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EMPIRICAL INVESTIGATION OF ALLOWANCE FOR
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ELECTRIC UTILITY INDUSTRY

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EMPIRICAL INVESTIGATION OF ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION IN THE ELECTRIC UTILITY INDUSTRY

By

Albert James Ifflander

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ABSTRACT

EMPIRICAL INVESTIGATION OF ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION IN THE ELECTRIC UTILITY INDUSTRY

By

Albert James Ifflander

Allowance for Funds used during construction (AFUDC) represents capitalized interest on funds devoted to construction projects. This capitalized interest flows through to the income statement and is considered other utility income in the year of capitalization. The problem relates to whether the allowance for funds is the same quality as the operating earnings of the utility. A major controversy has arisen among followers of the electric utility industry about AFUDC, whether it is really representing lower quality earnings and whether the declines in market valuation over the last fifteen years are the result of increasing percentages of AFUDC.

The research performed here focused on the information content contained in the disclosure of AFUDC and the immediate market reaction to information concerning AFUDC contained in the financial statements. The test design follows the methodology first developed by Gonedes. The basic premise is to form portfolios so that the relative risks as defined by Beta are equivalent. If the relevant risks are equivalent then the expected returns should also be equivalent. Both univariate and multivariate T-tests are performed to examine the equivalence of monthly stock

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returns. Equivalence of monthly stock returns around the disclosure date implies no information content to the disclosure of AFUDC earnings in the financial statements.

The major findings of the study may be summarized as follows remembering that method I companies exclude while method II companies include construction work in the rate base. First, there is no significant difference in monthly stock returns between portfolios of method I companies when AFUDC is used as the information variable. Second, there is no significant difference in monthly stock returns for portfolios of method I firms compared to portfolios of method II firms. The consludion is that all information is known previous to the disclosure date, allowing perfect forecasts of AFUDC in relation to operating earnings. Therefore, no significant information is contained in AFUDC disclosure that may be used by investors to assess stock returns.

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INTRODUCTION

The purpose of the present study is to assess whether there is any information contained in the disclosure of "allowance for funds used during construction" (hereafter, AFUDC), in the financial statements. This information may be unanticipated and therefore of use to investors in properly adjusting to changes in common stock values. In the study presented here, changes in common stock values can be tested by examining the immediate changes in market valuation, that is the distribution of stock returns, for electric utilities. Justification for this study is fourfold: 1) Previous research has not been conclusive with respect to capital markets reactions to AFUDC earnings; 2) Previous research has concentrated on the total valuation of firms with AFUDC earnings. The previous tests have used different accounting numbers and ratios, such as cost of equity capital, price-earnings ratios, market-to-book ratios and others, as surrogates for the true market valuation of these firms. To the author's knowledge, there have not been any tests focusing on the immediate market valuation or change in market valuation due to the disclosure of AFUDC earnings, which is the topic this research addresses;

3) Previous empirical tests of the differences in market valuation between method I and II firms is extremely limited. Briefly stated, method II firms include construction work in progress in the rate base while method I firms do not. This research addresses the change in market valuation and any differences between these methods; 4) This design is a substantial refinement compared to other studies. The research design has been used to examine other accounting policies and the immediate capital market reaction to them, but never in the case of AFUDC.

AFUDC is examined for any information content that might affect the distribution of stock returns for electric utilities. Disclosure of both the amount of AFUDC and the magnitude of AFUDC as a percentage of total earnings is examined for some impact on the investors' assessment of the distribution of stock returns for electric utilities.

There should be some perceived differences in the risk associated with each component of total earnings that will be reflected in common stock prices. The argument concerning AFUDC implies that AFUDC earnings are different quality earnings when compared to earnings from operations and therefore, of differing risks. The concept of "quality of earnings" is discussed at length in Chapter One. Briefly stated, the quality of AFUDC earnings is different because of the relationships of these earnings to cash flows, the timing of the cash flows and the variability of AFUDC earnings. Given the premise that the quality

of AFUDC versus operating earnings is indeed different, then there should be some perceived difference in the market price of equity securities which can be tested. Any differences in the risk of equity securities for electric utilities may affect the ability of electric utilities to raise more capital through common stock offerings. This eventually will impact the amount the customers of these utilities will pay for electric needs.

AFUDC has been a long-standing and important area of contention among followers of the electric utility industry. Accounting techniques for recording AFUDC have existed since the early 1900's. However, beginning in the mid 1960's, the debate has intensified. This is due to the fact that the percentage of total earnings represented by AFUDC increased on average, five to six times. This large and growing percentage of total earnings available to common stockholders, that is represented by AFUDC, has been accompanied by increasing skepticism in the investment community.[1] The reason for this skepticism is the perceived lower quality of electric utilities' earnings and consequently the ability of utilities to pay cash dividends from earnings. If the percentage of total earnings represented by AFUDC is higher than the dividend payout and remains high, then the utility may be forced to sell debt or equity to pay their cash dividends.

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As a result, utilities may be forced to sell more securities than the market is willing to bear, thus increasing the securities' cost and thereby hindering capital formation in the electric utility industry. This problem will continue to be an area of contention as construction periods lengthen, inflation increases, interest rates continue to increase and remain volatile, and more militant consumers accerbate the problem.

This study is divided in the following manner. The first chapter outlines a description of AFUDC and a discussion of the nature of the problem in detail. The chapter continues with a presentation of the regulatory process and the use of AFUDC in the context of this process. A mathematical framework for AFUDC is developed and the differences between the two specific applications of AFUDC are also formulated and described. The two applications of AFUDC are defined as method I and method II.

Chapter Two reviews both the major defenses and criticisms given for AFUDC as these concepts have been developed in the pertinent financial literature. Chapter Three is the literature review, including a discussion of the empirical tests performed in this field. Emphasis is placed on the results of these tests and some of the statistical problems which have biased these results. The appendix to Chapter Three contains empirical tests of price-earnings (P/E) and market-to-book (M/B) ratios, nd shows

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and shows how they differ between method I and method II firms. Much of the work presented in the first three chapters provides evidence suggesting AFUDC earnings are different and more risky than earnings from operations. Nevertheless, it seems the controversy has intensified instead of lessened. Therefore, as the use of AFUDC has increased, the topic has come under increased scrutiny. In fact, one recent gubernatorial race in New Hampshire focused on the different methods of accounting for AFUDC as something more than a minor difference between the two candidates.[2]

Chapter Four is a short review of the four aspects of relevant financial theory pertaining to this study. These aspects are integrated into the general methodology employed in this research. The final section of this chapter contains the specific application of this methodology and a detailed description of the specific hypotheses that are tested.

As already stated, the primary question is whether the disclosure of AFUDC is useful to investors in assessing stock returns. Therefore, the time period surrounding the month of disclosure is used to examine the monthly stock returns of two portfolios. One portfolio is identified as the treatment and the other portfolio is identified as the control. The classification of firms into the treatment and control portfolios is discussed in Chapter Four. Two basic strategies are

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employed for the formation of the treatment and control portfolios. First, treatment portfolios are formed to incorporate firms using the method I technique for reflecting AFUDC while the control portfolios are composed of method II firms. The second strategy employs only method I firms. The first are classified into portfolios on the basis of what percentage of total earnings is represented by AFUDC. High percentage firms will comprise the treatment portfolios and low percentage firms will comprise control portfolios. Betas, representing the relevant risks of each firm, are then calculated and weighted within each portfolio so as to ensure each pair of treatment and control portfolios has equivalent risk as measured by the beta of the portfolio. The hypothesis states that the information contained in the disclosure of AFUDC earnings has not been adequately anticiapted by the market and therefore has not been impounded in the measure of relevant risk, beta. This hypothesis can be tested by examining the monthly stock returns of portfolios with equivalent betas.

The significance of the difference between the monthly stock returns of the treatment and control portfolios is evaluated using Hotelling's T^2 test, which is the multivariate analog to the simple T-test between means. Also, in a number of cases, it is appropriate to use the simple t-test between means as the statistical test.

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Chapter Five contains a detailed discussion of all the tests performed and the results of these tests. Chapter Six offers the conclusions, limitations and areas for future research.

This study will hopefully shed some light on the practices of AFUDC. The market's reaction to the disclosure of AFUDC and any information content this disclosure might have is important to investors and to the public utility commissions responsible for the regulation of electric utilities. Any empirical evidence pertaining to AFUDC will help the public service commissions make better judgments concerning the use of AFUDC. Also, any evidence presented here should enable investors to make better judgments concerning changes in AFUDC policy, and the future effects this might have on the firm's valuation. Finally, the study will provide some evidence on the question of semi-strong market efficiency.

Footnotes

[1]This argument could be inferred from a number of authors. Among them Charles Tatham, "Interest During Construction and Price-Earnings Ratios," <u>Public Utilities Fortnightly</u> (September 27, 1973), pp. 32-36, Thomas G. Marx, "Market-to-Book Return on Equity Correlation," <u>Public Utilities Fortnightly</u> (December 4, 1975), pp. 28-31. Also a number of references at the end of Chapter 3.

[2]Donald D. Holt, "The Nuke That Became a Lethal Political Weapon," <u>Fortune</u> (January 15, 1979), pp. 74-77.

CHAPTER 1

DESCRIPTION OF ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION

This chapter contains three sections. The first section develops the concept of allowance for funds used during construction. The regulatory process and how AFUDC is used within this process is presented. The second section develops the differences between method I and method II. The last section is a mathematical and theoretical development of the earnings stream due to AFUDC. The cash flows of this earnings stream is developed and shown to be less than the income reported.

1.1 Definition of Allowance for Funds Used During Construction

AFUDC is the implicit cost of equity and the explicit cost of debt a utility will pay for its construction program. It represents the capitalized interest on a construction program, where the term "interest" includes both debt and equity costs.

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"Theoretically, the purpose of capitalizing AFUDC is to allow utilities to recover the capital costs of, and to earn return on, funds devoted to construction."[1] In other words, during the construction period the utility adds to construction work in progress the costs of capital used to finance that construction. Later, when the construction is completed and placed in service, the construction costs including the costs of capital are depreciated over the life of that plant. These additional financing costs can then be recovered through additional depreciation charges which are considered a cost of service expense.

Basically, AFUDC represents the income a utility would have earned on the funds devoted to a construction project if those funds had been used for some other purpose. In the case of AFUDC, even though reported as income, the income is not actually earned and there is no immediate associated cash flow. It is an accounting entry reflecting future cash flows that will result when the completed plant is allowed in the rate base.

For clarity of future discussion, a definition of earnings must be given here. Reported book earnings will consist of two components. The first component is "real" earnings signifying earnings that actually give rise to cash flows. Another way of expressing this is to call these earnings "operating earnings." The author realizes that perhaps not all operating earnings give rise to immediate cash flows, but let's assume this is true to

prevent any misunderstanding of what these earnings represent as opposed to AFUDC earnings. The second component of reported book earnings is AFUDC earnings. Future sections contain extended discussions and examples why AFUDC earnings may not be considered "real" earnings by investors. In all future discussions, "real" earnings will signify earnings from operations and other earnings will signify AFUDC earnings.

1.2 Background on AFUDC

AFUDC is an established part of utility accounting originating in the early 1900's. It has always been an area of contention in the regulatory field. But, starting in the mid-1960's, the debate intensified among people familiar with and responsible for electric utility regulations. This is due to the fact that AFUDC as a percentage of net income available to stockholders has grown dramatically from the mid-1960's until the present time. An examination of Table 1 clearly shows the trend towards much higher amounts of AFUDC as a percentage of reported book net income. In a sample of approximately 130 electric utilities taken from the compustat tapes, the average AFUDC as a percentage of net income was 4.7% in 1966, rising steadily to 24.2% in 1975 before declining slightly in 1976-77. The continuance of double-digit inflation in 1978-79 and the increased cost of building new power plants have only

Table 1

Distribution of Companies by Year and by Percent of Income Represented by AFUDC

		Years										
		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
	0- 5%	68*	55	42	35	26	24	21	17	15	18	16
	5-10%	35	42	41	26	22	20	18	16	13	10	19
	10-15%	4	11	17	21	22	19	10	13	10	12	14
% of	15-20%	1	3	8	15	16	15	18	16	13	12	10
income	20-25%	1	2		6	12	8	10	6	9	12	15
available	25-30%			1	6	8	11	10	11	10	12	12
to common	30-35%			1	3	3	6	11	11	7	7	10
represen-	35-40%					4	9	5	7	8	10	8
ted by	40-45%					2	9	2	3	6	6	5
AFUDC	45-50%			2	1	1	2	3	8	3	7	7
	50-55%						1	1	8	7	4	7
	55-60%					1	1	1	3	4	4	2
	60-65%					1	1			2	2	4
	65-70%						1		3	4	3	
	70-75%				1			3	2	9	2	2
	75-90%											
	Avg. %	4.7	6.1	8.2	10.7	13.3	16	18.8	20.8	24.2	22.4	21.9

*Number of companies

Source: Developed by author from compustat tapes.

served to continue this upward trend. Duff and Phelps, specialists in utility security analysis, report 59% as the average in 1979.[2]

Even more important is the increase in the number of firms with large amounts of AFUDC. In 1966, only two firms had AFUDC percentages greater than 15% of reported net book income. In 1971 there were forty-one firms greater than 25%. While in 1976, thirty-five firms had over 35% of the total reported earnings represented by AFUDC.

The companies that comprise the sample for this study appear to have a slightly higher averages of AFUDC when expressed as a percentage of total earnings. Table 2 gives the average percent by year and the standard deviation for both the method I and method II firms included in this study.[3] There are three observations one can make from this table: 1) The average percent varies from year to year among the firms that comprise both groups. 2) There is a substantial difference in the average percent each year between method I and method II firms for most of the years presented here. 3) The standard deviation is quite large with respect to the mean for each year and for both groups of firms. This implies the percent of total earnings represented by AFUDC varies substantially from firm to firm within a particular year.

Utilities are typically classified as income stocks because they pay large percentages of their earnings out

Table 2

Mean and Standard Deviation of AFUDC as a Percentage of Reported Income Available for Common

1970 - 1977

	Method I		Method II	
Year	Mean	Standard Deviation	Mean	Standard Deviation
1970	12.85%	10.32%	11.40%	6.24%
1971	17.78	14.08	19.06	9.97
1972	21.91	15.77	27.57	15.57
1973	24.63	18.15	32.07	17.75
1974	27.83	20.35	33.67	17.32
1975	32.81	21.93	37.38	14.59
1976	34.54	23.00	32.14	15.93
1977	30.21	17.99	38.22	17.73

Source: Developed by author from Compustat data.

in dividends. Dividend payouts of 60-70% are not at all uncommon in the utility industry. For the majority of firms studied (method I firms), there is no immediate cash flows associated with AFUDC earnings. Therefore, in later years of the 1970's, a number of electric utilities were paying more in cash dividends than they had available in cash from earnings. Security analysts have expressed concern over the growing size of AFUDC earnings because they are not current cash flow earnings. These earnings are only claims on future revenues. A question of the firm's financial status arises when substantial amounts of the firm's earnings do not give rise to cash flows and therefore impair the firm's ability to pay cash dividends. Mr. Richard Walker, managing partner of the Regulated Industries Division of Arthur Andersen and Company, testified before the Florida Public Service Commission on June 18, 1973. He states,

> Investors apparently do not value a dollar of earnings from the allowance for funds charged to construction as much as they do a dollar of earnings from operations, for in this sense they view it as being of lesser quality than cash flow.[4]

Many others have reached similar conclusions. Mr. W. T. Hyde, economist and public utility consultant, testified before the North Carolina Utilities Commission,

> Investors can hardly be expected to give much value to earnings so heavily dependent on the credit for interest charged to construction which results from nothing more than an arbitrary credit and an assumption that the plant under construction will produce sufficient

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> earnings to offset the decline in this credit when the plant is placed in service. This is a highly speculative and problematical assumption.[5]

> The recording of an allowance for the use of funds results in a significant increase in net income without a commensurate increase in cash flow.[6]

Clearly a number of people, including many experts in the field, consider AFUDC to be of inferior "quality" when compared to earnings from operation. The above comments suggest that this is primarily the result of the cash flow implications, both the timing and amount of those cash flows. Two questions immediately arise: 1) Exactly why are AFUDC considered inferior "quality" earnings, where quality is defined and discussed below; 2) If those earnings are inferior quality, do market agents value or react to those earnings differently than to earnings from operations? In other words, does the disclosure of AFUDC earnings produce some signaling that the market uses to assess the return distribution of that stock?

