same product group. From the above three assumptions and corresponding expressions for (S/T) we see that:

$$\{(C/T)_1/(C/T)_2\} = \{(S/T)_1/(S/T)_2\}^{1/\beta_1} \tag{V.9}$$

or

$$\{(C/T)_1/(C/T)_2\} = \{(S/T)_1/(S/T)_2\}^{1/(1 - \beta_2)} \tag{V.10}$$

or

$$\{(C/T)_1/(C/T)_2\} = \{(S/T)_1/(S/T)_2\}^{(1 - \beta_3)/\beta_1} \tag{V.11}$$

respectively.

From (V.9)—(V.11) we see that in the context of this model we may conclude that under any one of three assumptions firms in the same product group with equal sales to assets ratios also have equal advertising capital to assets ratios.

More generally, let us express the relation of C_1 to C_2 as:

$$C_1 = \{(S/T)_1/(S/T)_2\}^{1/\beta_1}(T_1/T_2)C_2 \tag{V.12}$$

or

$$C_1 = \{(S/T)_1/(S/T)_2\}^{1/(1 - \beta_2)}(T_1)T_2)C_2 \tag{V.13}$$

or

$$C_1 = \{(S/T)_1/(S/T)_2\}^{(1-\beta_3)/\beta_1}(T_1/T_2)C_2 \qquad (V.14)$$

respectively.
Let us write in general,

$$C_1 = \alpha(T_1/T_2)C_2 \qquad (V.15)$$

In cases where firms have equal sales to assets ratios $\alpha = 1$. Substituting equation (IV.4) above for C_i in (V.15), solving for λ^* and simplifying yields

$$\lambda^* = \frac{\alpha(A/T)_2 - (A/T)_1}{\alpha(A/T)_2/(1 + \rho_1) - (A/T)_1/(1 + \rho_2)} \qquad (V.16)$$

This is the advertising retention rate which makes $(C_1/C_2) = \alpha(T_1/T_2)$. (V.16) permits estimation of a product group's advertising retention rate from estimates of α and of firms' advertising to assets ratios and advertising growth rates.

The obvious choice of firms for estimation is a pair with equal sales to assets ratios, making $\alpha = 1$, independent of the β_i. A second criterion for selecting firms to estimate λ^* is a pair whose advertising growth rates differ as much as possible. This reduces the sensitivity of the estimate to any given error in the estimated ratio of (C_1/C_2). That is, when two firms' advertising growth rates are similar it takes large changes in λ^* to bring about small changes in the ratio of (C_1/C_2). Indeed, in the case where two firms' advertising growth rates are equal the above procedure can not be used, since this would make the *ratio* of (C_1/C_2) independent of both ρ and λ^*.

The advertising growth rate, ρ, can be estimated as follows. Rewrite equation (IV.1) as

$$A(t) = A(-1)(1 + \rho)^{t+1} \qquad (V.17)$$

then

$$\ln A(t) = \ln A(-1) + \{\ln(1 + \rho)\}(t + 1) \qquad (V.18)$$

Estimating (V.18) via simple regression yields $\ln(1 + \rho)$ and $\ln A(-1)$ estimates as slope and intercept respectively. The $\hat{\rho}$'s obtained from the $1\hat{n}(1 + \rho)$'s can then be used with $\hat{\alpha}$ and firms' advertising to equity ratios in (V.16) to obtain an estimate of the advertising retention rate for a product group.

Of course firms' actual advertising expenditures are unlikely to have followed (IV.1) exactly so the (IV.4), used in deriving (V.16), is an estimate of C(t). However, this will affect the λ^* estimate only as the ratio of the estimated C(t)'s differs from the true ratio. (The sensitivity of estimated (C_1/C_2) to errors in the Z assumptions is discussed in Appendix B.)

VI. Mergers

Before proceeding to the numerical sections of the paper two aspects of mergers should be mentioned.

In estimating a firm's advertising capital the past advertising expenditures of acquired firms are not included in the acquiring firm's advertising history. For purposes of correcting profit rates this is entirely proper, since when a firm grows through acquisition of another firm the value of the acquired firm's advertising capital at the time of acquisition will be included in the purchase price as "reputation" or "goodwill", and will thus be included in the acquiring firm's equity. Thus, if firms appropriately depreciate "goodwill", the model correctly adjusts rates of return by considering uncapitalized, and only uncapitalized, past advertising expenditures. Using acquired firms' past advertising in estimating C(t) would result in double counting of acquired-through-merger advertising capital.

An unfortunate consequence of mergers is that they make advertising capital and assets no longer mutually exclusive. This could be a problem in the context of the λ^* estimation model of section V above. Equation (V.16), by which λ^* is to be estimated, implicitly assumes that all of each firm's advertising capital is uncapitalized—which is untrue when there have been mergers in the firms' histories. In this case the ratio of uncapitalized advertising capital to assets will be lower than the ratio of total advertising capital to assets exclusive of advertising capital. It is this latter ratio that the model of section V deals with. The merger will have taken a portion of advertising capital from the numerator of the latter ratio and moved it to the denominator.

However, it should be noted that it is only differences between the firms in the proportion of advertising capital which has been capitalized which will bias the estimate of λ^*. If acquired-through-merger advertising capital is the same proportion of total advertising capital for both firms used in estimating λ^* the ratio of their uncapitalized advertising capitals will equal the ratio of their total advertising capitals. Thus in this case the estimate will not be biased on this account. Nonetheless, in general this possibility must be viewed as a stochastic factor affecting the estimated λ^* through the estimated (C/T)s ratio.

VII. The Data

In the statistical sections of this paper data on 39 firms in six separate consumer goods product groups are analyzed in the framework of the model developed above.

Data on advertising expenditures were obtained from the *Advertising Age* annual listing of largest (in \$) in U.S. advertisers generally for the years

1959-1968 inclusive. Corresponding accounting data on other variables for the firms were obtained from *Moody's Industrial Reports*. Fiscal year figures were attributed to the calendar year whose end was closest to the fiscal year end.

The primary *Advertising Age* advertising estimates are for the U.S. only, while *Moody's* data are firm totals, worldwide. To reduce this disparity in the data series an attempt was made to estimate total advertising for all firms. In those instances where the firm's consolidated operations were domestic only, or where *Advertising Age* also reported total firm advertising, no problem was presented (7 firms). In other cases foreign advertising was available for one or a few years and missing total advertising expenditures were estimated on the basis of the foreign to domestic advertising ratios available (7 firms). For still other firms only foreign and domestic sales data were available for one or more years and total advertising expenditures were estimated by assuming the foreign advertising to sales ratio equaled the firm's domestic advertising to sales ratio (24 firms). In cases where only one year's foreign sales was available this procedure was equivalent to estimating the firm's rate of growth of advertising from domestic advertising expenditures only and inflating its advertising estimates by the available foreign to domestic sales ratio (10 firms). For one firm, Westinghouse, this procedure was employed using the firm's foreign to domestic employment ratio. While being far from completely satisfactory, these procedures undoubtedly generated advertising estimates closer to firms' actual advertising than the original *Advertising Age* data. The final estimates are probably at least as good as those which have been employed in other studies in this area.

VIII. Advertising Retention Rate Estimates

For each product group advertising retention rates were estimated via equation (V.16) and the procedure outlined in section V.

Inequalities among firms' sales to assets ratios presented a problem in estimating α. From equations (V.12)—(V.14) we see that when firms' (S/T) ratios are not equal their ratio must be raised to some power greater than one to obtain α. Determination of the correct exponent for each product group was obviously impossible. This problem was dealt with in the following manner.