"Quality" of earnings is a nebulous term that first must be defined adequately to facilitate an understanding of AFUDC. "Quality" of earnings in the context of AFUDC can be defined as the value inherent in each dollar of AFUDC earnings. This concept of lower "quality" earnings as represented by AFUDC is based on two distinct components. First, it is the relationship between reported earnings and cash flows. Numerous authors argue that investors are concerned with cash flows rather than accounting earnings for several reasons. One is the ability to pay cash dividends as a return to common equity investors. Another aspect of this cash flow problem is the reinvestment implications. Any cash not paid out in dividends can be reinvested in the firm to earn more cash and therefore pay additional dividends in the future. The investment community might be skeptical of earnings, such as AFUDC, that do not give rise to cash flows, in the same manner as earnings from operations. This question of cash flows is compounded by the timing differences between AFUDC earnings and earnings from operations. Also, by the disparity between the timing of cash inflows and outflows. (The question of the timing and the mathematical relationship of AFUDC earnings to cash flows will be discussed further in later sections of this chapter). The cash outflows to pay interest payments on debt and the dividends on preferred and common equity are both current and certain. AFUDC earnings, which is the income "earned" during the construction period, do not give rise to immediate cash flows. They are postponed until the plant is completed and goes into service and then they are recovered over the depreciable life of the plant. AFUDC earnings are really claims to future cash flows. Thus, because AFUDC earnings are further in the future, they are more uncertain and therefore more risky than operating earnings.

The second component of "quality of earnings" is the variability of those earnings.[7] Two earnings streams may be thought to be of different quality because their variability as measured by their standard deviations are different. In this context, the variability of AFUDC earnings may be different than the variability of earnings from operations. This study addresses the more fundamental question of the timing of AFUDC earnings and a judgment on the variability of AFUDC is not necessary at this time. In summary, AFUDC earnings are considered of inferior quality primarily due to the timing of the associated cash flows. Even so, there are three different opinions among industry observers concerning the quality of AFUDC earnings.

The three groups are: 1) Those who believe AFUDC earnings are as good as earnings from operations; 2) Those who believe AFUDC earnings are worthless; 3) Those who believe AFUDC earnings are of "lower quality."

The first two groups are the minority, while the last group, which holds the intermediate position, seems to have the largest following. The majority of Chapter 2 contains the defenses and criticisms of AFUDC expoused by these three groups. It must be emphasized that it is rare to find industry observers who consider AFUDC earnings the same as earnings from operations. Most observers consider AFUDC to be of different quality and therefore investors should value AFUDC earnings differently. In a major piece of empirical work on this quality question, Bowen[8] has recently found evidence to substantiate the claim of the third group, that is; AFUDC earnings are of inferior

quality. There is some contradictory evidence on this quality question, which will be discussed in Chapter 3.

1.3 Regulatory Process

Public utilities are natural monopolies, therefore, the government has seen it in the best interest of the public to regulate these companies. This is accomplished through several levels of government control. At the federal level, there are two principal regulatory agencies. The Federal Energy Regulating Commission and the Federal Communications Commission provide the framework for accounting regulations, reporting requirements and general regulation of utilities engaged in interstate.

The primary regulatory body resides at the state level. Here, the public service commission in each state imposes the specific regulations on each company which supplies services in that state.

Regulation tries to accomplish the same goals for public utilities that competition achieves for unregulated competitive enterprises. This implies that the regulatory agencies must allow a rate of return sufficient to ensure the financial integrity and continuing existence of the utility. Balanced against this is the fact that utilities are monopolies and therefore the agencies must ensure that consumers are not forced to pay monopoly profits. Essentially, regulation means the regulation of earnings. Of course, in practice regulation means much more than the simple regulation of earnings. Virtually every aspect of the utility's operations are regulated in some way. For purposes of this research, we are principally concerned with the earnings of an electric utility. Therefore, it is convenient to think of regulation as the regulation of earnings. The major tenents of regulation were set forth in the Hope case in which the U.S. Supreme Court stated,

> It is important that there be enough revenues not only for operating expense 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 equity owner should be commensurate with risks on investments in other enterprises having corresponding risks. The 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.[9]

But, a qualifying view was also noted in an earlier Supreme Court case. In the Natural Gas Pipeline case the court stated,

> . . .the utility gets its return. . .by rates sufficient, having in view the character of the business, to secure a fair return upon the rate, provided the business is capable of earning it. But regulation does not insure that the business shall produce new revenues...[10]

In other words, regulation provides a utility with the opportunity to earn a fair return, but the return is not a guaranteed return.

In summary, the Supreme Court cases state that a utility is allowed to earn a fair return on assets enabling it to cover its operating expenses and capital costs. This return should be equivalent to a return earned by a

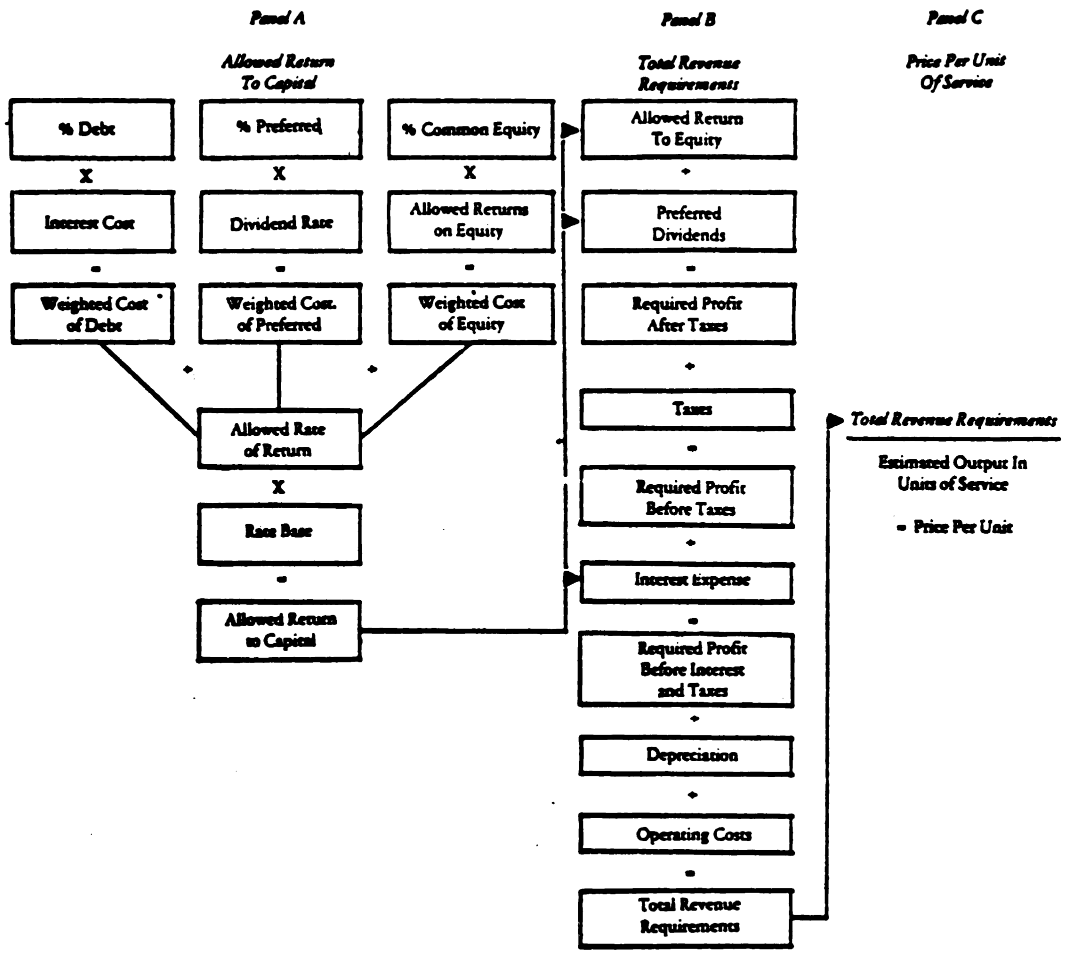
competitive enterprise with similar risks. The capital costs implied are the interest on debt and the dividends paid to both preferred and common stockholders. The rates are set in a formal hearing before the public service commission where the rate of return, the rate base and a schedule of rates is approved. In the illustration of this computation that follows, assume the following facts:

Rate base	10,000,000
Cost of service expenses including taxes and depreciation, but excluding the return to capital, that is, dividends and interest charges	1,000,000
Allowed rate of return	12%

The commission would allow a rate schedule to be approved which should allow a total of 2,200,000 in revenues. This would be a cost of service expense of $1,000,000 plus the allowed return to capital of 1,200,000 (12% x 10,000,000). An excellent overview of the entire rate-making process is provided in Figure 1. A brief discussion of the major points of contention involved in regulatory proceedings follows.

1.4 Rate Base

Obviously, from an examination of the exhibit a critical question in the regulation of electric utilities concerns the determination of the appropriate rate base. Two principal issues effect this rate base. First, what items should be included or excluded. The rate base is not the



Source: Dennis T. Officer, "Issues in Public Utility Regulation," <u>Arizona Business</u>, January, 1981, p. 19.

Figure 1

Overview of Rate-Making Process

same as total assets. All public service commissions agree that the plant in service belongs in the rate base, but the agreement stops there. In the context of this study an important point must be made here. Most commissions do not allow construction work in progress (CWIP) in the rate base. That is, plants under construction but not yet completed are excluded from the rate base. The commissions have not felt it proper to force present customers to pay for future electric supplies.

Second, the dollar value of the rate base is also important. This is concerned with whether a firm is allowed to use fair values or replacement values in the calculation of the rate base. Most firms are forced to use historical costs, which is original cost minus depreciation. In an era of high inflation the historical costs are substantially less than fair values. Therefore, increasing the rate base by using fair values would increase the prices customers would have to pay. This is a very controversial topic and it is beyond the scope of this research to answer this question. Therefore, there will be no further discussion of fair values versus historical costs.

1.5 Rate of Return

In theory the allowed rate of return equal the company's cost of capital. Therefore, theoretically, utility rates are set so as to cover all expenses including capital costs. But, there is a basic problem in that most utility commissions have ignored current financial theory relating to the cost of capital calculations. This problem has two aspects. First, the regulatory agencies have traditionally allowed the utility sufficient revenues to cover only the historical or embedded interest costs on long-term debt. The agencies do include the current cost of debt into the calculation of the cost of debt capital. This is the average cost of debt. However, in recent years, current interest rates are much greater than past interest rates. In other words, the current cost of debt is greater than the average cost of debt. When a utility finances a construction project, it must borrow at current rates, not at these historical or embedded rates. Therefore, there does appear to be a major difference between the rates a utility is required to pay on the debt funds used for construction and the revenues they are allowed to earn on this debt component. Whether this is inequitable in view of the ongoing nature of utilities and the way in which the appropriate rate of return is determined is perhaps debatable, but not of concern here.

Second, in the determination of the appropriate rate of return to equity, commissions tend to use the "comparable earnings" standard. For this standard, the commission computes the rate of return earned on the book value of the equity for both regulated and non-regulated industries. The utility is then allowed to earn a rate of return on the book value of its equity based on the rates other firms with similar risks earn.[11] There are two major problems with this approach. First, there is no straight forward or unambiguous method for determining equality of risks. Second, accounting methods are quite different between regulated and unregulated firms. Thus, rates of return based on book values makes comparisons very difficult. Therefore, due to the combination of these factors, it is only by chance that the allowed rate of return equals the company's incremental cost of capital.[12]

1.6 Expenses Allowed

The public service commissions also regulate the cost of service expenses which can be recouped through revenues. The basic expenses allowed are operating, maintenance, depreciation and taxes.[13] There are certain expenses such as advertising, research and prerequisites to executives which may not be allowed. These expenses are not pertinent for purposes of this study and will not be discussed further.

1.7 Regulatory Lag

When discussing rate of return a concept that cannot be ignored is regulatory lag. Regulatory lag refers to the lag in time from the date the utilities present their case to the commission until the rates are actually billed to customers. Due to the increased militancy of consumers and therefore, longer commission hearings, the problem of regulatory lag has become more important. During this time lag, the rate base, the cost of service expenses, and the cost of capital may change and result in a difference between expected and actual income. A few state commissions have attempted to alleviate this problem through automatic adjustment clauses for expenses and by projecting changes in the rate base and the cost of capital.[14] Yet, the majority of commissions do not follow this procedure and the problem of regulatory lag is now compounded by rapidly fluctuating interest rates.

1.8 Regulation and Allowance for Funds

Construction work in progress (CWIP) was discussed in an earlier section. It is an extremely controversial topic among regulators. In fact, most commissions do not allow plants not yet completed (CWIP) in the rate base. Commissions felt it is unfair for current users of utility services to pay a return on a utility plant that will benefit future customers.[15] The amount of other income reported as AFUDC in any year is a function of CWIP and the allowed rate of return. Therefore, the inclusion of CWIP in the rate base gives rise to a crucial difference in AFUDC among utilities. Those firms that include CWIP in the rate base are known as method II firms, while the majority of firms that don't allow CWIP in the rate base are method I firms. This dichotomization will serve as the basis for a number of empirical tests in later chapters.

In the regulatory framework there are two principal arguments given for the use of AFUDC. These are the separation and matching arguments which are discussed at length in chapter two. Briefly, the separation argument states that the real purpose of AFUDC is to separate the current operations from the effects of a construction program. The matching argument is a basic premise of accounting theory. Revenues should be matched with the expenses that generated those revenues.

> The recording of an allowance defers the cost of financing construction activities is premised on the basic regulatory principal that current customers should pay a return only on those assets that are currently performing a useful service.[16]

The utility industry is then faced with a dilemma. It is thought unfair to charge current customers for future services, but at the same time to properly match the costs and benefits of this service potential it must recognize the costs of construction. The best solution in the view of public service commissions is AFUDC. AFUDC allows a utility to report as income the capital costs of the construction program. This accomplishes two purposes. One, the income from and the effects of the construction program are separated from the income for current operations. Second, the costs of the construction are properly matched with the revenues from the construction program.

1.9 Brief History of AFUDC

The concept is part of the basic philosophy of regulation for utilities. The states of New York and Wisconsin provided for the capitalizing of interest paid on funds used to finance construction starting in 1909. This was concerned with just debt funds. The cost of capital was not recognized until 1914 when the Interstate Commerce Commission's system of accounts provided for both debt and equity to be capitalized.[17] The Federal Power Commission adopted a similar position, which was called interest during construction (IDC), starting in 1922. Even though the concept of recognizing all the costs of capital was developed early, the term allowance for funds used during construction (AFUDC) was not in common use until the late 1960's.[18]

1.10 Determination of Capitalizing Rates

A very serious practical problem arises when trying to determine the appropriate rate for the capitalization of allowance funds. That is, identification of the specific funds, which are used to finance a particular project.[19] In fact, financial theory suggests that this identification if possible, would not be correct. The Separation Theorem indicates that the financing decision must be separate from the investment decision. Therefore, the determination of the proportion of a project cost provided by debt or equity is a moot point. The rate should be the firm's marginal cost of capital according to financial theory. In practice the commissions allow a rate that varies considerably from year to year and among utilities in different states.[20] The construction work in progress account is multiplied by some rate, which is then considered the allowance for funds used during construction for that particular year. The rate is not set so as to capitalize a certain amount of interest, preferred dividends and certain return on common equity. In fact, utilities have different ways of calculating this rate, but for the most part, the rate is not related to the firm's marginal cost of capital. Some idea of the divergence among utilities is presented:

> Generally, it has been the practice of utility companies to credit Interest Charged Construction at a lower rate than the allowed rate of return; usually the rate used has been the prevailing short-term interest rate.[21]

In a different study, where the author examined the disclosure of the rate, he stated:

> It appears that most companies are not using a rate that is based directly on the cost of funds required for construction, but rather one that is considered representative of the industry. . .footnote disclosures in many cases described the rate as based upon, but less than the cost of capital employed to finance the construction program.[22]

Another author in analyzing the trends in the allowance rates notes:

> In analyzing the upward revision it is quite obvious that these rates did not cover the rapidly rising capital costs. For example, in 1968, when the cost of senior capital to electric utilities hovered at 7% and the cost of equity capital was considerably higher, most firms were capitalizing AFC at less than

> 7%. Likewise, for 1969 and 1970, when debt costs alone soared to ranges of from 8.5 to over 10 percent, the corresponding capitalizations rates continued to lag considerably.[23]

Finally, in a 1973 Federal Power Commission survey, it was found that only one commission (Puerto Rico) allowed the allowance rate to be the same as the allowed rate of return. Twelve of the fourteen other interpretable responses indicated that the rate was geared to the interest rate on debt.[24] But there may be a considerable difference between this rate and the cost of debt. An examination of current annual reports, reveals 8-9% is not uncommon when the cost of debt hovers around 12-14%. It appears the rate used to capitalize these capital costs of construction has very little theoretical validity.

1.11 Accounting for the Allowance

A discussion of the actual accounting entry to record AFUDC will perhaps help clarify the situation. The accounting entry is a debit to the asset account, construction work in progress and a credit to the allowance for funds used during construction. The later account is then closed to Income Summary. The entry follows:

Construction work in progress	XXX	
Allowance for funds used during construction		XXX

An example of the accounting ledgers is given in Figure 2. The first part of the exhibit shows the actual accounting entries, a debit to the asset account (CWIP) and a credit to the revenue account (AFUDC). The next section of the

Year 1-5 Accounting Entries

CWIP	8,000	
AFUDC		8,000

	CWIP
Begin	100,000
	8,000
	8,000
	8,000
	8,000
	8,000
Total	140,000

AFUDC	
8,000	yr 1
8,000	yr 2
8,000	yr 3
8,000	yr 4
8,000	yr 5

	Income Summary
Year 1	8,000
Year 2	8,000
Year 3	8,000
Year 4	8,000
Year 5	8,000
	40,000

AFUDC
8,000
8,000
8,000
8,000
8,000
40,000

Depreciation equals 28,000/year, given a total asset value of 140,000 and the use of straight-line depreciation.

Figure 2

Accounting Entries for the Allowance for Funds exhibit is an example of the actual ledgers over the five year period. The actual number are discussed in the explanation of Figure 3. The last section of Figure 2 shows the closing of the AFUDC account to the Income Summary account each year. This 8,000 is then included as income in each year. Once an annual amount is added to the CWIP account, it cannot be distinguished from other amounts in the CWIP account. The AFUDC is then closed to income summary. Starting in 1977 a slightly different procedure was used to report this income. It now appears as two separate line items on the utility's income statement. The portion of AFUDC attributed to debt funds appears as an offset (reduction) to interest expense. The portion attributed to equity funds appears under the section "Other Income." Even though this does separate the two components, the effect on the total income reported is the same as previous to 1977.

Figure 3 is an attempt at recreating a simplified income statement using the data presented in Figure 2. The first three years are left out of the exhibit for purposes of clarity since they are identical to years 19x4 and 19x5. The tax treatment of AFUDC may be different due to timing differences, but again for purposes of clarity a separate example is presented later in this chapter to exemplify the tax timing differences. The example can be divided into two five year sub-periods. Years 19x1 through 19x5 are the construction period. During these years AFUDC

	19x4	19x5	19x6	19x7	19x8	19x9	19x10
Rate base[a]	1,000,000	1,000,000	1,140,000	1,112,000	1,084,000	1,056,000	1,028,000
Revenues[b]	998,000	998,000	1,042,000	1,039,200	1,036,400	1,033,600	1,030,800
Expenses[c]	900,000	900,000	928,000[d]	928,000	928,000	928,000	928,000
Operating Earnings	98,000	98,000	114,000	111,200	108,400	105,600	102,800
- Interest	6,000	6,000	0	0	0	0	0
Income available before AFUDC	92,000	92,000	114,000	111,200	108,400	105,600	102,800
AFUDC	8,000	8,000	0	0	0	0	0
Total Income	100,000	100,000	114,000	111,200	108,400	105,600	102,800

[a]The rate base increases by the CWIP when plant is placed in service and declines by the amount of depreciation/yr.
[b]A utility is allowed to earn revenues to provide a 10% return on the rate base after cost of services expenses.
[c]Expenses include taxes.
[d]Expenses in years 6-10 are $28,000 greater due to the additional depreciation expenses.

Assumptions:
- Method I Companies only
- Rate Base excluding CWIP - $1,000,000
- Investment in CWIP - $ 100,000
  - Finance by 50% debt at 12%
  - 50% equity
- Allowed rate of return on rate base - 10%
- Allowed rate of return on CWIP - 8%. This used to find the amount of AFUDC in any given year.
- Plant placed in service on Jan. 1, 19x6 - depreciation over 5 years.
- Rate base in 19x6   1,000,000 + (5 x 8,000) + 100,000 = 1,140,000

This is a simplication, the AFUDC is now separated into two segments; the component attributable to debt and the amount attributable to equity. The effect on the income statement is the same.

Figure 3

Simplified Example of a Hypothetical Income Statement for a Utility, Showing the Effects of AFUDC on Reported Income are recorded as earnings without an attendant cash flow. The addition of AFUDC to the construction work in progress account (CWIP) during this construction period causes the asset value to increase by the amount of the AFUDC. In this case the asset value increases by $8,000 per year for a total of $40,000. This increases the asset value of the asset account (CWIP) to $140,000. This $8,000 per year is recorded as other income, AFUDC. The $8,000 per year can be found by multiplying the CWIP account, $100,000, by the allowance rate (rate of return allowed on CWIP) of 8%. Notice that the total income the utility reports is $8,000 greater than the revenues they are actually allowed to collect from customers. The next step occurs when the plant is completed.

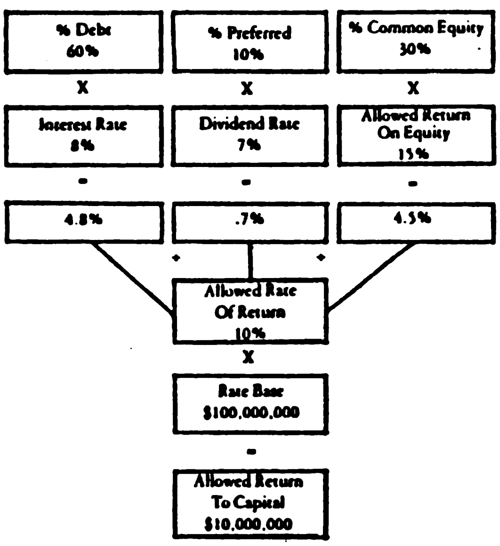
The CWIP account is allowed to enter the rate base in year 6, thereby increasing the rate base from $1,000,000 to $1,140,000. At the same time the depreciation expense increases by $28,000 due to the addition of CWIP to the rate base. This additional depreciation expense really has two components, $20,000 is the original cost of the plant depreciated on a straight-line basis over the five year life. $8,000 is the depreciation due to the addition of $40,000 of AFUDC to CWIP over the construction period and the subsequent depreciating of this $40,000 over the five year life of the plant. The $8,000 can now be collected from customers as a cost of service expense. The problem is that AFUDC is reported as $8,000 of income in years 19x1-19x6 and the $8,000 is not actually collected from customers until years 19x6-19x10.

The rate base in years 19x6-19x10 declines by $28,000 per year reflecting this depreciation expense. Also, revenues in years 19x6-19x10 also decline reflecting the lowering of the rate base each year. Years 19x1 through 19x5 show an interest expense of $6,000 per year which is the $50,000 of debt times the cost of 12%. The assumption is that the debt is retired at the end of the fifth year. Again this may be a simplification since a utility could be expected to pay off the debt with the proceeds of the new plant, but for purposes of clarity it was thought necessary to use this format. The crucial point that one may glean from this example is the recording of $8,000 of income in years 19x1 through 19x5 when that income is not currently a cash flow and will not be a cash flow until some future time, years 19x6 through 19x10.

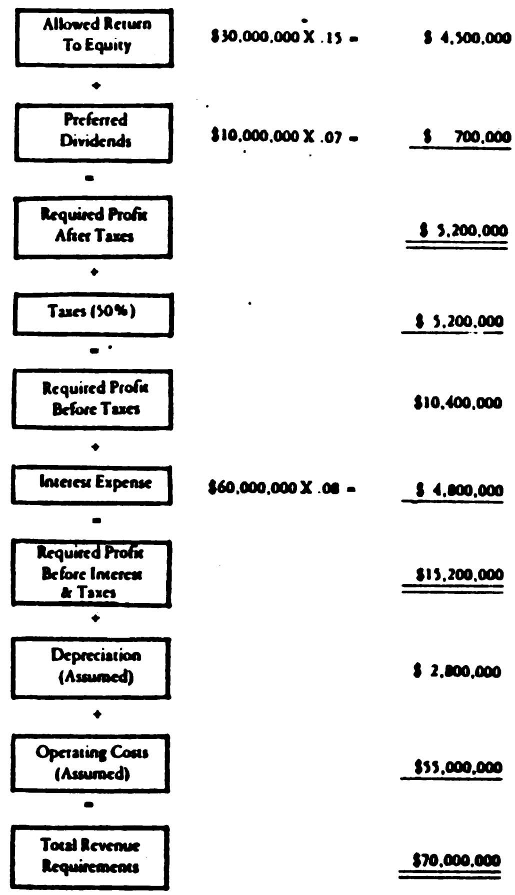
Figure 4 substitutes actual numbers into the theoretical framework of Figure 2. This may offer the reader additional insight into the process of revenue determination for an electric utility. The effect of an increased rate base and additional depreciation charges are evident from this exhibit.

1.12 <u>Taxes and the Disclosure of AFUDC</u>

The Internal Revenue Service does not consider AFUDC income as taxable income. AFUDC is a device used purely for rate-making and financial reporting purposes.



Allowed Return to Capital XYZ Power Co.



Total Revenue Requirements XYZ Power Co.

Source: Dennis T. Officer, "Issues in Public Utility Regulation," Arizona Business, January, 1981, p. 19.

Figure 4

Illustration of Rate-Making Process

Therefore, the recording of allowance income does not increase the company's income tax liability. In the year the AFUDC credit is recognized, book income exceeds taxable income by the amount of the credit, but in later years book income is less than taxable income due to the difference in depreciation expense allowed. The depreciation expense due to the allowance is not a tax deductible depreciation, therefore there is a reduction in book income compared to taxable income. AFUDC then causes book income to be greater than taxable income in earlier years, but this difference "turns around" in later years. This is a classic example of the timing difference for interperiod tax allocation.

Figure 5 is a simplified example illustrating the timing differences for AFUDC. The total tax paid over the six year life is $18,000. In the first three years book income exceeds taxable income by $2,000, the amount of AFUDC. $1,000 is the debt portion and $1,000 is the equity portion. Only the debt portion creates a deferred tax liability which will be eliminated in years 4-6. In years 4-6 taxable income exceeds book income by $1,000 which is the additional depreciation charges due to the capitalized debt portion of AFUDC.

However, the total amount of AFUDC reported as income does not represent a timing difference between book and taxable income. There are two aspects which may affect the differences between book and taxable income. The timing

	19x1	19x2	19x3	19x4	19x5	19x6
EBIT	10,000	10,000	10,000	8,000	8,000	8,000
- Interest	2,000	2,000	2,000	2,000	2,000	2,000
+ AFUDC debt component	1,000	1,000	1,000	0	0	0
	9,000	9,000	9,000	6,000	6,000	6,000
+ AFUDC equity component	1,000	1,000	1,000	0	0	0
Book Income	10,000	10,000	10,000	6,000	6,000	6,000
Taxable Income	8,000	8,000	8,000	7,000	7,000	7,000
Taxes	3,200	3,200	3,200	2,800	2,800	2,800
Net Income	6,800	6,800	6,800	4,200	4,200	4,200

Assumptions:

3-year project life
3-year construction period
CWIP = 20,000 $\left.\begin{matrix}\\\end{matrix}\right\}$ ½ debt + ½ equity
Allowance = 10%
Tax rate = 40%
Additional deprec. of 2000/yr - reduces EBIT in years 4-6

Figure 5

Example of Timing Differences for Tax Purposes of AFUDC difference, which is explained above, and a permanent difference. A permanent difference results from income reported for book purposes which is never reported as taxable income. For example, income on a municipal bond which is of course federal tax exempt. Recall that AFUDC consists of two components, the amount attributed to debt financing, and the amount attributed to equity financing. The portion of AFUDC related to debt financing is a timing difference. The interest expense related to debt funds is tax deductible immediately in the period incurred for tax purposes, but is deferred and expensed as a depreciation expense over the life of the plant for book purposes.

The portion attributed to the equity financing which is considered "Other Income" is a different case, a case of permanent differences. Since this component is due to the opportunity cost foregone by investors it is of course not a tax deductible expense for any corporation. Therefore, this portion of AFUDC, which is classified as "Other Income" gives rise to a permanent difference between book and taxable income, for which no inter-period tax allocation is appropriate.[25] In summary, only the $1,000 attributed to the debt funds is a timing difference which reverses in later years.