Numerous Cobb-Douglas aggregate production function studies have found the exponents of capital and labor to be about .25 and .75 respectively. I employed this information by assuming, for each product group, that $\beta_2 = (1/3)\beta_3$. In addition I assumed that $\beta_1 = \beta_2$. Given (V.2), the assumed exponents were thus $\beta_1 = \beta_2 = .2$ and $\beta_3 = .6$. I further assumed that assumptions (V.3), (V.4) and (V.5) were equally probable and that one of them must hold. Then the expected value of the exponent of the ratios of (S/T)'s in equations (V.12)—(V.14) is 2.75. The expression $\alpha = \{(S/T)_1/(S/T)_2\}^f$ was evaluated using f = 2.75 to obtain an $\hat{\alpha}$ with which to estimate λ^* for each product group. While somewhat arbitrary, this procedure undoubtedly reduces the expected error in $\hat{\alpha}$, and thus in $\hat{\lambda}^*$, relative to, say, letting f = 0 or f = 1. The sensitivity of the λ^* estimates to the value of f is examined in the next section.

The firms used in estimation were selected to minimize the sensitivity of the λ^* estimates to the assumptions of the estimation procedure. As discussed above, the primary criterion was to obtain an $\{(S/T)_1/(S/T)_2\}$ ratio close to one for each product group, making $\hat{\alpha}$ insensitive to f. Occasionally firms' (S/T) ratios were averaged over a number of consecutive years where doing so reduced the difference in the ratios. Then, from the set of firms with approximately equal (S/T) ratios the pair with the most divergent advertising growth rates was chosen to estimate λ^* for each product group.

TABLE 1
ESTIMATES OF ADVERTISING RETENTION RATES

Product Group	Firm 1, Firm 2	Estimated Retention Rate
Autos	General Motors, Chrysler	.949
Cosmetics	Chesebrough-Ponds, Gillette	.872
Drugs	Sterling, Plough	.913
Electrical	General Electric, RCA	.876
Foods	Pillsbury, Standard Brands	.632
Tires	B. F. Goodrich, Firestone	.853

The estimates of λ^* are presented by product group in Table 1. These estimates indicate that advertising retention rates tend to be quite high, a finding clearly at odds with the accounting assumption that the advertising retention rate is zero. Also, with the exception of the food group, these retention rates are considerably higher than the .667 retention rate assumed by Weiss.[8]

IX. RELIABILITY OF THE RETENTION RATE ESTIMATES

To examine the sensitivity of the λ^* estimates to the exponent of the ratio of the (S/T)'s, values of $\hat{\lambda}$ were calculated using values of f = 1, 2, 2.75 and 3.5 to evaluate α. These estimates are presented by product group in Table 2. We see that the estimates are quite insensitive to the exponent of the ratio

[8] Leonard W. Weiss, *supra* note 2.

TABLE 2
ESTIMATED ADVERTISING RETENTION RATES AS A FUNCTION OF f
$(C_1/C_2) = \alpha(T_1/T_2) \quad \alpha = \{(S/T)_1/(S/T)_2\}^f$

Product Group	Firm 1 / Firm 2	$(S/T)_1/(S/T)_2$	Retention Rate when f = 1.0	2.0	2.75	3.5
Autos	General Motors / Chrysler	.99994	.949	.949	.949	.949
Cosmetics	Chesebrough-Ponds / Gillette	.98336	.888	.879	.872	.864
Drugs	Sterling / Plough	.99425	.924	.918	.913	.908
Electrical	General Electric / RCA	1.00692	.872	.874	.876	.877
Foods	Pillsbury / Standard Brands	.99328	.659	.644	.632	.619
Tires	B. F. Goodrich / Firestone	1.00343	.823	.852	.853	.857

of the (S/T)'s over this range of exponentiation. It would take high exponents to produce λ's greatly different from the λ^* estimates of Table 1.

There are, of course, other possible sources of error in the estimated ratio of (C_1/C_2). To examine the sensitivity of the estimated λ^*'s to other possible errors in this ratio, $\hat{\lambda}$ was recalculated for each product group using $(C_1/C_2) = .95\{(S/T)_1/(S/T)_2\}^{2.75}(T_1/T_2)$ and $(C_1/C_2) = 1.05\{(S/T)_1/(S/T)_2\}^{2.75}(T_1/T_2)$. The results are presented in Table 3. We see that if the true ratio of (C_1/C_2) for these firms is within 5 per cent of the estimated ratio for each product group the retention rate estimates of Table 1 do not differ greatly from those which would be obtained using the true ratio.

Additional evidence on the reliability of the retention rate estimates may be obtained by noting that if the sales model and assumptions of section V hold, there is a linear relation, with a slope coefficient between zero and one, between ln(S/T) and ln(C/T) across firms in a product group. To see this

TABLE 3
ESTIMATED ADVERTISING RETENTION RATES AS A FUNCTION OF (C_1/C_2)
$[\alpha' = \{(S/T)_1/(S/T)_2\}^{2.75}(T_1/T_2)]$

Product Group	Retention Rate when (C_1/C_2) = .95 α'	α'	1.05 α'
Autos	.941	.949	.955
Cosmetics	.837	.872	.898
Drugs	.834	.913	.957
Electrical	.858	.876	.889
Foods	.460	.632	.726
Tires	.753	.853	.905

rewrite equations (V.6), (V.7) and (V.8) in natural logarithm form as, respectively

$$\ln(S/T) = \ln\beta_0 + \beta_3\ln\gamma + \beta_1\ln(C/T) \qquad \text{(IX.1)}$$

or

$$\ln(S/T) = \ln\beta_0 + \beta_3\ln\delta + (1 - \beta_2)\ln(C/T) \qquad \text{(IX.2)}$$

or

$$\ln(S/T) = (1 - \beta_3)^{-1}\ln\beta_0 + \beta_3(1 - \beta_3)^{-1}\ln\epsilon + \beta_2(1 - \beta_3)^{-1}\ln(C/T) \qquad \text{(IX.3)}$$

if γ, δ or ϵ are constant for a product group then the first two terms on the right in (IX.1), (IX.2) or (IX.3), respectively, are a constant. This suggests checking the model by regressing ln(S/T) of ln(C/T) across firms in each product group to obtain slope coefficients between zero and one. It should be noted that regression coefficients between zero and one are possible here even if γ, δ and ϵ vary across firms in a product group: (for example, ln of these variables could be orthogonal to ln(C/T)). Note also that the advertising capital for each firm must be estimated via equation (IV.4) and the retention rate estimates of Table 1. These estimates are themselves based on the assumptions they are now being asked to check. Thus the most which can be obtained here is consistency of the model and the results.[9] On the other hand, having γ, δ or ϵ constant across all firms in the product group is sufficient, not necessary for unbiasedness of $\hat{\gamma}^*$ on this account. γ, δ or ϵ need only be constant for the two firms used in estimation for the estimator to be valid.

These regressions were run for the same year or years from which λ^* was estimated for each product group. The results are presented in Table 4.

Each of the estimated coefficients is consistent with the hypothesis that the true slope coefficient is between zero and one. Three of the estimated coefficients are in the zero—one interval; and for one product group, cosmetics, the hypothesis that the true coefficient is outside the zero—one interval is rejected at the 10 per cent significance level.

Tables 2 and 3 show the retention rate estimates to be quite insensitive to various assumptions of the estimation procedure. However, it would be an error to conclude from this that these are exceptionally reliable estimates or that equation (V.17) is a generally rigorous estimator. Recall that the estimating firms and years were selected precisely to produce this insensitivity

[9] There are also statistical problems with the proposed regressions. There are generally few degrees of freedom, stochastic variation in T biases the slope estimator upwards, and measurement error in C biases the estimator towards zero. For true coefficients between zero and one the biases tend to offset each other.