The Securities and Exchange Commission does not have any specific pronouncements related to AFUDC on the utility's income statement, except one discussed below. However, most utilities do disclose in footnotes to their financial statements, the nature of the allowance and the rate used to compute the allowance. Recently the SEC has required one or more of the following disclosures in registration statements filed with the commission on a case by case basis:

1) Disclosure of the portion of net income available to common stock which is attributed to the common equity portion of the allowance for funds used during construction.
2) An exhibit to the registration statement which illustrates the computation of the common equity portion of the allowance.
3) Deduction of the allowance, or a portion thereof, from sources of funds from operations in the statement of changes in financial position.[26]

The other federal agency, which does impose industry wide accounting requirements, is the Federal Energy Regulatory Commission. The requirements are: (1) To specify the account title, allowance for funds used during construction, for the income statement, (2) To define the allowance for funds used during construction as "the net cost during the period of construction of borrowed funds used for construction purposes and a reasonable rate on other borrowed funds used for construction purposes and a reasonable rate on other funds when so used,"[27] and (3) To specify that the entire amount be deducted from sources of funds from operations in reports filed with the commission.[28]

In 1977 both the SEC and FPC issued a new requirement. The total amount of AFUDC must be separated into two components as stated earlier.[29] These are the debt component and the equity component.

1.13 Differences Between Method I and Method II

Many commissions use method I, a few use method II and a fair number use a combination of both.[30] It is important that the difference is clearly understood. An illustration accentuating the differences follows, assume the following facts:

1)	Rate base excluding CWIP until completion of the plant	10,000,000
2)	Investment in CWIP including 100,000 of capitalized allowance for funds from this year	1,000,000
3)	Allowed rate of return on rate base	12%
4)	Allowance rate for AFUDC (applied to CWIP) to get current year's AFUDC	10%

The basic difference between method I and method II is that CWIP is included in the rate base for method II and CWIP is excluded for method I. For method I companies, the current year's allowance for funds and the firm's investment in CWIP are both ignored in setting current revenue requirements.[31] Rates charged to consumers would then be set to provide income of $1,200,000 (the allowed rate of return of 12% times the rate base of $10,000,000) for method I firms.

Method II firms are quite different because both the current year's allowance for funds and the investment in CWIP are considered in the rate making process.[32] Even though method II does allow CWIP in the rate base, they do not allow the current year's capitalized allowance for funds to be included. This prevents the utility from capitalizing the allowance and then earning a return on it in the same year. This would be double counting. The procedure is really two steps. First, the method II firm includes CWIP in the rate base. In this example, the initial amount would be $1,320,000. This is the allowed rate of return of 12% times the rate base, including CWIP, of 11,000,000 (12% x (10,000,000 + 1,000,000) = 1,320,000). Second, the current year's allowance for funds is subtracted from this total revenue figure. In this example, the current year's allowance is $90,000 (10% x 1,000,000 - 100,000). The total revenue figure minus this year's allowance yields the return an utility would be allowed to earn. Here, $1,320,000 - $90,000 equals $1,230,000.

This is an important point. Remember for method I firms, the income the utility is allowed to earn is $1,200,000. The full cost of the construction program

12% x 1,000,000 = 120,000 is borne by future customers. Method II firms split the cost of construction between current and future customers. In this case $30,000 (1,230,000 - 1,200,000) is paid by current customers and the majority of the cost (the $90,000 deduction in the determination of income allowed) is paid by future customers. The next section discussed the interest on interest question and the effect this has on the amount of AFUDC. Also, Figure 6 provides examples of this split cost under different alternatives.

1.14 The Concept of Interest on Interest

Interest on interest is an important concept which very few commissions allow. In a 1970 survey of 130 electric utilities on this question, the authors state:

> ". . .of the (130) utilities that reported capitalizing AFC, only four reported that they, at one time or another, compounded the allowance, that is, left prior AFC capitalized in the expenditure base in computing the current portion."[33]

Interest on interest pertains to the question of, whether or not previously capitalized allowance for funds should be included in construction work in progress for this year's allowance computation. In the example above, if the commission allows this year's allowance for funds to be 10% of $1,000,000 or $100,000 it is allowing interest on interest. The concept really has to do with compounding interest because the $100,000 of previously capitalized allowance for funds is allowed to earn an additional $10,000 (10% x $100,000), of allowance for funds in this year. Since most commissions don't allow this, the amount that would be the allowance in this year is $90,000 [10% (1,000,000 - 100,000)]. One can also see that this amount which is not allowed, compounds year by year over the life of the construction period. Considering the construction period may be 10 to 12 years, this could be a substantial amount which the utility is not allowed to earn.

This question can be examined from another perspective, that is, the rate of return allowed on this allowance amount once it has been added to the construction work in progress. For method II, without interest on interest, the allowance for funds dollars are immediately invested at the rate of return allowed by the commission. Also, since they are allowed in the rate base from year 1 (start of construction) through year N (end of life of the plant) when the plant is fully depreciated, these dollars earn the rate of return allowed by the commission for the same period of time in which income is reported. Again using the previous example, the $100,000 of previously capitalized allowance earns a return of 12% in this year. Continuing another year and assuming the only change is the allowance entry made in this year, then the next year the amount previously capitalized will be $190,000 (100,000 + 10% (1,000,000 - 100,000)). This amount will then earn 12% in the next year or whatever rate the commission allows.[34] The example could be continued far into the future, but the critical point is that under method II, theoretically from the year the allowance is recorded until the plant is fully depreciated, the allowance dollars are invested at the appropriate rate of return.

The important point is that under method II the interest question is not relevant. As stated before, for method II firms, interest on interest results in the partitioning of the return into the amount received in the current period and the amount to be received in future periods. If interest on interest was allowed in the first year, the $100,000 or previously capitalized allowance would still earn 12% or $12,000. But, $10,000 (10% x 100,000) would then be added to the rate base to be received in future periods (through additional depreciation expenses) and $2,000 would be received in the current period.

The interest on interest question affects method I firms in a far different fashion when viewed from the perspective of the rate of return allowed on the allowance for funds dollars. First, if interest on interest is allowed, the allowance dollars are invested during the construction period at the rate used to capitalize the allowance. Turning again to our example, if interest on interest is allowed, the $100,000 of previously capitalized allowance dollars earn a return of 10% or $10,000, for the current year. Second, if interest on interest is not allowed, the allowance dollars are invested during the construction period at a zero rate. For example, the $100,000 of previously capitalized allowance produces no

	Case A		Case B		Case C	
	I	II	I	II	I	II
Return on Plant in Service	100,000	100,000	100,000	100,000	100,000	100,000
Return on CWIP including previously capitalized AFUDC	7,200	9,000	9,000	9,000	9,000	9,000
Return on previously capitalized AFUDC	0	1,000	0	1,000	1,000	1,000
Total Return	107,200	110,000	109,000	110,000	100,000	100,000
Portion of Total Return included in rates for the current year	100,000	102,800	100,000	101,000	100,000	100,000
Amounts added to CWIP (AFUDC)	7,200	7,200	9,000	9,000	10,000	10,000
Total Return	107,200	110,000	109,000	110,000	110,000	110,000

Assumptions:

Rate base excluding CWIP = 1,000,000

Average Investment in CWIP including $10,000 of previously capitalized AFUDC = 100,000

Case A - AFUDC rate of 8%, allowed rate of 10%, and AFUDC not compounded.
Case B - AFUDC rate of 10%, allowed rate of 10%, and AFUDC not compounded.
Case C - AFUDC rate of 10%, allowed rate of 10%, and AFUDC compounded.

In every case the total return is 10% of 1.1 million for a method II firm but it is divided into a current portion and future portion, therefore the timing varies. For method I the current return remains constant but the total return changes, therefore the amount varies.

Figure 6

Example of Interest on Interest Timing Differences return in the current period. Even with interest on interest, the returns on the previously capitalized allowance for method I, are in the form of an additional allowance until the plant is placed in service at which time they will be recouped through additional depreciation charges (cost of service expenses).

Contrast this to method II, where the returns on allowance dollars can take two forms: 1) Immediate cash flows if interest on interest is now allowed or 2) Partitioned between immediate and future cash of interest on interest is allowed.[35]

Summarizing for method II firms, the compounding (interest on interest) effects the timing of the utility's return on construction work in progress, but these factors do not affect the amount of the return. On the other hand, for a method I firm the compounding effects the amount but not the timing of the utility's return on construction work in progress.[36] A method II firm should prefer no interest on interest while a method I firm should prefer to use interest on interest. Since the majority of firms don't allow interest on interest it points out another difference between method I and method II firms. Method I firms are again penalized with respect to method II firms. Figure 6 on the previous page illustrates these differences between method I and method II firms.[37]

1.15 Mathematical Treatment of Differences Between Method I and Method II[38]

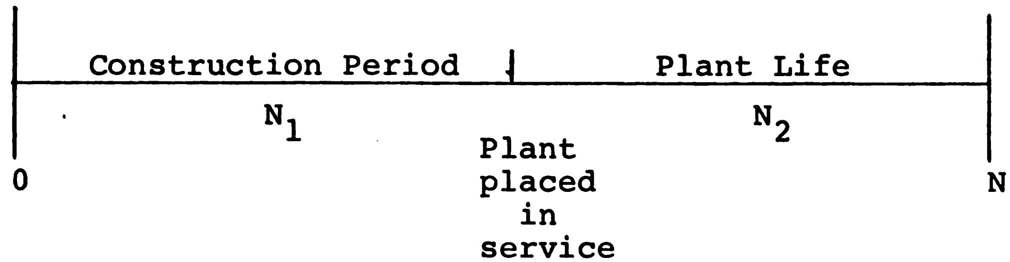
Method I Firms. Let C_1 be the amount of allowance in the plant accounts at the time when the plant is placed in service. Let C_1 represent just the allowance for 1 year, all other years of the construction period will be identical. The future value is then $(1 + r)^{N_2}C_1$ where r = return allowed on the rate base by the commission, and N_2 = the number of years for plant life. If this sum is discounted to the year when the plant is placed in service, the present value is

$$\frac{(1 + r)^{N_2}C_1}{(1+ r)^{N_2}} = C_1$$

But now if C_1 is discounted back to the date the allowance income is reported, (time $0 + N_1$) the reported income will exceed this discounted value of C_1. Figure 7 on the next page presents a schematic drawing of this concept.

The interest on interest rate is important in the determination of C_1. $C_1 = C_0 (1 + i)^{N_1}$ where i = interest on interest rate and N_1 = construction period. If $i = 0$, then $C_1 = C_0$. Therefore, the difference between the allowance income reported and the present value of the related cash flows depends on three factors:

1) Length of the construction period (N_1)
2) Interest on interest rate (i)
3) Opportunity cost of funds (assume $r = k$ = marginal cost of capital)



$$C_o\ (1+i)^{N_1} = \frac{C_1}{(1+r)^{N_1}} \longleftarrow C_1 \longrightarrow (1 + r)^{N_2} C_1$$

N_1 = Construction period
N_2 = Plant life
C_1 = Amount of the allowance at time 0 + N_1
C_0 = Amount of the allowance at time 0
i = Interest on interest rate
r = Allowed rate of return

Figure 7

Time Line Showing the Time Period from The Start of Construction to End of the Plant Life

A major difference between method I and method II is that under method I the allowance amount at time 0 does not compound (interest on interest) over the construction period (N_1) to give the value C_1. It is really the value C_0. Then when discounted back over N_1 years to time 0, the income reported is greater than the present value of C_1. The present value of each dollar of C_1 can be found by solving the following equation

$$\frac{(1 + i)^{N_1}}{(1 + r)^{N_1}}$$

where the parameters are as defined above.

Figure 8 shows the calculations for different parameter values when this equation is solved. An examination of the exhibit reveals a startling fact. There are substantial differences between each dollar of allowance income reported and the present value of the related cash flow. For example,

1) In the typical case where no interest on interest is allowed and the opportunity cost of funds is 12%, the ratio of increase in value to income reported decreases from 89% to 32% as the construction period increases from 1 year to 10 years.

2) Even if interest on interest is allowed at the rate of allowance, which is still

Figure 8

Present Value of the Cash Flows From
$1 of Allowance Income

Opportunity Cost of Funds 12%

Length of Construction Period	Interest on Interest Rate 0%	8%	9%
1	.893	.962	.971
2	.797	.925	.943
3	.712	.889	.915
4	.635	.855	.888
5	.567	.822	.863
6	.506	.790	.837
7	.452	.760	.813
8	.404	.731	.789
9	.360	.703	.766
10	.322	.676	.744

less than the opportunity cost of funds, and if the differential is 3%, the ratio decreases from 97% to 74% over the 10 year period.

Therefore, for method I firms, there are substantial differences between the income reported and the present value of the income actually earned over the life of a construction project.

Method II Firms. Under this method construction work in progress is included in the rate base. It remains in the rate base from year 1 until year N where N is time when the plant is fully depreciated. Therefore, the value of the firm is increased by the present value of the annual return on the allowance plus the amount of the allowance. Let C_2 be the allowance, r the return allowed by the commission, N_1 the construction period, and N_2 the life of the plant to which the allowance is added. The future value of the cash flows is then $(1 + r)^{N_1 + N_2} C_2$ and the present value of this stream at the time when the income is reported is

$$\frac{(1 + r)^{N_1 + N_2}}{(1 + r)^{N_1 + N_2}} C_2$$

or C_2, which is the amount of income reported. Therefore, for method II firms, the present value of the increase in value of the firm due to the allowance is equal to the amount of the income reported.

Summarizing, it was pointed out earlier that the "quality" of earnings refers to the timing and amount of the cash flows related to those earnings. The above discussion provides a mathematical framework within which the cash flows of AFUDC earnings are shown to be significantly less than the cash flows of earnings from operations for method I firms. This indicates that the "inferior quality" connotation that many investors place on AFUDC earnings does have some theoretical justification. In the case of method II firms this may be an unfair connotation, since the cash flows of AFUDC earnings are equivalent to the cash flows of earnings from operations.

The mathematical treatment of AFUDC and the comparison of method I with method II both suggest that there is a difference between the income reported and the income or cash flow actually earned by the utility. The discrepancy between the income numbers gives rise to the argument about the "quality" of these earnings. It is not hard to see why a large number of people associated with electric utilities might be concerned with the market reaction to a utility's earnings. Particularly when the percent of earnings represented by allowance for funds used during construction hovers around 40-50%. Since disclosure of the item is minimal and the practice of capitalizing this component varies by state and by year, it is not surprising to find that AFUDC comes under attack as one of the reasons for the decline of market valuation of electric utilities.

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In the next chapter empirical tests are discussed which provide evidence that those earnings attributed to AFUDC have a different market reaction due to their increased risk. The market then values those earnings differently than earnings from operations. In other words, earnings actually earned through revenues from customers are valued differently than earnings due to an accounting entry.

There certainly seems to be some justification for a study that will present evidence concerning the immediate market reaction to AFUDC earnings. Hopefully the evidence presented here will be useful in the regulation of electric utilities and aid investors in evaluating those securities.

1.16 Summary

In this chapter first, an overview of the regulatory process was presented. Second, the concept of allowance for funds used during construction and how it fits into the regulatory process was presented. Special attention was noted of the fact that the primary purpose of AFUDC is to prevent current customers from paying for future supplies of power. Third, a very brief history of the concept was traced to the early 1900's. Fourth, the determination of the appropriate capitalization rate and the specific accounting for AFUDC was detailed. Fifth, the scarcity of formal disclosure requirements by the SEC and FPC was discussed. Sixth, the interest on interest question was discussed with implications for both method one and method two firms. Finally, a mathematical development was presented for method I and method II and for AFUDC in general.