TABLE 4
RESULTS OF REGRESSIONS $\ln(S/T) = d_0 + d_1 \ln(C/T)$

Product Group	$\hat{d}_1$	Standard Error	d.f.
Autos	1.027	.010	1
Cosmetics	.306*	.120	5
Drugs	.051	.082	6
Electrical	−1.312	.484	1
Foods	.043	.103	12
Tires	−.336	.667	2

* Hypothesis $\{d_1 < 0 \text{ or } d_1 > 1\}$ rejected at 10% significance level.

of the results. Choosing different firms or years would have produced different retention rates, in some instances outside the zero—one interval. Nevertheless, these firms and years do yield sensible, insensitive retention rate estimates consistent with the estimation model. Thus, taken together, I believe the results of this section allow one to have some degree of confidence in the advertising retention rate estimates reported in Table 1.

X. CORRECTED RATES OF RETURN

The advertising retention rate estimates in Table 1 are used to obtain corrected profit rates for 1968 for the 39 firms in my sample.[10] Corrected firm rates of return were estimated as

$$\widehat{(\pi/E)}^* = \frac{\pi + A - (1 - \hat{\lambda}^*)\hat{C}^*}{E + \hat{\lambda}^*\hat{C}^*} \tag{X.1}$$

Rather than using equation (IV.4) to estimate C*, a somewhat more accurate expression, incorporating my (K + 1) actual advertising estimates and inputing the sample period advertising growth to the pre-sample period, was used. Recall C(t)* is defined as, from (IV.2)

$$C(t)^* = \sum_{i=0}^{\infty} \lambda^{*i} A(t - i)$$

Writing this in two parts we have

$$C(t)^* = \sum_{i=0}^{k} \lambda^{*i} A(t - i) + \sum_{i=k+1}^{\infty} \lambda^{*i} A(t - i) \tag{X.2}$$

Inputing the sample period advertising growth rate to the pre-sample period, (X.2) becomes

[10] Data availability, and comparability with previous work, dictated using (net revenue)/(net assets) rather than (net revenue + interest)/(total assets) as the rate of return measure. The effect of this is examined below.

$$C(t)^* = \sum_{i=0}^{k} \lambda^{*i}A(t - i) + \lambda^{*k+1}A(t - k - 1) \left[\frac{1 + \rho}{1 + \rho - \lambda^*}\right] \quad (X.3)$$

which was used in (X.1) to obtain $(\widehat{\pi/E})^*$. As before, the advertising growth rate, ρ, was estimated from (V.18). $A(t - k - 1)$ is the same as $A(-1)$ in equation (V.17) and so it was obtained from the intercept estimate in (V.18).[11]

Estimated values of advertising retention rates, λ^*, advertising to sales ratios, (A/S), accounting rates of return, (π/E), and corrected rates of return, $(\widehat{\pi/E})^*$, are presented by firm in Table 6.

The means and variances of the two profit rate variables are shown in Table 5. From Table 5 we see that P = .658. Thus, using even the rough adjustment procedures of this paper, the capitalization of advertising is able to account for over 65 per cent of the variation in accounting rates of return among these firms.

TABLE 5
MEAN AND VARIANCE OF ACCOUNTING AND CORRECTED RATES OF RETURN

	$\%(\pi/E)$	$\%(\widehat{\pi/E})^*$
Mean	14.857	11.321
Variance	20.521	7.028

The corrected rates of return have lower average value and smaller variance than the accounting rates of return. Using the variances we can construct a statistic analogous to the R^2 of multiple regression. Let:

$$P = \frac{\mathrm{Var}(\pi/E) - \mathrm{Var}(\widehat{\pi/E})^*}{\mathrm{Var}(\pi/E)}$$ = the proportion of variation in accounting rates of return explained by capitalization advertising.

The average value of these corrected profit rates indicates that as a group heavy advertisers do not earn unusually high rates of return. The median accounting rate of return of the Fortune 500 in 1968 was 11.7 per cent, just 0.379 percentage points above the mean corrected profit rate of these heavy advertisers.[12] The association of heavy advertising with above normal profit rates is, on this evidence, an illusion created by accounting rates of return.

[11] (X.3) was not used in estimating λ^* because this would have involved solving a (k + 1) degree equation.

[12] See Fortune [Magazine], June 15, 1968. There is a problem, of course, in comparing these corrected rates of return to the accounting rates of return in the *Fortune* 500. However, the comparison is unlikely to be misleading. Since most firms in the Fortune 500 probably have low advertising to equity ratios correcting their rates of return would have little, if any, impact on their profit rates. In addition, the median would tend to be insensitive to individual changes which did occur.

TABLE 6
ESTIMATED ADVERTISING RETENTION RATE, ADVERTISING INTENSITY, ACCOUNTING RATE OF RETURN AND CORRECTED RATE OF RETURN BY FIRM

Firm	$\hat{\lambda}$*	%(A/S)	%(π/E)	%($\widehat{\pi/E}$)*
Alberto-Culver	.872	26.53	23.93	9.57
Borden	.632	2.36	7.61	7.35
Bristol-Myers	.913	16.59	19.40	12.88
Campbell Soup	.632	5.77	12.32	10.64
Carnation	.632	3.96	13.88	13.45
Carter-Wallace	.872	27.83	11.16	8.75
Chesebrough-Ponds	.872	11.97	20.28	9.99
Chrysler	.949	1.34	14.07	10.29
CPC International	.632	6.23	12.52	11.03
Firestone	.853	2.25	12.57	11.44
Ford	.949	1.46	12.67	9.60
General Electric	.876	1.17	14.32	10.93
General Foods	.632	10.16	14.20	11.88
General Mills	.632	6.89	12.58	11.29
General Motors	.949	1.23	17.75	13.34
Gillette	.872	19.09	28.15	16.66
B.F. Goodrich	.853	2.24	7.61	7.36
Goodyear	.853	2.28	12.75	11.92
Heinz	.632	5.01	10.25	10.40
Johnson & Johnson	.913	5.05	14.41	11.02
Kellogg	.632	16.40	20.33	12.68
Kraftco	.632	2.64	11.24	9.87
Miles Labs.	.913	22.90	12.48	6.96
Nabisco	.632	7.16	15.24	12.21
Noxell	.872	38.58	17.22	12.05
Pfizer	.872	8.27	13.89	13.85
Pillsbury	.632	6.97	10.36	9.13
Plough	.913	24.65	21.79	17.69
Quaker Oats	.632	5.75	12.50	9.03
Ralston-Purina	.632	2.29	11.86	10.02
RCA	.876	2.75	16.45	14.77
Revlon	.872	10.03	16.54	9.61
Richardson-Merrell	.913	20.72	11.98	9.51
Smith, Kline & French	.913	10.02	23.69	19.23
Standard Brands	.632	7.70	12.95	11.40
Sterling Drug	.913	20.93	18.70	10.86
Uniroyal	.853	2.43	11.40	10.34
Warner-Lambert	.913	15.11	17.88	13.86
Westinghouse	.876	1.62	10.51	8.67

XI. ADVERTISING INTENSITY AND RATE OF RETURN

In this section simple regression is used to estimate the relationship between each of the profit rate variables and the advertising to sales ratio. While the evidence of the previous section indicates that, on average, heavy advertisers do not have above average profit rates, a strong positive association between advertising intensity and the corrected rates of return is still possible. Equations (XI.1) and (XI.2) report the regression results for the accounting and corrected rates of return, with t-statistics and R^2's.

$$\%(\pi/E) = 12.449 + \underset{(3.445)}{.242\%(A/S)} \qquad R^2 = .243 \qquad (XI.1)$$

$$\%(\pi/E)^* = 10.991 + \underset{(.884)}{.041\%(A/S)} \qquad R^2 = .021 \qquad (XI.2)$$

Equation (XI.1) shows the same qualitative result as every study which has employed accounting rates of return: a highly statistically significant positive relation between accounting profit rate and advertising intensity. This is an important result because it indicates that the results of equation (XI.2), which differ from those of other studies, are not due to any peculiarities of this data set, but rather stem from allowing the advertising retention rates to be determined by a model and the data, instead of solely by assumption.

Equation (XI.2) indicates there is no statistically significant relationship between advertising to sales ratios and corrected rates of return. The coefficient of the advertising intensity ratio is extremely small, and less than its standard error.

A problem with these regressions is that there is measurement error in (A/S), and thus in each regression its coefficient is inconsistent towards zero. Surprisingly however, the t-statistics are the appropriate ones for testing the null hypothesis of no relation between (A/S) and the rates of return.

Given the usual regression assumptions, Cooper and Newhouse[13] show that in the case of simple regression with measurement errors the t-statistic has the t distribution, on the null hypothesis that the slope is zero and the assumption that the measurement error is normally distributed. Thus the t-test is the appropriate test of the hypothesis of no relation between advertising intensity and rate of return, and the t-statistics reported in (XI.1), and (XI.2) are the appropriate ones for testing this hypothesis. (Intuitively, on the null hypothesis that the slope is zero there is no inconsistency problem.) Thus the finding of no statistically significant relationship between advertising intensity and corrected rates of return is valid independent of measurement error in the advertising to sales ratios.[14]

[13] Cooper & Newhouse, Further Results on the Errors in the Variables Problem (Rand Corp., No. P-4715, Oct. 1971).

[14] Measurement error in (A/S) reduces the power of the t-test. Cooper and Newhouse show that for slope $\neq 0$ the t-statistic is inconsistent downward. Thus the probability of making a type II error is greater here than if a regression without measurement error in (A/S) could be run. Given the low t-value in (XI.2) this is not a serious problem in this case.

Letting the true slope = β and the OLS estimator = $\tilde{\beta}$, it is well known that plim $\tilde{\beta} = \beta\{1/(1$

Another possible problem with regression (XI.2) is that the profit rates are returns on equity, rather than on total assets, and thus ignore variations in financial leverage among the firms. One way of dealing with this situation is to standardize for leverage by regressing $\widehat{(\pi/E)}^*$ on both (A/S) and firms' debt to equity ratios, (D/E). Doing so results in equation (XI.3).

$$\%(\pi/E)^* = 11.779 + \underset{(.588)}{.028\%(A/S)} - \underset{(-1.362)}{.027(D/E)}$$

$$R^2 = .069 \quad \text{(XI.3)}$$

From (XI.3) we see that, after accounting for leverage variation among the firms, advertising intensity and corrected rates of return on equity are still unrelated.

Additional evidence on this point can be obtained from six firms in the sample which had no long term debt in 1968, so that their returns on equity and on assets were the same. Estimated (A/S) for these firms ranged approximately from 5 to 38 per cent. Repeating regression (XI.2) for this subsample yields

$$\%(\pi/E)^* = 11.371 + \underset{(.342)}{.039\%(A/S)} \qquad R^2 = .028 \qquad \text{(XI.4)}$$

(XI.4) is virtually identical to (XI.2). There is no evidence here of a positive relation between advertising intensity and corrected rates of return. Equations (XI.3) and (XI.4) lead to the conclusion that the finding of no statistically significant relation between advertising intensity and corrected rates of return is not dependent of having used returns on equity as the profit rate variable for this study.

XII. Conclusion

The results of this paper are completely at odds with the "barriers to entry" view of advertising.[15] Over a wide range of advertising intensity and

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$+ \Phi)\}$; where $\Phi = \text{Var}\{\text{error in (A/S)}\}/\text{Var}\{\text{true (A/S)}\}$. Thus a consistent estimator of the slope is $\bar{\beta} = (1 + \Phi)\,\hat{\beta}$. For those interested in guessing at Φ to generate alternative estimates of $\bar{\beta}$ in (XI.2) I note that, from Table 6, Var (A/S) = 84.8, and range of (A/S) = 37.41. My guess is that $\Phi \leq .1$ so that $.041 < \bar{\beta} \leq .045$.

[15] The import of these results is conveniently and well illustrated by the following situation. On January 24, 1972, the Federal Trade Commission issued a complaint against the four largest U.S. manufacturers of ready-to-eat breakfast cereal: Kellogg, General Mills, General Foods, and Quaker Oats. Nabisco and Ralston-Purina were also mentioned in the complaint, but were not named as respondents. See F.T.C. v. Kellogg, *et al.*, No. 8883, Jan. 24, 1972. The FTC's complaint is reprinted in 5 Antitrust Law & Econ. Rev., Fall 1971, at 75. The FTC charged, among other things, "These practices of proliferating brands, differentiating similar products and promoting trademarks through intensive advertising result in high barriers to entry in the RTE cereal market." *Id.* at 80. "Respondents have obtained profits and returns on investment

diverse products there appears to be no systematic relationship between advertising and profitability—once the asset nature of advertising is taken into account. As one might have suspected, freedom of speech is compatible with competition.

APPENDIX A

The Bias in Calculated Rate of Return

The relation of $|(\pi/E) - \rho/(1+\rho)|$ to a bias in calculated rate of return has already been explained one way in the text. Alternatively, directly differentiating equation (IV.10)

$$(\pi/E)' = \frac{R(1+\rho-\lambda) + Q\rho\lambda}{1+\rho-\lambda+Q(1+\rho)\lambda} \tag{IV.10}$$

with respect to λ, and denoting the denominator by D, yields

$$\partial(\pi/E)'/\partial\lambda = D^{-2}\{Q\rho(1+\rho) - QR(1+\rho)^2\}$$

or

$$\partial(\pi/E)'/\partial\lambda = QD^{-2}(1+\rho)^2\{\rho/(1+\rho) - R\}$$

So $\partial(\pi/E)'/\partial\lambda$ is greater than, less than, or equal to zero as $\rho/(1+\rho)$ is greater than, less than, or equal to (π/E), respectively. This confirms the "marginal" calculated rate of return approach taken in the text.

To see rigorously the effects of increases in $|\lambda - \lambda^*|$ and Q on a bias in calculated rate of return let $\lambda = \lambda^*$ in equation (IV.10), making $(\pi/E)' = (\pi/E)^*$

$$(\pi/E)^* = \frac{R(1+\rho-\lambda^*) + Q\rho\lambda^*}{1+\rho-\lambda^*+Q(1+\rho)\lambda^*} \tag{A.1}$$

Solving (A.1) for R and substituting this expression for accounting rate of return back into (IV.10) yields:

substantially in excess of those that they would have obtained in a competitively structured market." *Id.* at 84. The results herein imply that the Commission has erred in focusing on accounting rates of return. Without entering into a discussion of whether or not the FTC action would be justified if its "facts" were correct (I do not think it would), I note that the corrected profit rates estimated above indicate that the Commission's allegations are false.

All the firms mentioned in the FTC complaint are reported in Table 6 of section X. The average accounting profit rates of the four respondents in 1968 was 14.90%, and that of all six firms mentioned was 14.45%. However, the average corrected profit rates of the four respondents was only 11.22%, and that of all six firms was 11.19%. These rates are below the median rate of return of the Fortune 500 in 1968. On this evidence, the high entry barriers and high profit rates which the FTC is alleging do not exist. Its proposed "remedies" in this situation (divestiture of assets, royalty-free licensing of brand names and trademarks, etc.) are totally unwarranted.

$$(\pi/E)' = (\pi/E)^* \left[\frac{1 + \rho - \lambda^* + Q(1 + \rho)\lambda^*}{1 + \rho - \lambda^*}\right] \times \left[\frac{1 + \rho - \lambda}{1 + \rho - \lambda + Q(1 + \rho)\lambda}\right] - \left[\frac{Q\rho\lambda^*}{1 + \rho - \rho^*}\right]\left[\frac{1 + \rho - \lambda}{1 + \rho - \lambda + Q(1 + \rho)\lambda}\right] + \left[\frac{Q\rho\lambda}{1 + \rho - \lambda + Q(1 + \rho)\lambda}\right] \quad (A.2)$$

The expression for the bias in calculated rate of return is thus the right hand side of (A.2)—$(\pi/E)^*$. As it stands (A.2) is intractible. However, since we already know the effects of changes in ρ on any bias $(\pi/E)'$—through changes in $\rho/(1 + \rho)$—we can simplify greatly equation (A.2) by setting $\rho = 0$. We need not further concern ourselves with ρ, as to its qualitative effect on the bias, other than to note that the relation between (π/E) and $\rho/(1 + \rho)$ is now dictated solely by the sign of (π/E).