Footnotes

[1]Lawrence Pomerantz and James E. Suelflow, "Allowance for Funds Used During Construction: Theory and Application," (East Lansing, Michigan: Division of Research, Michigan State University, 1975) p. 75.

[2]Discussion with Thomas Harrimon, Senior Utility Analyst, Duff & Phelps on July 2, 1980.

[3]Differences between method 1 and method 2 will be discussed at length in later sections of this chapter. Briefly, method 1 does not include and method 2 does include CWIP in the rate base.

[4]Richard Walker, "Testimony and Exhibits of Richard Walker for Arthur Andersen & Co.," Florida Public Service Commission Docket No. 72609-PU, June 18, 1973.

[5]Affidavit by Mr. W. Trueslo Hyde, Jr., filed with the N. Carolina Utilities Commission in Re Duke Power Co. Docket No. E-7, Sub 128.

[6]Arthur L. Litke, "Allowance for Funds Used During Construction," Public Utilities Fortnightly, (September 28, 1972), pp. 19-22.

[7]O'Donnell, John L., "Relationships Between Reported Earnings and Stock Prices in the Electric Utility Industry," The Accounting Review, (January, 1965), p. 135-143. Professor O'Donnell was one of the first to examine the quality of earnings question and the affect it may have on stock prices.

[8]Robert M. Bowen, "Valuation of Earnings Components in the Electric Utility Industry," The Accounting Review, Vol. LVl, No. 1, January, 1981, p. 1-21.

[9]F.P.C. v. Hope Natural Gas Company, 320, U.S. 591 (1944).

[10]Natural Gas Pipeline Co. of America v. F.P.C., 315, U.S. 575 (1942).

[11]Each of these items is defined and discussed in the following pages. Also, Figure 2 is a schematic presentation of these items.

[12]Stewart C. Meyers, "The Application of Finance Theory to Public Utility Rate Cases," The Bell Journal of Economics and Management Science (Spring, 1972), p. 59.

[13]Dennis T. Officer, "Issues in Public Utility Regulation," Arizona Business, January, 1981, p. 21.

[14]Murray L. Weidenbaum, "Variation in Public Utility Regulation," Public Utilities Fortnightly (October 24, 1974), p. 30.

[15]Everett L. Morris, "Capitalization of Interest on Construction: Time for Reappraisal?" Public Utilities Fortnightly, (March 4, 1971), p. 26.

[16]Arthur L. Litke, "Allowance for Funds Used During Construction," pp. 20-23.

[17]Ibid.

[18]The account title Allowance for Funds Used During Construction was established by Order No. 436 issued by the Federal Power Commission in August, 1971.

[19]Paul B. Coughlan, "Interest During Construction: A Little Appreciated Cost," Public Utilities Fortnightly (September 28, 1972), p. 19.

[20]Pomerantz and Suelflow, p. 93.

[21]Dennis R. Bolster, "Should Plant Under Construction be Included in Rate Base?" Public Utilities Fortnightly (May 27, 1971), p. 27.

[22]Lyle M. Dahlenbury, "Allowance for Funds Used During Construction - Calculation and Disclosure Problems," Public Utilities Fortnightly (January 17, 1974), pp. 68-72.

[23]Pomerantz and Suelflow, p. 93.

[24]Federal Power Commission, Federal and State Commission Jurisdiction and Regulation of Electric and Gas Utilities, 1973 (Washington, D.C.: U.S. Government Printing Office, 1973), p. 64.

[25]Bunch, C. Robert, "The Tax Effects of AFUDC: Financial Accounting Aspects," Public Utilities Fortnightly (August 14, 1980). A detailed treatment of this topic is given in this article.

[26]Dahlenbury, "Calculation and Disclosure," p. 17.

[27]Federal Power Commission, Uniform System of Accounts Prescribed for Public Utilities and Licenses (Washington, D.C.: U.S. Government Printing Office, 1973).

[28]Federal Power Commission, Accounting Release No. AR-10 (Washington, D.C.: Federal Power Commission, 1971).

[29]Federal Power Commission, Order No. 561 (Washington, D.C.: Federal Power Commission, 1977) and Securities Exchange Commission, Accounting Bulletin No. 15, Washington, D.C.: 1977.

[30]Bolster, "Should Plant Under Construction," p. 27 made the initial distinction between method 1 and method 2.

[31]Ibid, p. 28.

[32]Ibid, p. 28.

[33]Pomerantz and Suelflow, p. 73.

[34]It must be recognized that this rate of return is what the utility should earn, not what they actually earn. The same problem exists with the other assets of the utility, what they are allowed to earn and what they actually earn are very likely to be different. Second, the rate of return allowed can change from year to year.

[35]This treatment of interest on interest draws heavily on Johnson's work in his dissertation.

[36]Johnny R. Johnson, "Losses on Investment in Construction Work in Progress," Public Utilities Fortnightly (September 14, 1978), p. 22-29.

[37]Ibid, p. 23.

[38]Johnny R. Johnson, "The Allowance for Funds Used During Construction: Market Reaction to Current Accounting Practice," unpublished dissertation, Virginia Polytechnic Institute and State University, 1976, pp. 45-50. This mathematical treatment of the differences between method I and method II is first developed here.

CHAPTER 2

DEFENSES AND CRITICISMS OF ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION

This chapter reviews and discusses the major defenses and criticisms of AFUDC as these have been presented in the financial literature. First, an examination of the principal defenses given for the practice of AFUDC, with the emphasis placed on the validity of these arguments. The counter arguments and criticisms of this practice are then reviewed. It should be noted that these arguments are not necessarily the views of the author. The discussion is merely an attempt at delineating the pros and cons of this controversial topic. Finally, the chapter concludes with a presentation of "other utility income," that is, depreciation and deferred taxes. AFUDC is compared to depreciation and deferred taxes in terms of the timing and amount of their respective cash flows.

2.1 Defenses

2.1.1 Matching. The matching concept as defined in accounting theory is frequently given as a defense for AFUDC.

Matching implies that any costs associated with an asset must be matched with the revenues that asset produces for a correct determination of income in that period. Eldon Hendriksen gives a succinct summary of this idea.

> When costs can be reasonably associated with revenue, they should be charged to expense in this same period in which the related revenue is recognized. . . .When costs can be reasonably associated with specific revenue of a future period. . .they should be carried forward as deferred charges and matched with the related revenue when it is recognized.[1]

Defenders of AFUDC argue that the capital costs, both debt and equity costs, associated with the construction of a new plant are no different than the costs of labor and materials. Proper accounting then requires these costs be capitalized, that is, added to the costs of that asset, and expensed through additional depreciation charges when the plant is complete, that is, when it starts producing revenues. They conclude, this results in the proper matching of all costs associated with the construction of this asset and the revenues produced by this asset.[2] Defenders of this argument present a two case scenario much like the following. In the first case, the plant is purchased complete from an outside contractor. The alternative scenario is construction of the plant by the utility. It seems illogical to conclude that the cost of the plant should be different depending on how it is acquired. Surely the contractor would include his capital costs during the construction period as part of the price of the plant. Therefore, it is appropriate for the utility to capitalize their capital costs and thereby add these costs to the price (asset value) of the plant.

These capital costs consist of both the explicit costs of debt and the implicit costs of equity. Proponents of this argument go to great lengths to justify equity costs as "true" costs of construction. Yet, no justification is really needed. Financial theory indicates there is no difference between these two costs. Equity owners have just as much right to a fair return as debt holders. The opportunity cost foregone by equity holders is as valid as any cash outlay, therefore these equity costs should be capitalized just like the interest costs on debt. In fact, the Federal Energy Regulatory Commission advocates the separation of these components on the income statement. Prior to 1977, the capital costs were not separated into the two components of debt and equity. But, starting in the 1977 annual reports, the Federal Energy Regulatory Commission by Order No. 561 mandated that AFUDC should appear as two entries. One entry reflects the AFUDC provided by debt funds, while the other entry reflects the AFUDC provided by equity funds.

Nevertheless, even though financial theory considers equity costs a legitimate cost, proponents of the matching concept for AFUDC still go to great lengths to justify these costs, and by this justification conclude the matching argument is then true. Defenders argue that the cost due to the equity investment in the plant under construction is more important in the utility industry.

"This equity component of AFUDC applies only to regulated industries, for its creation is properly allowed by utility commissions and cannot be recorded justifiably by managements of industrial companies."[3]

This argument is based on the fact that for nonregulated companies, stockholders could forego a return on the investment in the plant during this period of construction because of the possibility of larger returns in future periods, thereby compensating investors for the lost return in the construction period. Since electric utilities are regulated there is no possibility of abnormal returns, profits above those allowed by the commission, in future periods. Therefore, the opportunity cost foregone on equity funds is a true cost just like any cash outlay. It should then be capitalized.

One author argues that these equity costs represent a created asset, which is included in the rate base, thereby earning the company a rate of return or cash inflow. By adding these capitalized equity funds to the asset value, the asset value increases, and therefore, increases the depreciation charges, which result in a cash inflow recouped through "cost of service expenses." He argues it is a claim on cash similar in nature to accounts receivable.[4]

In summary, this defense relies on the concept of matching as presented in accounting theory and on the justification of equity costs as real costs, in fact more real than in the non-regulated sector. The criticisms of this view are now presented.

The matching argument does seem to be deficient in a number of areas. First, this author fails to understand how the justification of equity costs make the matching argument true. Financial theory indicates the opportunity costs foregone on equity funds are a very real cost in both the regulated and non-regulated sectors. Arguing that these costs are more real in one sector appears to contradict financial theory. Therefore, justification of the matching argument based on this concept is apparently erroneous.

Second, the allowance for funds on equity is not truly similar to accounts receivables. Earnings and therefore cash flows for accounts receivables are not recognized and reported, until those earnings are actually realized. In contrast, allowance for equity funds results in earnings reported on the income statement long before actual realization. There appears to be a substantial difference in the risk between these two assets due to the time factor. The time from realization of income to accounting for the asset value in the case of accounts receivable is less than one year. The allowance for equity funds may have a time lag of ten years or longer, depending on the length of the construction period. It seems tenuous to make the analogy between accounts receivables and the allowance on equity funds since there is a real difference in the time between reporting earnings and realizing cash flows.

The next two deficiencies relate to the allowance for funds in total, not just to the equity component. One problem is the fact that the allowance for funds does not result from the systematic allocation of interest, preferred dividends and return on common equity. This concept of the capitalization rate is discussed further in Chapter Two in the section "Determination of Capitalization Rates." The crucial point needed for the discussion here, is that the rate used to compute the allowance for funds is not the average or marginal cost of capital. The rate used is determined arbitrarily and only by accident would the rate used equal the average cost of capital.

The second problem is that the capitalization of an allowance for funds will not result in the same cost of plant that would occur if an outside contractor had built the plant. The rate of return on any asset should be commensurate with the risk of that asset. Therefore, the asset risk should not be affected by who builds the plant, the cost should be the same for both the contractor and the utility. Practical considerations of the regulatory climate make this application of matching the required return with the risk of the asset virtually impossible.

The utilities use an "embedded" cost of capital. The utilities' calculation of the cost of capital is based on an average of all outstanding debt issues. This is more properly identified as an average cost of capital, not a marginal cost of capital. Secondly, the allowance rate, which is used to capitalize these debt and equity costs for the construction project, is not equivalent to the average cost of capital. The allowance rate is set lower than the average cost of capital. Therefore, the construction firm could use the marginal cost of capital, the average cost of capital or some other rate, adjusted for the risk of the project, but it is unlikely that the rate the contractor chooses is the same as the allowance rate the utility uses. It appears the statement, "the costs should be the same whether the plant is built by an outside contractor or by the utility itself," is apparently unrealistic.

2.1.2 Separation Argument. This defense is based on the premise that the construction and operating activities should be separated. Earnings per share for any utility should be the same during the construction period as they would have been if there had been no construction program. An illustration shown in Figure 9 is presented on the following pages.[5]

Defenders of this approach argue the construction program should not affect earnings per share. This is exactly what is achieved by recording the allowance for funds, if the allowance rate equals the firm's cost of capital. An examination of the illustration reveals company B's earnings per share drop relative to company A's and company C's EPS remains the same as company A's given the same construction program. The only difference between company B and company C is that company C includes an allowance for funds when calculating their earnings per share. Company D is the last case presented. In this case the earnings per share are not equal to company A's because the allowance rate is not equal to the marginal cost of capital. One can see a substantial difference in EPS does result from using an allowance rate less than the cost of capital for the utility.

The separation argument seems to be deficient in at least two respects. The argument is based on the fact that net income should not be allowed to fluctuate due to construction activities. In other words, net income should be shielded from any effects the construction program might have on net income. Today, construction activities are an integral part of most utilities operations. To defend a procedure that results in a net income figure, which is independent of a significant economic event occurring during some period, it not only illogical, but also does not agree with generally accepted accounting principles. This is a particularly important point given the nature and activism of some consumers towards nuclear power plants. By no means is a utility assured of completing

Figure 9

The Separation Argument for Allowance for Funds

Assumptions

1. Three companies A, B, and C are identical except A has no construction program but B and C do.

2. C capitalizes an allowance for funds used during construction at the marginal cost of capital but B does not.

3. At the end of 1 year, A purchases a plant identical to the completed construction owned by B and C.

4. Company D capitalizes the allowance at 8%, a rate less than the marginal cost of capital.

5. All companies began the year with the following capital structure:

	Book Amounts	Weights
Bonds - 8%	27,500	.55
Preferred Stock - 8%	5,000	.10
Common Stock - $10 par	17,500	.35

6. The new construction of $10,000 is financed as follows:

Bonds - 10%	5,500
Preferred Stock - 10%	1,000
Common Stock - $10 par	3,500

7. Cost of new equity is 17.85%.

8. Tax rate is 50%.

*Marginal cost of capital:

Source	After Tax Cost	x Weight	= Component Cost
Bonds	.05	.55	.0275
Preferred Stock	.10	.10	.0100
Common Stock	.1785	.35	.0625
			.1000
			or 10%

Figure 9 (cont'd)

	A	B	C	D
Revenues	20,000	20,000	20,000	20,000
Cost of service expenses (excluding taxes)	10,000	10,000	10,000	10,000
Taxes	3,900	3,625	3,625	3,625
Operating income	6,100	6,375	6,375	6,375
Interest	2,220	2,750	2,750	2,750
Preferred dividends	400	500	500	500
Income available before allowance	3,500	3,125	3,125	3,125
Allowance for funds	--	--	1,000	800
Net income available to common stockholders	3,500	3,125	4,125	3,925
Earnings per share	2.00	1.47	1.97	1.87

The decrease in EPS under Case C was due to the increase in the cost of debt and preferred stock compared to previous years. If these capital costs were to remain the same the EPS under Case C would equal Case A.

*It should be noted that for purposes of illustration the marginal cost of capital is used here. The author realizes that this method is not employed by utilities. Utilities use what is more properly called an average or embedded cost of capital. The embedded cost of capital employs the use of previous debt issues in the calculation of the cost of capital. Again it is beyond the scope of this study to decide the correct method of calculation.

the nuclear power plant. Witness the trouble the Consumers Power Company of Michigan has had with its Midland nuclear plant. Even if the plant is completed, there is no assurance that it will operate for the intended time period for which it has been designed. Therefore, a false sense of security may be given to investors by showing earnings as if there was no construction program and no attendant difficulties with the future operation of that power plant.