Setting $\rho = 0$ (A.2) becomes

$$(\pi/E)' = (\pi/E)^* \left(\frac{1 - \lambda^* + Q\lambda^*}{1 - \lambda^*}\right)\left(\frac{1 - \lambda}{1 - \lambda + Q\lambda}\right)$$

and so, letting the bias = B:

$$B = (\pi/E)^* \left[\left(\frac{1 - \lambda^* + Q\lambda^*}{1 - \lambda^*}\right)\left(\frac{1 - \lambda}{1 - \lambda + Q\lambda}\right) - 1\right]$$

differentiating B with respect to λ, λ^* and Q, $(\pi/E)^*$ constant, and simplifying yields

$$dB = \frac{-RQ}{(1 - \lambda + Q\lambda)^2}\, d\lambda + \left(\frac{1 - \lambda}{1 - \lambda^*}\right)\left(\frac{RQ}{(1 - \lambda + Q\lambda)(1 - \lambda^* + Q\lambda^*)}\right) d\lambda^* + \frac{R(1 - \lambda)(\lambda^* - \lambda)}{(1 - \lambda + Q\lambda)^2(1 - \lambda^* + Q\lambda^*)}\, dQ \quad (A.3)$$

When $(\pi/E) = \rho/(1 + \rho)$ that is, when $R = 0$ here, each term on the r.h.s. of (A.3) is zero. There is no bias in $(\pi/E)'$.

Recalling the $(\pi/E)'$ curves of the text, and noting that increases in B reduce the absolute size of the bias when B is negative, that is when $(\pi/E)^* > (\pi/E)'$, the affects on the bias in $(\pi/E)'$ of changes in λ, λ^*, and Q are easily ascertained from (A.3) for the cases $(\pi/E) \neq \rho/(1 + \rho)$.

The first term on the right in (A.3) indicates that increases in $|\lambda - \lambda^*|$, increase the absolute bias in $(\pi/E)'$, λ^* and Q constant.

The second term indicates that increases in $|\lambda - \lambda^*|$, λ, and Q constant, increase the absolute bias in $(\pi/E)'$.

The third term indicates that increases in Q increase the absolute bias in $(\pi/E)'$, λ and λ^* constant.

Thus increases in $|\lambda - \lambda^*|$ and Q will increase any bias in calculated rate of return.

APPENDIX B

THE Z ASSUMPTIONS

If assumption (V.3), (V.4) or (V.5) does not hold for the two firms used in estimating λ, then $\alpha \neq 1$ when the firms have equal sales to assets ratios. For example, let us replace (V.3) by

$$\begin{aligned} Z_1(t) &= \gamma_1 T_1(t) \\ Z_2(t) &= \gamma_2 T_2(t) \end{aligned} \tag{B.1}$$

Then

$$(S/T)_1 = \beta_0 \gamma_1{}^{\beta_3} (C/T)_1{}^{\beta_1} \tag{B.2}$$

and

$$(S/T)_2 = \beta_0 \gamma_2{}^{\beta_3} (C/T)_2{}^{\beta_1} \tag{B.3}$$

Specifying $(S/T)_1 = (S/T)_2$ we see that this can be true if

$$(C/T)_1/(C/T)_2 = (\gamma_1/\gamma_2)^{\beta_3/\beta_1} \tag{B.4}$$

One nice thing about (B.4) is that as a matter of chance it seems unlikely to happen. This is in contrast to (V.3) which we would expect to hold if firms faced the same relative factor prices for these inputs. If (B.4) did occur proportional differences in the firms' (C/T) ratios could be greater than, less than, or equal to the proportional differences in their (Z/T) ratios depending on whether β_3 was greater than, less than, or equal to β_1 respectively.

Repeating this analysis by relaxing assumption (V.4) yields:

$$(C/T)_1/(C/T)_2 = (\delta_1/\delta_2)^{\beta_3/(1-\beta_2)} \tag{B.5}$$

In this case proportional differences in the (C/T) ratios are unambiguously scaled down from the proportional difference in the (Z/C) ratios.

Relaxing (V.5) and repeating the above procedure yields:

$$(C/T)_1/(C/T)_2 = (\epsilon_1/\epsilon_2)^{\beta_3/\beta_1} \tag{B.6}$$

which is analogous to (B.4). Equations (B.4), (B.5) and (B.6) indicate that if assumption (V.3), (V.4) or (V.5) is even approximately correct the ratio of the (C/T) ratios may not differ greatly from one when the (S/T) ratios are equal.

For example, letting $\beta_1 = \beta_2 = .2$ and $\beta_3 = .6$ as in the text (B.4) becomes

$$(C/T)_1/(C/T)_2 = (\gamma_1/\gamma_2)^3$$

(B.5) becomes

$$(C/T)_1/(C/T)_2 = (\delta_1/\delta_2)^{.75}$$

and (B.6) becomes

$$(C/T)_1/(C/T)_2 = (\epsilon_1/\epsilon_2)^3$$

In this case:
to have C_1 within 5% of C_2 either γ, or ϵ, must be within 1.65% of γ_2 or ϵ_2 respectively, or δ_1 must be within 6.6% of δ_2.

APPENDIX C

There are two attempts in the literature to estimate advertising retention rates under the geometric depreciation pattern assumed above, Palda and Peles.[16] Both of these studies estimated λ's from a model of the following basic form.

$$S(t) = a_0 + a_1 C(t) + e(t) \tag{C.1}$$

where:

t = time period
S = \$ sales rate
C = \$ advertising capital
e = error term

Using the Koyck transformation of (V.1) yields

$$S(t) = a_0(1 - \lambda) + a_1 A(t) + \lambda S(t - 1) + e(t) - \lambda e(t - 1) \tag{C.2}$$

which can be estimated via OLS. The actual regression equations estimated by Palda and Peles were generally more complicated than (C.2), employing additional variables and alternative forms.

For several reasons I did not wish to estimate λ's from this model. First, there is the well-known general biasedness and inconsistency of the OLS estimators of (C.2) arising from the dependence of $S(t - 1)$ on $e(t - 1)$. Second, the works of Palda and Peles indicate that the estimates obtained are sensitive to the specification of the regression equation. The $\hat{\lambda}$'s were to be crucial to the $(\widehat{\pi/E})^*$'s, and thus the $(\widehat{\pi/E})^*$'s would be dependent on the regression equation specified. It appeared unlikely that precisely the same regression equation would yield non-nonsense λ's for all of the product

[16] K. S. Palda, The Measurement of Cumulative Advertising Effects (Ford Doctoral Dissertation Series, 1964); Yoram Peles, Rates of Amortization of Advertising Expenditures, 79 J. Pol. Econ. 1032 (1971).

groups. The search for the "proper" set of standardizing variables promised to be monumental and highly arbitrary task; with little to guide the work other than the fact that I wanted λ's in the zero-one interval. I believed this procedure would greatly impair the reliability of any subsequent results, as well as delay their time of arrival. (C.2) was run for the two firms in each product group used to estimate λ^* in the text. The above forebodings proved to be warranted. The OLS estimator of λ^* in (C.2) performed quite erratically, yielding λ^*'s outside the zero-one interval for five of the twelve firms. These results are presented in Table C-1.