Second, the argument does not result in the correct statement of earnings per share unless the allowance rate is equal to the marginal cost of capital. As discussed above, this is a false assumption. Therefore, the separation argument is not valid on the assumption that it properly shields net income from the construction activities of that period. This procedure does not result in the separation, which is claimed by its followers unless the allowance rate is equivalent to the marginal cost of capital.

2.1.3 Valid Asset Argument. This argument is based on the concepts developed in the accounting literature. "Assets represent service potentials or rights to prospective benefits."[6] When the allowance for funds is created and added to the asset account, it becomes indistinguishable from previous amounts in this asset account. Therefore, this amount attributed to AFUDC gives rise to future benefits in the form of revenues the utility will earn, as a function of the rate of return allowed on the expanded rate base. Hence, the allowance for funds is a valid asset. Litke states:

> Income generated from the capitalization of an allowance for funds used during construction is valid income because it will become part of the assets of the utility on which they will be entitled to earn a return and which will be recovered through depreciation expense in their cost of service over the service life of the property. Accordingly, the allowance capitalized represents a valid asset and the derivative is equally valid.[7]

David Kosh states:

> Any investment (capital costs of construction) made in a utility or for that matter in any other business must wait for its return in the future. The only difference is that as concerns AFUDC there is a short lag before any returns can be anticipated; the lag being the duration of the construction period.[8]

There is no major criticism of this argument. In fact, it is the only valid defense for AFUDC. But, there are some minor points of clarification. First, the time lag for AFUDC is not a short period of time. It frequently can be ten years or longer. The importance of this point was examined further in Chapter One when the present values of the AFUDC cash flows are developed. Second, the argument makes no mention of the validity of this income stream, which will occur in future periods, in comparison with the validity of an income stream, which is derived in the current period, that is a result of a rate of return which is allowed on the rate base. This specific topic will be discussed at length in Chapter One, where the differences between method I and method II and their respective income streams are presented. Briefly, much of the literature on this particular topic contends there is a significant difference between these two income streams. Therefore, even though the valid asset argument appears to have some theoretical support, it suffers from the fact that no distinction is made between the two income streams derived from the different regulatory treatments of AFUDC.

2.1.4 Additional Defenses. There are two minor defenses in addition to the three major arguments previously presented, which can be found in the literature. The first is simply the fact that this practice has been well established for many years and it is in widespread use. One author goes so far as to use the Taiwan Power Company, of the Peoples Republic of China, as an example of its worldwide impact. The author also notes that a few industrial corporations also use this practice.[9] In other words everybody uses it so it must be correct. The second defense relies on the fact that stable earnings should result from this practice even during a construction period.[10] Stable earnings is a goal that many corporations, including those in the competitive environment, strive to achieve. In the utility regulatory climate, stable earnings also have a well developed following. The author does not intend to imply that this idea per se is wrong. Rather, the implication is that, manipulation through use of this questionable accounting practice might be viewed with a somewhat more jaundiced eye by members of the investment community. The first defense clearly appears without serious merit. The defense offered by the stable earnings concept also appears to be somewhat questionable, but perhaps defendable given the regulatory climate towards risk.

2.2 Criticisms

There are three major criticisms of the allowance for funds, the next section will discuss each one.

2.2.1 Manipulation. A serious concern to users of financial statements is the possibility that some of the numbers may be manipulated by management. This could occur simply by changing the allowance rate or the construction work in progress account to which it is applied.[11] Proponents contend this is not a valid point because allowance practices are rigorously examined by the regulatory commissions.[12] Nevertheless, the allowance rate does change quite often. It varies among firms within any one year and it varies from year to year for any one firm. There is not just one model that all commissions use to calculate this allowance rate and the scrutiny of this practice does vary from commission to commission.

It appears that manipulation whether intentionally or unintentionally, as a direct result of the regulatory climate, does occur. For example, a $500,000,000 construction program and a change in the allowance rate from 8% to 8½% adds $2,500,000 to earnings. This is a considerable sum of money that might create some skepticism in the investment community. This is especially true, since as already noted, there is very little theoretical explanation for either 8% or 8½%. Investors might be expected to view this practice with some concern, especially since the allowance rate changes quite often.

2.2.2 Quality of Earnings. This is the most serious and frequent criticism encountered in the literature. Chapter One is devoted to a discussion of this issue. Therefore, the discussion here will be brief. Statements along the following lines are common in the literature on this particular area.

> Today's utility income accounts for the most part are full of what have come to be known as "gimmicks". . .One of the most serious of the gimmicks results from including a credit for interest charges to construction in current earnings.[13]

> Serious question arises as to whether the reported figures really reflect even current, or latest reported, earnings,. . .This results from the fact that earnings as reported include for many, if not most, companies a large bookkeeping item formerly called, "interest during construction.[14]

> The peculiar regulatory accounting concept that interest accruing against a utility during a construction period is an asset rather than an expense, and that the offsetting credit somehow produces income.[15]

There has also been an empirical study where investor attitudes towards the allowance were examined. The conclusion was that allowance earnings are inferior to other earnings. Mitchell and Hutchins surveyed "110 of the largest institutions in the U.S.," they conclude "no one among informed investors believes that AFUDC earnings are the same quality as operating earnings."[16] Again it should be pointed out here that no distinction between method I and method II was discussed when allowance earnings were judged to be inferior to other utility earnings. There are major differences between these two methods in terms of the quality of the earnings that are derived. The concept of quality earnings was discussed previously and Chapter One contains an extended development of this concept.

2.2.3 Unstable Earnings. This criticism is tenuous since it is the counterpoint to stable earnings as a defense. Both the criticism and the defense implies that the income statement should be shielded from a significant economic event of the period. Clearly this is illogical given the purpose of accounting principles. But to give some idea of the concern for this topic in the utility industry, chairman George I. Bloom, of the Pennsylvania Public Utility Commission makes this point.

> The bad thing about the IDC contribution to net is that it is unstable. During the course of construction of a new generating station, the successive quarterly reports of a utility show a large and rapid build-up of the IDC credit on the income statement. Then suddenly, on the day the station is completed and goes into operation, the supply of IDC credits ceases and, barring some other offsetting factor, such as another generating station in the early stages of construction, the reported net per share shows a decline.
>
> A declining net per share tends to lower the price at which the utility can market new common, and this lower price increases the dilution of earnings for the existing shares. Since utility managements are elected

> principally with the votes of the existing common shareholders, they are naturally reluctant to sell new common, and tend to do as much financing as possible through sale of senior securities.[17]

Looking back at Figure 9, critics argue that when the plant is placed in service in Case C or Case D, the plant is unlikely to produce utility income sufficient to offset the loss of $1,000 or $800, respectively, that will no longer be present. Defenders of AFUDC contend this point is irrelevant. Companies A and C will have the same earnings next year. This is exactly what the allowance is designed to do, separate the operations of the firm from the effects of large construction programs. As pointed out earlier, this is illogical given the purpose of generally accepted accounting principles.

2.3 Comparison of AFUDC With Other Income

AFUDC can now be compared to other utility income such as depreciation and deferred taxes. The valid asset argument focuses on the determination of future cash flows. It is then necessary to compare the cash flows associated with AFUDC and the cash flows associated with depreciation and deferred taxes to see if they are the same or different. If they are dissimilar then of course another criticism would have justification. Any income figure can be converted to cash provided by operations with this simple equation: cash flow provided by operations = net income reported $\pm$ noncash items recognized in computing net income. There are many noncash items recognized in computing utility income. However, if the term cash flow is expanded to near cash flow (to include receivables and payables) the principal adjustments are for depreciation and deferred taxes. Then for all practical purposes the equation becomes: cash flow provided by operations = utility income reported + depreciation + deferred taxes.

2.3.1 Depreciation. In a public utility the depreciation charges are considered a cost of service expense whereby the future rate base is reduced and therefore the future cash flows will be reduced. But, the cash flows which result in this period are exactly equal to the present value of the future cash flows which are foregone by taking the depreciation in this period.

For example, let D be the current depreciation expense. If depreciation is not taken this period the rate base would not be reduced by an amount equal to D. Furthermore, if D remains in the rate base until some future period N, D will produce return in each period of r where r is the rate of return allowed by the commission. The future value at any period N of D and the returns on D is then, $D\,(1 + r)^N$. Discounting this to the present we simply divide by $(1 + r)^N$ which leaves us with D. Therefore, the income reported in the period and the income actually earned will be the same. There should be no differences in determining the value of utility income since the cash flows are equal to recorded depreciation.

The same formulation can be given to AFUDC up to a certain point. A number of people argue that AFUDC and depreciation are the same in terms of the cash flows actually earned by the firm. In Chapter One a detailed discussion of AFUDC earnings is given, with the relation of AFUDC earnings to cash flow. A brief overview will give some idea of the basic difference between depreciation and AFUDC earnings.

The amount of the allowance that is recorded in the plant accounts at the time the plant is placed in service will produce future cash flows. Let A_1 represent the amount of the allowance in the plant accounts at this time. Then the future value of A_1 is $A_1\ (1 + r)^N$. Discounting this to the beginning time period when the plant is first placed in service, we divide by $(1 + r)^N$ which leaves us with A_1. Up to this point depreciation and AFUDC are the same, but here a crucial divergence occurs. The depreciation D is recorded in the period and the amount D is recovered in the same period through "cost of services expenses." But in the case of AFUDC remember the AFUDC for this plant is recorded as income long before the plant is actually placed in service. Therefore, A_1 must still be discounted by $(1 + r)^n$ where n represents the length of the construction period. Referring to Figures 7 and 8 in Chapter One and the appropriate discussion, one can see that there is a substantial difference between the income reported as AFUDC and the cash flows associated with that income. It would seem that depreciation and AFUDC are similar, but that AFUDC must be discounted by this additional period of time. Thus, AFUDC and depreciation do not contribute to the earnings and cash flows of an electric utility in the same manner.

2.3.2 Deferred Taxes.[18] This discussion centers on deferred taxes as a component of cash flow for an electric utility. It does not focus on the relationship between AFUDC and deferred taxes. The relationship between AFUDC and deferred taxes is treated in Chapter One. There are two procedures followed by utilities in the treatment of deferred taxes. A number of commissions requires that the credit be deducted from the rate base.[19] In this case the present value of the future benefit foregone is the current cash received. In algebraic terms, let T represent current deferred taxes, r the rate of return allowed on the rate base and P the future tax payment to be made. If T is not recognized now, then the rate base will be higher by this amount until some period n when P is made. The future value of not recognizing T is the return foregone each year (T x r) plus P in year n. Assuming the tax rate is constant, P equals T, and the future value is then $T\ (1 + r)^N$. Discounting this back to the present (dividing by $(1 + r)^N$ we get just T.

The second procedure requires that the deferred tax credit be treated as a cost-free source of capital.[20] An illustration follows, assume the following definitions:

T = amount of the deferred tax credit

R = rate base under the first procedure

$R + T$ = rate base under the second procedure

r = rate of return allowed under the first procedure

$(\frac{R}{R+T})r$ = rate of return under the second procedure

Under this second procedure you can see the return foregone is the lower return represented by $(\frac{R}{R+T})r$, (this is less than Rr) times the higher rate base represented by (R+T). The rate base is higher because of the absence of the deduction for the tax payment made in period n.

The stream of payments in each future year is given by:

$$(\frac{R}{R+T})r \times (R+T) = Rr$$

Rr is exactly the same stream of payments which accrues to the firm as in the first procedure above. Therefore, the two procedures offer identical treatments of the future returns to utilities.

The determination of cash flows which occurs in any year because the firm recognizes depreciation and deferred taxes is different from AFUDC in the determination of other utility income. The cash flows from depreciation and deferred taxes does not increase or decrease the value of the firm beyond the income reported because the cash flows received are at the expense of foregoing future cash flows which have a present value equal to the current benefit received. In other words, the income reported is equal to the present value of the inflows of cash from both depreciation and deferred taxes. As discussed in previous paragraphs this is not the case for AFUDC. The cash inflow from AFUDC is less than the income reported. Therefore, in the determination of cash flow accruing to a utility, depreciation and deferred taxes are quite different from AFUDC.

2.4 Summary

This chapter presents the principal criticisms and defenses of AFUDC. The defenses were shown to be somewhat lacking in the theoretical support. The only defense with any merit is the valid asset argument, but this was also shown to be questionable since no distinction is made between method I and method II income streams. The criticisms of AFUDC center on the quality, stability and manipulation of these earnings. The investment community's reservations regarding these earnings was also presented. Finally, a short discussion of two components of other utility income, depreciation and deferred taxes, and their similarities and differences to AFUDC was developed.

Footnotes

[1]Eldon Hendriksen, Accounting Theory (Richard D. Irwin, Inc.), Homewood, Illinois, Third Edition, 1977.

[2]Everett L. Morris, "Construction of Interest on Construction: Time for Reappraisal," Public Utilities Fortnightly (March 4, 1971), p. 23.

[3]Robert E. Frazer and Richard C. Ranson, "Is Interest During Construction 'Funny Money'?" Public Utilities Fortnightly (December 21, 1972), p. 21.

[4]Frazer and Ranson, "Funny Money," p. 20.

[5]This example is similar to the illustration in Robert Frazer and Richard Ranson, "Is Interest During Construction Funny Money?" Public Utilities Fortnightly (December 21, 1972), p. 21. Also Johnny R. Johnson dissertation.

[6]Eldon Hendriksen, p. 257.

[7]Arthur L. Litke, "Allowance for Funds Used During Construction," Public Utilities Fortnightly (September 28, 1972), p. 20.

[8]David Kosh, "Interest During Construction Renamed Allowance for Funds Used During Construction," Regulatory Commission Development Short Course, Michigan State University, 1974.

[9]Frazer and Ranson, p. 23.

[10]Pomerantz and Suelflow, p. 119.

[11]Morris, "Time for Reappraisal," p. 21.

[12]Ibid.

[13]Frazer and Ranson, Ibid., p. 21.

[14]Charles Tatham, "Interest During Construction and Price-Earnings Ratios," p. 33.

[15]George I. Bloom, Chairman of the Pennsylvania Public Utility Commission, speech before New York Society of Security Analysts or quoted in Public Utilities Fortnightly, September 28, 1972, p. 37.

[16]Charles A. Benore, "Accounting Procedures and Standards Related to Capital Formation in the Electric Power Industry and the Differences in Earnings Quality Among Major Electric Power Companies," paper presented to the NARUC staff Subcommittee at Washington, D.C. on September 10, 1975.

[17]George I. Bloom, Interest During Construction Evaluated," Public Utilities Fortnightly (September 28, 1972), p. 37.

[18]The algebraic formulation of deferred taxes and depreciation was developed in Johnny R. Johnson dissertation.

[19]National Association of Regulatory Utility Commissioners, 1974, Annual Report on Utility and Carrie Regulation (Washington: National Association of Regulatory Utility Commissions, 1976), p. 396.

[20]Ibid.

CHAPTER 3

LITERATURE REVIEW

This chapter will review the financial literature pertaining to empirical tests of AFUDC. Previous empirical tests have focused on differences in total market valuation. In this context, differences in market valuation have been empirically tested, using three widely followed financial ratios; price earnings ratio, market-to-book ratio, and interest coverage ratio. This chapter will discuss the effect AFUDC might have on each of these ratios and the empirical work in each area. Additional empirical work on AFUDC will also be reviewed.

3.1 Price Earnings Ratio

The first area of interest is empirical tests using price-earnings ratios (hereafter P/E). P/E ratios are widely published and followed by investors as some indication of relative earnings quality and future growth prospects for earnings. From the security analyst's point of view, serious questions have been raised about the validity of a utility's earnings when they contain a large component attributed to AFUDC. They view this as having a deleterious effect on P/E ratios. Common stock valuation is a complicated and controversial topic. For purposes of this discussion we will assume most financial analysts use some method of capitalization of earnings for common stock valuation. This entails some problems; earnings must first be adequately defined and measured.

The security analyst is more concerned with earnings that represent cash flow, therefore he would be more concerned with the so called "revenues minus expenses concept." Irving Fisher eloquently outlines this position. He points out that "no concept of income, which includes appreciation or depreciation in capital value as a positive or negative item of income, is acceptable as a basis of valuation under the "capitalized income" method. The only concept, which is strictly valid for this purpose is the "flow-of-services" concept, of which the "cash receipts-minus-cash-disbursements" concept is a modified version."[1] "Under such a definition of income, no account is taken of the increase or decrease in the capital value of the property from which the income is derived. Hence no vicious-circle fallacy is involved in the assumption that the present value of the property is the discounted value of the anticipated flow of services. On the other hand, the increased net-worth concept of income is clearly disqualified."[2] . "In other words, if income is used as the basis of capital value, we cannot include in income an amount which itself represents an enhancement in capital value. This would obviously be double counting."[3]

The previous discussion implies AFUDC does not meet the revenues minus expenses concept of earnings. Therefore, AFUDC would be expected to have some effect on the P/E ratios of electric utilities. For example, using Standard and Poor's 40 utilities for comparison purposes only and the average AFUDC percentage calculated from the compustat tapes in 1976 gives some idea of the discrepancy that might occur. When AFUDC is included in earnings the P/E ratio is 6.44, but if AFUDC is substracted from earnings the P/E ratio becomes 8.25.

Which multiple is correct? It depends on who is calculating the ratio and their attitude towards AFUDC. A problem arises in that the P/E ratio could change substantially if the amount of AFUDC changed, even though earnings from operation remain unchanged. The historical pattern of P/E ratios and future estimates of the P/E ratio would be distorted because AFUDC can change drastically from year to year, depending on a number of both internal and external factors.

A number of researchers (Severiens, Stich, Tatham) have examined the effect of AFUDC on P/E ratios. Severiens further develops the concept of why P/E ratios might be effected by AFUDC.[4] The growth in earnings is an important variable that investors attempt to assess in determining stock prices. Malkiel and Cragg's study noted that expectations of changes in the normal trend of growth in earnings per share have been the principal reason for price-earnings differences during most of the postwar period.[5] Perhaps a more important variable in electric utilities is increases in dividends. Due to regulation and the reputation of quality stocks as income stocks with high dividend yields, the dividend factor should be of serious concern to investors. Since AFUDC is a non-cash item, which is added to income, it does not enhance the ability of utilities to pay increased dividends in the immediate future. Another factor is that the growth rates in earnings can also be irratic due to the uncertain nature of AFUDC earnings. These two arguments are presented to provide some theoretical basis for why increasing amounts of AFUDC might have a negative association with price-earnings multiples.

Severiens studied 12 electric utilities using linear regressions, where the change in P/E ratio is regressed against a number of factors. He found the most significant variable to be AFUDC, both in individual firm regression and in the combined regression of all firms. He states, "the sign is negative suggesting that the market discounts its effect on earnings."[6] Stated differently, the market valuation of a firm as represented by the P/E ratio declines with increasing amounts of AFUDC.

Tatham and Stich both present theoretical arguments similar to the above argument. Tatham makes the point that since the portion of AFUDC as a percentage of income has increased substantially from 1965 to 1975, the P/E ratios based on reported earnings are not the same. "We can hardly use historic averages as a guide to what an appropriate price-times-reported earnings should be today."[7] If the utility analyst chooses to capitalize reported earnings, with their large and fluctuating AFUDC component, he has no historic guide as to what price-earnings multiple might be appropriate. But, the analyst also might be very hesitant to conclude that the proper earnings figure to use would entirely exclude AFUDC. AFUDC is a current recording of future earnings, which should be recouped, at least to a certain extent at a later date. Therefore, when using P/E ratios as guides to stock values the portion of AFUDC should have an important impact on this ratio. The implications, from the work of Severiens, Tatham and Stich, are that as the percentage of AFUDC increased the P/E ratios of electric utilities declined.

Johnson in an unpublished dissertation did a more comprehensive study of AFUDC and P/E ratios. Unlike the previous studies, Johnson focused on the differences in P/E ratios between method I and method II firms. As stated previously, these two methods are two different regulatory treatments of AFUDC. Beaver and Morse attribute at least some of the differences in P/E ratios to be different accounting methods.[8] A serious problem arises in that it would prove difficult to isolate and quantify the effect AFUDC might have on the P/E ratios. A number of confounding variables could effect the statistical nature of any test done on P/E ratios. Confounding variables are variables that might affect the test, in this case, differences in P/E ratios, but aren't under control in the design. Numerous factors effect the market valuation of a firm as represented by its P/E ratio other than the amount of AFUDC. This is not to cast doubt on the previous arguments on why P/E ratios might be effected by AFUDC, but to suggest that better statistical techniques might be used to ascertain the real influence of AFUDC.

Nevertheless, Johnson examined this question of AFUDC as an accounting difference and the effect on P/E ratios for a sample of 45 method I and 9 method II companies for the period 1965-1974. His hypothesis was concerned with the earnings/price ratio which is the inverse of the P/E ratio. Johnson hypothesized that method II companies would not be effected by AFUDC since CWIP is included in the rate base and the value of the firm due to the allowance is equal to the amount of the allowance income that is reported. In this case the accounting entry accurately reflects the cash flow the firm receives. Method I firms do not include the CWIP in the rate base, consequently any AFUDC recognized as income has no immediate cash flow implications. It is only an accounting entry, the firm does not receive any cash from the transaction. Therefore, the market should react to these two methods in different ways. The Wilcoxon Rank Sum Test, which is a non-parametric test, was used. His conclusion was that the average price earnings ratio for method I firms was lower than the price earnings ratio for method II firms. The statistical significance or differences between the P/E ratios of method I and method II firms was found at the .0749 level.[9] Since this is one of the very few empirical tests performed on the differences between method I and method II firms, a detailed discussion of the non-parametric tests and a replication of Johnson's tests on P/E ratio and market-to-book ratios with more current data is provided in an appendix to Chapter Three.

3.2 Market-to-Book Ratio

Another ratio of particular interest to the utility industry is the market-to-book ratio. Both the P/E ratio and the market-to-book ratio are surrogates of investment risk to the common equity. These ratios have suffered a marked decline as compared to the industrial averages in the last fifteen years. The downward trend in the market-to-book ratio is outlined in Table 3.[10] The table shows that the ratio for utilities is not much different from the industrials until 1966. After this date the utility ratios suffer a continuous decline up through 1974. Whereas, in 1966 utility stocks were priced comparably

Table 3

A Comparison of Market Value to Book Value Ratios Between Industrials and Utilities for the Years 1960-1974

Year	Moody's 125 Industrials	Moody's 24 Utilities
1960	1.99	1.77
1961	2.21	2.20
1962	2.03	2.11
1963	2.22	2.27
1964	2.48	2.28
1965	2.55	2.35
1966	2.25	2.00
1967	2.33	1.90
1968	2.41	1.74
1969	2.24	1.60
1970	1.85	1.27
1971	2.09	1.29
1972	2.26	1.17
1973	2.07	1.00
1974	1.42	.67

Source: Robert S. Stich, "An Additional Standard for Measuring Common Equity Costs," Public Utilities Fortnightly, February 26, 1976, p. 36.

to industrials, in 1974 they sold for less than half on a book value basis. Obviously, this is of serious concern to public utility officials and investors since any new common stock that is sold must be sold below book value. This might lead to dilution of the common equity and therefore, the determent of current stockholders.

An examination of Table 4, which contains the P/E ratios through 1977, reinforces this observation of a declining trend in the market valuation of electric utilities. The P/E ratios and the market-to-book ratios for utilities were comparable to the industrials until 1966, at which time they started on a downward slide which continued through the 1970's.

The market-to-book ratio can be likened to the P/E ratio, in that it is also thought of as some measure of investor confidence in the utility's future earnings capabilities. It is also argued that not just earnings, but "real" earnings are the key to this ratio.[11] As already stated, this ratio has suffered a serious decline since 1965. In one study, 80 electric utilities were divided into deciles by market-to-book ratios in 1965 and then compared in 1974. This ratio declined from 192.0% to 68.8% for the 1st decile and from 377.3% to 106.4% for the 10th decile. Clearly the market has reacted to declining real earnings of utilities with increased skepticism, to the point where the majority of utilities are selling at prices below book value. This

Table 4

A Comparison of P/E Ratios Between Industrials and Utilities for the Years 1960-1977

Year	400 Industrials	130 Electric Utilities
1960	18.14	18.6
1961	22.47	23.4
1962	17.05	20.3
1963	18.69	20.3
1964	18.55	21.4
1965	17.87	19.5
1966	14.47	16.7
1967	18.57	14.6
1968	18.38	15.7
1969	16.45	12.1
1970	18.58	12.8
1971	18.72	12.2
1972	19.31	11.6
1973	12.32	8.9
1974	7.89	6.7
1975	11.80	8.4
1976	11.19	8.9
1977	9.01	8.4

Source: Computed by the author from Compustat data and Standard and Poors Statistical References Guide.

does not bode well for the electric utilities' future ability to raise capital. Electric utilities will need to raise massive amounts of capital for large construction programs in the future. As one author states, "it will be difficult enough for the healthiest of firms; trying to compete for this limited resource requires that utilities regain the interest of the investment community, and the only way they can do this is by improving their earnings."[13]

There have been a number of reasons given for the decline in this ratio. The principal factors are inflation, regulatory lag, and as a number of authors suggest, the increased use of AFUDC (lower quality earnings). The focus of this argument is the concept of real earnings and future earnings prospects. AFUDC as already explained can effect the earnings of the utility. It is not surprising to see AFUDC come under scrutiny as the cause of the decline in the market-to-book ratio.

The market-to-book ratio was examined by a number of researchers, (Burkhardt and Viren, Hyman, Marx, Fitzpatrick and Statzel, Johnson, among others). Conflicting statistical conclusions are the product of this research. This could be due to differences in the statistical design and multicollinearity among the variables tested in that specific design. The following is a brief review of each of these tests.

Hyman first examined 24 of the largest electric utilities in the period 1967-72 using multiple regression.[14] A regression with total return as the dependent variable and a number of variables including return on equity, change in return on equity, payout ratio, a quality index represented by the percentage amount of AFUDC, growth in equity and market-to-book ratio, among others as the independent variables were used to examine what might cause differences in total return. He concludes, "Quality of earnings does seem to have some effect on the market action of the stocks. . . .Perhaps, then, there will have to be some de-emphasis on earnings per share, and more attention paid to how these earnings are generated if they are to benefit the stockholder."[15] In a similar study, the dependent variable was the market-to-book ratio and the independent variables included the payout ratio, percentage of AFUDC, coverage ratio and return on equity. Hyman[16] found the return on equity to be the most statistically significant of the variables tested, with the coverage ratio also being significant. He concluded that the effect of AFUDC was already included in the coverage ratio. The implications of these studies are tentative at best due to the small sample size, limited time period and multicollinearity among the variables. Multicollinearity refers to the fact that one or more independent variables in the regression equation are correlated with each other. Any statistical significance attached to any of these variables may then be misstated.

Burkhardt and Viren[17] studied 95 electric utilities but only used 1976 as the test period. They examined a large number of independent variables and the effect on the market-to-book value. Among the independent variables were earnings growth in EPS, bond rating, regulatory ranking, cash dividend payment and AFUDC. They found that AFUDC was not significant, but growth rate in EPS, the rating of the company's bonds and the coverage of the firm's cash dividend payment was significant. AFUDC would affect all three of the variables here and due to multicollinearity any conclusions about AFUDC are suspect.

Fitzpatrick and Stitzel[18] used data from 1969-1975 and the 90 utilities on the Value Line data base. The independent variables included AFUDC, risk measures (Beta), profitability ratios (for example return on equity) and cash flow measures. They found AFUDC statistically significant only for years 1972-75. "These results suggest that as AFUDC as a percent of net income increases, more and more concerned attention is focused on the AFUDC issue by the investment community. This concern is evidently being reflected in a measurable reduction in market-to-book valuations."[19] These results suffer from the same statistical problems, as mentioned above.

Finally, Johnson examined the differences in market-to-book ratio for method I and method II firms. He ranked companies according to their market price per share compared to book value per share. They by using the Wilcoxon Rank Sum test he was able to test whether the ranking of firms according to market-to-book ratio was actually different for method I and method II firms. Johnson found the method I firms' market-to-book ratio was statistically different from method II firms at the significance level of .1230.[20]

It appears then, that there is no conclusive evidence to support the hypothesis that AFUDC is a different quality earnings and therefore this should be reflected in the market-to-book ratio. This is due as much to the problems of statistical design as to the results of the studies mentioned here. Johnson's study appears to be the best designed study since the others suffer from problems already mentioned.

Nevertheless, Johnson's study is also deficient in a number of areas that the research by this author will try to eliminate; (1) the test of differences in the market-to-book ratio was significant at only the .1230 level. This might be economically insignificant at such a high level of significance. The implication here is that even though there is statistical significance the differences in economic values upon which this study is based may be so minor as to render any economic policy decisions useless. In fact, looking at the original data of market-to-book ratios, one finds it takes very little change in the ratio to substantially change the ranking. For example, a change in the ratio from 1.31 to 1.41 changed the ranking from 13 to 21. Since there was only 9 firms in the method II grouping, but 45 firms in the method I grouping, any slight change in the ratio due to some other factor besides AFUDC could bias the results. (2) The time period for the study ended in 1974. Even though the upward trend in AFUDC started in 1966, AFUDC accounted for only 13.3% of net income on average as late as 1970 (Table 1). The large jumps in the period 1972-1974 might have effected the market differently and therefore the statistical nature of the tests. (3) Dividing the companies into method I and method II would add a substantial risk of confounding variables due to the regulatory climate. If the commissions approved method II, where CWIP is included in the rate base, perhaps they might be more lenient in other matters such as rate increases. The question then arises whether the market reacted differently to the method of accounting for AFUDC or to differences in regulatory climate. Surely these two aspects must be strongly correlated. This is then a crucial problem which will be eliminated in the research undertaken here, by equating the two groups of firms according to their relative market risk as reflected in their Betas, which should account for any perceived differences in regulatory climate. Any of the above problems may have biased Johnson's results, therefore, the results while not inconclusive, may be suspect.