TABLE C-1
RESULTS OF REGRESSIONS
$S(t) = a_0 + a_1 A(t) + \lambda S(t-1)$ (7 d.f.)

Product Group	Firms	$\hat{\lambda}$	Standard Error
Autos	Chrysler	.966	.225
	General Motors	.674	.237
Cosmetics	Chesebrough-Ponds	1.106	.237
	Gillette	1.477	.395
Drugs	Sterling	.233	.132
	Plough	−.511	.711
Electrical	General Electric	.991	.152
	RCA	.535	.127
Foods	Pillsbury	1.069	.187
	Standard Brands	.749	.174
Tires	B. F. Goodrich	−.117	.165
	Firestone	.875	.257

APPENDIX B

Expected Return on Common Equity (NET-311) Vs. Expected Earnings on Market Prices

	(a) **Company** **(NET-311)**	(b) **Expected Return on Common Equity** **(NET-311 col. a)**	(c) **Five-Year Projected Average Annual P/E Ratio** **(Avera Testimony Workpapers)**	(d) **Expected Earnings on Market Prices** **(1 / Column c)**	(e) **Difference Between Expected Return on Common Equity and Inverted P/E Ratio** **(Column b - Column d)**
1	ALLETE	10.5%	11.5	8.70%	1.80%
2	Alliant Energy	11.0%	13	7.69%	3.31%
3	Ameren Corp.	7.5%	14.5	6.90%	0.60%
4	American Elec Pwr	9.5%	13.5	7.41%	2.09%
5	Avista Corp.	8.5%	13.5	7.41%	1.09%
6	Black Hills Corp.	8.0%	13.5	7.41%	0.59%
7	CenterPoint Energy	12.0%	13.5	7.41%	4.59%
8	Cleco Corp.	11.5%	13	7.69%	3.81%
9	Consolidated Edison	9.0%	13	7.69%	1.31%
10	Dominion Resources	14.5%	15	6.67%	7.83%
11	DTE Energy Co.	9.5%	12.5	8.00%	1.50%
12	Edison International	9.0%	13.5	7.41%	1.59%
13	El Paso Electric Co.	10.5%	15	6.67%	3.83%
14	Empire District Elec.	9.0%	12.5	8.00%	1.00%
15	Exelon Corp.	12.5%	13.5	7.41%	5.09%
16	FirstEnergy Corp.	10.0%	13.5	7.41%	2.59%
17	Great Plains Energy	7.5%	12	8.33%	-0.83%
18	Hawaiian Elec.	10.0%	13.5	7.41%	2.59%
19	IDACORP, Inc.	8.5%	13	7.69%	0.81%
20	Integrys Energy Group	9.5%	12.5	8.00%	1.50%
21	NextEra Energy, Inc.	12.5%	13	7.69%	4.81%
22	Northeast Utilities	9.5%	13	7.69%	1.81%
23	NorthWestern Corp.	10.0%	13.5	7.41%	2.59%
24	OGE Energy Corp.	11.0%	14	7.14%	3.86%
25	Otter Tail Corp.	9.5%	15	6.67%	2.83%
26	Pepco Holdings	8.0%	14	7.14%	0.86%
27	PG&E Corp.	10.0%	12.5	8.00%	2.00%
28	Pinnacle West Capital	9.0%	13.5	7.41%	1.59%
29	PNM Resources	9.0%	12	8.33%	0.67%
30	Portland General Elec.	9.0%	12.5	8.00%	1.00%
31	PPL Corp.	11.5%	12	8.33%	3.17%
32	Pub Sv Enterprise Grp.	11.0%	13	7.69%	3.31%
33	SCANA Corp.	9.5%	12.5	8.00%	1.50%
34	Sempra Energy	11.5%	13	7.69%	3.81%
35	Southern Company	12.5%	14	7.14%	5.36%
36	TECO Energy	13.0%	12.5	8.00%	5.00%
37	UIL Holdings	9.5%	16	6.25%	3.25%
38	Vectren Corp.	11.5%	15	6.67%	4.83%
39	Westar Energy	8.5%	12.5	8.00%	0.50%
40	Wisconsin Energy	13.5%	14.5	6.90%	6.60%
41	Xcel Energy Inc.	10.0%	13	7.69%	2.31%
	Average	**10.18%**	**13.33**	**7.54%**	**2.64%**

APPENDIX C

FLAG POLE PREMIUM ANALYSIS DATA

Date	Utility	Docket No.	Flag Pole	Bond Yield	Flag Pole Premium
Apr-06	Baltimore Gas & Elec.	ER05-515	11.00%	6.22%	4.78%
Apr-06	Baltimore Gas & Elec.	ER05-515	11.00%	6.22%	4.78%
Aug-06	Westar Energy Inc.	ER05-925	11.00%	6.51%	4.49%
Oct-06	Bangor Hydro-Elec. Co.	ER04-157	11.00%	6.46%	4.54%
Apr-07	San Diego Gas & Elec.	ER07-284	11.00%	6.12%	4.88%
Jul-07	Idaho Power Co.	ER06-787	11.00%	6.28%	4.72%
Jul-07	Wisconsin Elec. Pwr. Co.	ER06-1320	11.00%	6.28%	4.72%
Oct-07	Commonwealth Edison Co.	ER07-583	11.00%	6.43%	4.57%
Nov-07	Duquesne Light Co.	EL06-109	11.00%	6.44%	4.56%
Nov-07	Pepco Holdings, Inc.	ER08-10	11.00%	6.44%	4.56%
Feb-08	Atlantic Path 15	ER08-374	11.00%	6.42%	4.58%
Mar-08	Westar Energy Inc.	ER08-396	11.00%	6.46%	4.54%
Mar-08	Startrans IO, LLC	ER08-413	11.00%	6.46%	4.54%
Apr-08	NSTAR Elec. Co.	ER07-549	11.00%	6.54%	4.46%
Apr-08	Southwestern Public Service	EL05-19	11.00%	6.54%	4.46%
Apr-08	Trans-Allegheny	ER07-562	11.00%	6.54%	4.46%
Apr-08	Virginia Elec. & Power Co.	ER08-92	11.00%	6.54%	4.46%
Jul-08	Arizona Public Service Co.	ER07-1142	11.00%	6.80%	4.20%
Jul-08	So. Cal Edison (c)	ER08-375	11.00%	6.80%	4.20%
Aug-08	Virginia Elec. & Power Co.	ER08-1207	11.00%	6.86%	4.14%
Aug-08	Pepco Holdings, Inc.	ER08-686	11.00%	6.86%	4.14%
Aug-08	New England Pwr. Co.	ER07-694	11.00%	6.86%	4.14%
Sep-08	Public Service Elec. & Gas	ER08-1233	11.00%	6.94%	4.06%
Oct-08	Pepco Holdings, Inc.	ER08-1423	11.00%	7.23%	3.77%
Oct-08	Central Maine Power Co.	EL08-74	11.00%	7.23%	3.77%
Oct-08	Duquesne Light Co.	ER08-1402	11.00%	7.23%	3.77%
Nov-08	Northeast Utils Service Co.	ER08-1548	11.00%	7.60%	3.40%
Nov-08	Central Maine Power Co.	EL08-77	11.00%	7.60%	3.40%
Dec-08	NSTAR Elec. Co.	ER09-14	11.00%	7.80%	3.20%
Dec-08	Tallgrass / Prairie Wind	ER09-35/36	11.00%	7.80%	3.20%
Feb-09	Black Hills Power Co.	ER08-1584	11.00%	8.08%	2.92%
Mar-09	AEP - SPP Zone	ER07-1069	11.00%	8.22%	2.78%
Mar-09	Pioneer Transmission	ER09-75	11.00%	8.22%	2.78%
Mar-09	ITC Great Plains	ER09-548	11.00%	8.22%	2.78%
Mar-09	Public Service Elec. & Gas	ER09-249	11.00%	8.22%	2.78%

Apr-09	Green Power Express	ER09-681	11.00%	8.13%	2.87%
May-09	PPL Elec. Utilities Corp.	ER08-1457	11.00%	7.93%	3.07%
May-09	PPL Elec. Utilities Corp.	ER08-1457	11.00%	7.93%	3.07%
May-09	PPL Elec. Utilities Corp.	ER08-1457	11.00%	7.93%	3.07%
May-09	Baltimore Gas & Elec.	ER09-745	11.00%	7.93%	3.07%
May-09	Niagara Mohawk Pwr. Co.	ER08-552	11.00%	7.93%	3.07%
May-09	Oklahoma Gas & Elec.	ER08-281	11.00%	7.93%	3.07%
Jun-09	Kentucky Utilities Co.	ER08-1588	11.00%	7.79%	3.21%
Aug-09	Westar Energy Inc.	ER07-1344	11.00%	7.39%	3.61%
Aug-09	So. Cal Edison (d)	ER09-187	11.00%	7.39%	3.61%
Oct-09	Xcel Energy	ER08-313	11.00%	6.76%	4.24%
Nov-09	National Grid Generation LLC	ER09-628	11.00%	6.50%	4.50%
Nov-09	Westar Energy Inc.	ER09-1762	11.00%	6.50%	4.50%
May-10	AEP - PJM Zone	ER08-1329	11.00%	6.21%	4.79%
Oct-10	AEP Transco	ER10-355	11.00%	5.84%	5.16%
Oct-10	KCPL	ER10-230	11.00%	5.84%	5.16%
Sep-10	So. Cal Edison (e)	ER10-160	11.00%	5.93%	5.07%
Dec-10	So. Cal Edison	ER11-1952	11.00%	5.76%	5.24%
Feb-11	Northern Pass Transmission	ER11-2377	11.00%	5.87%	5.13%
May-11	Ameren	EL10-80	11.00%	5.98%	5.02%
May-11	Atlantic Grid Operations	EL11-13	11.00%	5.98%	5.02%
Jun-11	Xcel Energy	ER10-1377	11.00%	5.92%	5.08%
Jun-11	PJM & PSE&G	ER11-3352	11.00%	5.92%	5.08%
Jun-11	South Carolina Elec. & Gas	ER10-516	11.00%	5.92%	5.08%
Oct-11	Duke Energy Carolinas	ER11-2895	11.00%	5.45%	5.55%
Oct-11	RITELine	ER11-4069	11.00%	5.45%	5.55%
Nov-11	PATH	ER08-386	11.00%	5.31%	5.69%
Dec-11	PJM & PSE&G	ER12-296	11.00%	5.21%	5.79%
May-12	Public Service Colorado	ER11-2853	11.00%	5.06%	5.94%
May-12	Public Service Colorado	ER11-2853	11.00%	5.06%	5.94%
Jun-12	DATC Midwest Holdings	ER12-1593	11.00%	5.03%	5.97%
	Average		**11.00%**	**6.72%**	**4.28%**

SUMMARY OUTPUT

Regression Statistics	
Multiple R	1
R Square	1
Adjusted R Square	1
Standard Error	0
Observations	66

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.00534524	0.005345	#NUM!	#NUM!
Residual	64	0	0		
Total	65	0.00534524			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.11	0	65535	#NUM!	0.11	0.11	0.11	0.11
X Variable 1	-1	0	65535	#NUM!	-1	-1	-1	-1

APPENDIX D

Date	Utility	Docket No.	Base ROE	BBB Utility Bond Yield	Risk Premium
Apr-06	Baltimore Gas & Elec.	ER05-515	10.80%	6.22%	4.58%
Apr-06	Baltimore Gas & Elec.	ER05-515	11.30%	6.22%	5.08%
Aug-06	Westar Energy Inc.	ER05-925	10.80%	6.51%	4.29%
Oct-06	Bangor Hydro-Elec. Co.	ER04-157	11.14%	6.46%	4.68%
Apr-07	San Diego Gas & Elec.	ER07-284	11.35%	6.12%	5.24%
Jul-07	Idaho Power Co.	ER06-787	10.70%	6.28%	4.42%
Jul-07	Wisconsin Elec. Pwr. Co.	ER06-1320	11.00%	6.28%	4.72%
Oct-07	Commonwealth Edison Co.	ER07-583	11.00%	6.43%	4.57%
Nov-07	Duquesne Light Co.	EL06-109	10.90%	6.44%	4.46%
Nov-07	Pepco Holdings, Inc.	ER08-10	10.80%	6.44%	4.36%
Feb-08	Atlantic Path 15	ER08-374	10.65%	6.42%	4.23%
Mar-08	Westar Energy Inc.	ER08-396	10.80%	6.46%	4.34%
Mar-08	Startrans IO, LLC	ER08-413	10.65%	6.46%	4.19%
Apr-08	NSTAR Elec. Co.	ER07-549	10.90%	6.54%	4.36%
Apr-08	Southwestern Public Service	EL05-19	9.33%	6.54%	2.79%
Apr-08	Trans-Allegheny	ER07-562	11.20%	6.54%	4.66%
Apr-08	Virginia Elec. & Power Co.	ER08-92	10.90%	6.54%	4.36%
Jul-08	Arizona Public Service Co.	ER07-1142	10.75%	6.80%	3.95%
Jul-08	So. Cal Edison	ER08-375	9.54%	6.80%	2.74%
Aug-08	Virginia Elec. & Power Co.	ER08-1207	10.90%	6.86%	4.04%
Aug-08	Pepco Holdings, Inc.	ER08-686	11.30%	6.86%	4.44%
Aug-08	New England Pwr. Co.	ER07-694	11.14%	6.86%	4.28%
Sep-08	Public Service Elec. & Gas	ER08-1233	11.18%	6.94%	4.24%
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Oct-08	Central Maine Power Co.	EL08-74	11.14%	7.23%	3.91%
Oct-08	Duquesne Light Co.	ER08-1402	10.90%	7.23%	3.67%
Nov-08	Northeast Utils Service Co.	ER08-1548	11.14%	7.60%	3.54%
Nov-08	Central Maine Power Co.	EL08-77	11.14%	7.60%	3.54%
Dec-08	NSTAR Elec. Co.	ER09-14	11.14%	7.80%	3.34%
Dec-08	Tallgrass / Prairie Wind	ER09-35/36	10.80%	7.80%	3.00%
Feb-09	Black Hills Power Co.	ER08-1584	10.80%	8.08%	2.72%
Mar-09	AEP - SPP Zone	ER07-1069	10.70%	8.22%	2.48%
Mar-09	Pioneer Transmission	ER09-75	10.54%	8.22%	2.32%
Mar-09	ITC Great Plains	ER09-548	10.66%	8.22%	2.44%
Mar-09	Public Service Elec. & Gas	ER09-249	11.18%	8.22%	2.96%
Apr-09	Green Power Express	ER09-681	10.78%	8.13%	2.65%

May-09	PPL Elec. Utilities Corp.	ER08-1457	11.10%	7.93%	3.17%
May-09	PPL Elec. Utilities Corp.	ER08-1457	11.14%	7.93%	3.21%
May-09	PPL Elec. Utilities Corp.	ER08-1457	11.18%	7.93%	3.25%
May-09	Baltimore Gas & Elec.	ER09-745	11.30%	7.93%	3.37%
May-09	Niagara Mohawk Pwr. Co.	ER08-552	11.00%	7.93%	3.07%
May-09	Oklahoma Gas & Elec.	ER08-281	10.60%	7.93%	2.67%
Jun-09	Kentucky Utilities Co.	ER08-1588	11.00%	7.79%	3.21%
Aug-09	Westar Energy Inc.	ER07-1344	10.80%	7.39%	3.41%
Aug-09	So. Cal Edison	ER09-187	10.04%	7.39%	2.65%
Oct-09	Xcel Energy	ER08-313	10.77%	6.76%	4.01%
Nov-09	National Grid Generation LLC	ER09-628	10.75%	6.50%	4.25%
Nov-09	Westar Energy Inc.	ER09-1762	10.80%	6.50%	4.30%
May-10	AEP - PJM Zone	ER08-1329	10.99%	6.21%	4.79%
Oct-10	AEP Transco	ER10-355	10.99%	5.84%	5.16%
Oct-10	KCPL	ER10-230	10.60%	5.84%	4.77%
Sep-10	So. Cal Edison	ER10-160	10.33%	5.93%	4.40%
Dec-10	So. Cal Edison	ER11-1952	10.30%	5.76%	4.54%
Feb-11	Northern Pass Transmission	ER11-2377	10.40%	5.87%	4.53%
May-11	Ameren	EL10-80	12.38%	5.98%	6.40%
May-11	Atlantic Grid Operations	EL11-13	10.09%	5.98%	4.11%
Jun-11	Xcel Energy	ER10-1377	10.40%	5.92%	4.48%
Jun-11	PJM & PSE&G	ER11-3352	11.18%	5.92%	5.26%
Jun-11	South Carolina Elec. & Gas	ER10-516	10.55%	5.92%	4.63%
Oct-11	Duke Energy Carolinas	ER11-2895	10.20%	5.45%	4.75%
Oct-11	RITELine	ER11-4069	9.93%	5.45%	4.48%
Nov-11	PATH	ER08-386	10.40%	5.31%	5.09%
Dec-11	PJM & PSE&G	ER12-296	11.18%	5.21%	5.97%
May-12	Public Service Colorado	ER11-2853	10.10%	5.06%	5.04%
May-12	Public Service Colorado	ER11-2853	10.40%	5.06%	5.34%
Jun-12	DATC Midwest Holdings	ER12-1593	12.38%	5.03%	7.35%
	Average			**6.72%**	**4.10%**

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.129572003
R Square	0.016788904
Adjusted R Square	0.001426231
Standard Error	0.004947735
Observations	66

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.67527E-05	2.67527E-05	1.092837403	0.299775767
Residual	64	0.001566725	2.44801E-05		
Total	65	0.001593478			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.103435141	0.004585558	22.55672016	3.66087E-32	0.094274436	0.112595845	0.094274436	0.112595845
X Variable 1	0.070745788	0.06767415	1.045388637	0.299775767	-0.064448869	0.205940444	-0.064448869	0.205940444

APPENDIX E

VALUE LINE & YAHOO FINANCE BETA COMPARISON

(a) Company	(b) Value Line Beta	(c) Yahoo Finance Beta	(d) Adjusted Yahoo Finance Beta
ALLETE	0.65	0.11	0.41
Alliant Energy	0.6	-0.05	0.30
Amer. Elec. Power	0.55	-0.1	0.27
Ameren Corp.	0.55	0.06	0.37
Avista Corp.	0.65	0.03	0.35
Black Hills	0.75	-0.37	0.09
CenterPoint Energy	0.85	0.58	0.72
CMS Energy Corp.	0.55	-0.09	0.27
Consol. Edison	0.4	0.02	0.35
Dominion Energy	0.6	0.17	0.45
DTE Energy	0.55	0	0.33
Duke Energy	0.5	-0.09	0.27
Edison Int'l	0.55	-0.15	0.23
El Paso Electric	0.65	0.33	0.55
Exelon Corp.	0.65	0.28	0.52
FirstEnergy Corp.	0.6	0.23	0.49
Hawaiian Elec.	0.6	0.09	0.39
IDACORP, Inc.	0.55	0.28	0.52
NextEra Energy	0.55	-0.16	0.23
NorthWestern Corp.	0.55	-0.06	0.29
OGE Energy	0.85	0.58	0.72
Otter Tail Corp.	0.75	0.39	0.59
PG&E Corp.	0.65	-0.38	0.08
Pinnacle West Capital	0.55	-0.08	0.28
PNM Resources	0.65	0.13	0.42
Portland General	0.6	0.04	0.36
PPL Corp.	0.7	0.32	0.55
Public Serv. Enterprise	0.6	0.26	0.51
SCANA Corp.	0.65	-0.03	0.31
Sempra Energy	0.75	0.25	0.50
Southern Co.	0.5	-0.2	0.20
Vectren Corp.	0.6	0.08	0.39
Xcel Energy Inc.	0.5	-0.12	0.25
Average	**0.61**	**0.07**	**0.38**

(a) NET-708 at 1 (excluding companies whose data is no longer published by Value Line)
(b) The Value Line Investment Survey (Jan. 9, 2019)
(c) https://finance.yahoo.com (Jan. 9, 2019)
(d) Computed using the formula $\beta_{adjusted} = 0.33 + 0.66 * \beta_{raw}$ (*see* R. Morin, *New Regulatory Finance* 74 (2006)).

APPENDIX F

Market Capitalization and DCF Result Comparison

Company (NET-708 at 1)	Market Cap (NET-708 at 1)	DCF Result (High Cost of Equity on NET-702 at 1)
Empire District Elec	$952	8
Otter Tail Corp.	$1,126	9.9
El Paso Electric	$1,350	8.7
NorthWestern Corp.	$1,483	9.3
Avista Corp.	$1,639	9
PNM Resources	$1,855	12.2
ALLETE	$1,931	10.6
Black Hills Corp.	$1,947	10.2
UIL Holdings	$2,011	9.1
Portland General Elec.	$2,291	9.7
IDACORP, Inc.	$2,421	8.3
Hawaiian Elec.	$2,714	9.6
Cleco Corp.	$2,839	11.4
Vectren Corp.	$2,912	9.9
Great Plains Energy	$3,560	10.9
TECO Energy	$3,860	8.6
Westar Energy	$4,197	11.2
Integrys Energy Group	$4,531	11
NV Energy, Inc.	$4,722	7.8
Pepco Holdings	$4,910	9.3
Alliant Energy	$5,569	10.2
Pinnacle West Capital	$6,353	11.9
SCANA Corp.	$6,753	9.1
OGE Energy Corp.	$6,914	9.1
CMS Energy Corp.	$7,373	10
Ameren Corp.	$8,496	7.8
Wisconsin Energy	$9,823	8.8
CenterPoint Energy	$10,242	9.2
DTE Energy Co.	$11,778	8.6
Northeast Utilities	$13,642	11.7
Xcel Energy, Inc.	$14,482	9.2
Edison International	$16,395	9.4
Pub Sv Enterprise Grp	$17,372	8.5
FirstEnergy Corp.	$17,649	10.2
Consolidated Edison	$17,874	7.7
PPL Corp.	$18,190	9.7
PG&E Corp.	$19,059	8.3
Sempra Energy	$19,321	9.3
American Elec Pwr	$23,618	8.6
Exelon Corp.	$29,456	10.9
NextEra Energy, Inc.	$32,875	10
Dominion Resources	$33,431	11.7
Southern Company	$41,013	9.4
Duke Energy Corp.	$51,103	8.9

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.030911593
R Square	0.000955527
Adjusted R Square	-0.022831247
Standard Error	1.180277998
Observations	44

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.055959761	0.055959761	0.040170499	0.842114966
Residual	42	58.50835842	1.393056153		
Total	43	58.56431818			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	9.645853868	0.247534933	38.96764694	1.32804E-34	9.146308149	10.14539959	9.146308149	10.14539959
X Variable 1	-3.08429E-06	1.53887E-05	-0.200425795	0.842114966	-3.41399E-05	2.79714E-05	-3.41399E-05	2.79714E-05