3.3 Interest Coverage Ratio

The last financial ratio which has been hypothesized as being affected by AFUDC is the interest coverage ratio. Here AFUDC poses an obvious problem since AFUDC is in theory an offset to interest expense. Prior to 1970 AFUDC was shown as a deduction from interest expense, then for a time it appeared under the section "Other Income" but now it is divided between both these sections of the income statement. The component attributed to debt funds is shown as an offset to interest and the component attributed to equity funds is shown as other income. "To the security analyst this is an interesting aspect of the matter, for he finds that, by shuffling the items on the income account a portion of the interest deduction is turned into income and used to demonstrate its own margin of protection. It is conceivable that a bond buyer might view this a bit darkly."[21]

The fixed charge coverage ratio represents the relationship between earnings available to pay interest charges and the total amount of fixed interest charges. AFUDC can effect this ratio depending on whether the interest charges are reduced (denominator) or the earnings are reduced (numerator). There seems to be no consistent or uniform method for calculating the coverage ratios for utilities. Even though there is one appropriate method for SEC reporting requirements, the conclusions analysts draw from these numbers may be quire different. "Some analysts completely exclude the AFUDC credit; others include it as a part of the earnings available for interest; a third group deducts it from the total interest change."[22] This would create substantial differences in the ratio calculated. In the case of the Consumers Power Company, for example, total interest charges for 1977 amounted to $131,388,000; total AFUDC was 54,211,000 and earnings before interest and taxes was $263,733,000. The ratio could be 2.00 times if AFUDC was included in earnings or 1.59 times if not included and finally 3.41 times if AFUDC was deducted from total interest charges.

These are substantial differences which may affect the utilities credit rating and bond ratings. The fixed charge coverage ratio is not the only analytical tool used by the rating agencies in determining the quality of bonds for investment purposes but it is probably the most important.[23] Therefore, the treatment of AFUDC can effect the coverage ratio and the bond ratings for the utility.

Donald W. Johns in research done for the Public Service Commission of Michigan examined the relationship between AFUDC and bond ratings. He examined a sample of 55 utilities taken from the Compustat data base. His test hypothesis was that pretax interest coverage ratios adjusted for AFUDC will predict utility bonds ratings with less error than unadjusted pretax interest coverage ratios. His conclusion was that pretax coverage ratios with AFUDC removed was not statistically different from pretax coverage ratios including AFUDC when used to predict bond ratings. He further states, "no statistical evidence that investors or rating agencies discount AFUDC when determining the cost of debt on bond ratings, respectively, was found to exist in the information examined."[24] This research is the strongest endorsement given here for the conclusion that AFUDC has no effect on market values.

3.4 Other Empirical Tests of AFUDC

The final review to be included in this chapter is another test of differences between method I firms and method II firms performed by Johnson in his dissertation.[25] This test is the most statistically valid test of those reviewed in this chapter. It does provide some valid evidence for differences in total market valuation between these two groups of firms. This design is a two-step process. First, the percentage change in earnings is regressed against the percentage change in stock prices for each of the ten years in this study, 1965-1974. These ten regressions were of the form:

$$P_i = \alpha_i + \beta_i E_i + \varepsilon_i$$

where: P_i = the change in stock price for year i.

E_i = the change in earnings in year i.

ε_i = the residual or error in year i.

Johnson based his design on the premise that the residuals contain all the information not explained by the independent variable, for the observed variation in the dependent variable. Therefore, Johnson's hypothesis was that an allowance factor representing the percentage of AFUDC should be included in a regression model of P_i and E_i. He could test this hypothesis by going to the second step. The second step is a regression of the form:

$$\varepsilon_i = a_i + b_i AFUDC_i + d_i$$

where: ε_i = the residuals from the previous regressions in each year i.

$AFUDC_i$ = the change in the allowance factor for each year i.

The slopes of this regression, represented by b_i, then served as the basis for the statistical tests. Johnson hypothesized, that since method I AFUDC earnings are not the same quality as method II AFUDC earnings, a regression of the change in AFUDC percentage from year to year should have some relationship to residuals for method I firms. But there should exist no such relationship for method II firms. The slopes for both groups of firms are combined and ranked from smallest to largest. Then the sum of the ranks for one of the groups is compared to the expected sum of the ranks for that group using the Wilcoxon Rank Sum test, a non-parametric test. Johnson concluded; there is a statistically significant difference between method I firms and method II firms at a significance level of .033.

This aspect of Johnson's study does seem to provide some valid evidence for differences in market valuation between these two groups of firms. A crucial difference does exist between Johnson's work and the statistical tests that are performed in this study. Johnson concentrated on the total market valuation for individual firms without regard for differences in market risk, which may have biased any regression, where the regression is a change in stock prices on changes in earnings. This research attempts to eliminate any differences in market risk and thereby examine any changes in market valuation which may be due to the disclosure of AFUDC earnings.

In summary, whereas previous empirical work has looked at the total market valuation of firms at some point in time, this research concentrates on the changes in market valuation which may be due to the disclosure of AFUDC earnings. The previous statistical designs have suffered from confounding variables, that is, variables that could effect the total market valuation of firms, but where these variables have not been accounted for in the statistical design. This research makes every attempt to present an unbiased experimental design, whereby all factors effecting the firm are held constant except for the variable under study. This variable is the disclosure of AFUDC earnings. The specific statistical design which is used to accomplish these goals is developed in the next chapter.

Footnotes

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[6]Severiens, p. 31.

[7]Charles Tatham, "Interest During Construction and Price-Earnings Ratios," Public Utilities Fortnightly, September 27, 1973, pp. 32-36.

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[9]Johnny R. Johnson, "The Allowance for Funds Used During Construction: Market Reaction to Current Accounting Practice," unpublished dissertation, Virginia Polytechnic Institute and State University, 1976.

[10]Robert Stich, "An Additional Standard for Measuring Common Equity Costs," Public Utilities Fortnightly, February 26, 1976, pp. 34-39.

[11]Thomas G. Marx, "Market-to-Book Return on Equity Correlation," Public Utilities Fortnightly (December 4, 1975), pp. 28-31.

[12]Ibid.

[13]Robert Stich, p. 39.

[14]Leonard S. Hyman, "Market-to-Book Ratio: Statistical Confirmation or Aberration?" Public Utilities Fortnightly (December 19, 1974), p. 28.

[15]Leonard S. Hyman, "Utility Stocks in 1967-72: A Rale of Woe," Public Utilities Fortnightly, February 28, 1974, pp. 23-28.

[16]Leonard S. Hyman, "Market-to-Book Ratio: Statistical Confirmation or Aberration?" Public Utilities Fortnightly (December 19, 1974).

[17]Daniel A. Burkhardt and Michael A. Viren, "Investor Criteria for Valuing Utility Common Stocks," Public Utilities Fortnightly (July 20, 1978), pp. 27-35.

[18]Dennis B. Fitzpatrick and Thomas E. Stitzel, "Capitalizing on Allowance for Funds Used During Construction: The Impact on Earnings Quality," Public Utilities Fortnightly (January 19, 1978), pp. 18-22.

[19]Ibid., pp. 21-22.

[20]Johnson, p. 89.

[21]George E. Phelps, "That Bothersome Construction Interest Allowance," Public Utilities Fortnightly (January 31, 1974), pp. 21-27.

[22]Pomerantz and Suelflow, Allowance for Funds Used During Construction, p. 138.

[23]Ibid., p. 137.

[24]Donald W. Johns, "Testimony Before Michigan Public Service Commission, Investigating the Effects of AFUDC on Bond Ratings and Interest Coverage."

[25]Johnson, dissertation, pp. 77-82.

CHAPTER 4

METHODOLOGY: THEORETICAL DEVELOPMENT AND EMPIRICAL SUPPORT

This chapter is divided into six sections. A brief summary of the theoretical concepts used here, that is; information content, market efficiency, the capital asset pricing model, and the distribution of security returns comprises the first four sections. The fifth section will integrate these concepts, and discuss their application to the present study. The methodology that is used here, that is; the equivalence of relative risks and the testing of vector means, has been well developed in the literature. Consequently this study will draw heavily on a number of articles by Gonedes and Dopuch, and Gonedes, for notational guidance.[1] The last section details the specific hypotheses to be tested.

4.1 Information Content

As already discussed the purpose of this study is to determine the information content of AFUDC. In other words, does AFUDC provide information that the capital markets use to assess the distribution of future security returns.

An event x can be shown to have information content if the conditional distribution f(R/x) is not equivalent to the unconditional distribution f(r) for any R, where R is some random variable. Of course there must be some reason for believing that x and R are in some way related. If f(R/x) = f(R) then x is ignored in agent's assessment of R. Stated differently, x has no information content which is used to evaluate changes in R.[2]

Accounting variables are random variables that may reflect information about the distributions of future values of firm's securities. The equilibrium prices of a firm's ownership shares are dependent upon assessed distribution functions of the dollar returns per share. These distribution functions are dependent on the available information about the firms operating and financing decisions. This dependency provides the basis for the many available studies on the accounting items that may reflect new information pertinent to establishing a firm's equilibrium values.[3] See, for example, Ball and Brown, Eskew and Wright, and Gonedes.[4]

In the context of this study, an information content can be inferred to an accounting event x by observing the behavior of some random variable R during a period of time when it is thought the accounting event might have some impact on the random variable. The event x being considered here is AFUDC disclosure. The random variable, R is the stock returns of electric utilities, or the firm's equilibrium value.

4.2 Market Efficiency

To be able to assess the impact of accounting events and their disclosures some period must be identified within which any information effects could be expected to be apparent. Much of the evidence supporting market efficiency suggests that stock prices adjust instantaneously to new information once it becomes publicly available. Therefore, one potential time period is the time period immediately following the disclosure of the accounting event, which in this case is AFUDC earnings.

Previous work by a number of researchers has also implied that the information content of some economic events that are reflected in accounting numbers may appear in stock prices a number of months before actual public disclosure.[5]

This could certainly be true of AFUDC. Disclosure of the specific practices concerning AFUDC to the general public is scarce. In fact, the classification of firms into either method I or method II does not exist in the company's annual reports or 10-K reports. The amount of AFUDC is disclosed quarterly and annually. But information as to the practices used to calculate AFUDC is limited to two or three sentences in a footnote to the financial

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statements. Security analysts could be expected to obtain other company documents such as filings with the SEC concerning the issuance of new securities, but an examination of these documents reveals basically the same information as in the annual reports. Nevertheless, security analysts who follow utilities could be expected to have a better understanding of what AFUDC represents than the general public. But as the previous chapters have indicated, there is substantial disagreement even among these professionals.

The security analyst might also be expected to have a forecast of AFUDC in relation to operating earnings sometime before the annual report is released. But it is doubtful whether all these forecasts are correct. If the forecasts are not correct then there is some justification for examining the annual reports and the disclosure of AFUDC for information content.

In fact, the most widely followed investment advisory services such as <u>Value Line</u> and <u>Standard and Poors</u> do not mention AFUDC when discussing earnings or earnings forecasts for utilities. Therefore, since forecasts of AFUDC do exist, and because there are a number of security analysts who follow utilities, there should be some market anticipation to the disclosure of AFUDC earnings. But since forecasts are not always correct and since there is disagreement among analysts, there may also be some market reaction. Whether the anticipation is more important any reactio

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reaction to AFUDC earnings will be examined in the context of this research. The time period for this study is then the period immediately surrounding AFUDC disclosure. The time period was chosen so that any reaction to quarterly reports can also be tested.

An important point about tests of market efficiency is now discussed. A number of studies have relied upon capital market efficiency to measure the relationship between stock prices and accounting events. At the same time, studies, which are designed to measure the relationship between accounting information and market prices, have stated that their evidence supports the hypothesis of market efficiency.[6] This is circular reasoning. Either the research design makes some assumption about market efficiency and tests for the effects of accounting information or it makes some assumptions about accounting information effects and tests for efficiency. It clearly cannot be both. Therefore, the present study will make some assumption of market efficiency and test for the effects of accounting information, which is the magnitude and disclosure of AFUDC earnings.

4.3 Capital Asset Pricing

In order to infer information content to some event x, one must hold all other things constant. In a real world setting this is impossible to achieve, but by using the properties of the two-parameter asses pricing model one can overcome this problem of holding all other things constant, insofar as tests on vectors of mean security returns are concerned. By focusing attention on the values of relative risks, as defined by the two-parameter asset pricing model, one can distinguish among securities of firms with different production-investment and financing decisions. The theoretical connection between relative risk and firms' production-investment and financing decisions is developed in Fama and Miller and Hamada.[7]

Already stated is the fact that the distribution function of security returns is dependent on the firm's operating and financing decisions, which are reflected in accounting numbers. Therefore, if one assumes that all other competing factors of a firm's financing and production-investment decisions have been controlled through use of the two-parameter model and the equivalency of the relative risks, then a statement can be made about the differences between any two distributions and the event under study. That is, if two firm's, which are identical in every respect except for the event under investigation, have differences in the distribution function of security returns, then that difference can be attributed to the information content of the event under investigation.

The capital asset pricing model combined with the efficiency of capital markets provides a well defined framework for assessing the information content of AFUDC. The model used here is the one proposed by Black and tested by Black, Jensen and Scholes and by Fama and MacBeth.

Jensen also provides a detailed summary of the various forms of the CAPM, the tests on each form, and the model's assumptions.[8] These assumptions are also used here.

The two-parameter model implies that the equilibrium expected returns are given by:

$$E(\tilde{R}_t) = E(\tilde{R}_{zt})\underline{L} + [E(\tilde{R}_{mt}) - E(\tilde{R}_{zt})]\underline{B}_t \qquad \text{(Eq 4.1)}$$

where $\tilde{R}_{mt}$ is the rate of return on the market portfolio m; $\underline{L} = (1,1,\ldots,1)^T$, and Nx1 vector; $\underline{B}_t = (B_{1t}, B_{2t},\ldots, B_{nt})^T$, and Nx1 vector; $B_{it} = \text{cov}(\tilde{R}_{it}, \tilde{R}_{mt})/\text{var}(\tilde{R}_{mt})$ is the relative risk of asset i in the market portfolio; and $\tilde{R}_{zt}$ is the rate of return on asset, z, with $B_{zt} = 0$.

The available empirical evidence as summarized in Jensen indicate that the model explains security returns fairly well.[9] The three important conclusions drawn from the literature on this model are: (1) there does seem to be a positive trade-off between risk and return; (2) the relationship between risk and return is approximately linear; (3) only systematic risk as represented by B_{it} effects the average returns from holding some asset i. The conclusions hold where asset i is a portfolio of security returns rather than an individual security since the empirical tests are conducted at the portfolio level. But the theoretical model holds for all single assets and portfolios.

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4.4 Distributional Properties and Security Returns

This study, as in many other studies, assumes that security returns are normally distributed. Fama has shown that security return distributions are members of the symmetric, stable family.[10] The normal distribution is a member of this family with finite means and infinite variances.[11] This family of stable distributions has two properties which make the normal distribution so desirable in portfolio models. First, the stability property of these distributions is critical in ensuring that distributions of portfolio returns are all the same two-parameter type. Second, this family provides a generalization of the central limit theorem, therefore, there is some theoretical justification for the fact that observed return distributions seem to conform well to members of the stable class.[12] Gonedes has shown that this slight departure from normality implies that the return distributions are leptokurtic ("fat tailed").[13] But the departure is not severe enough to invalidate the assumption of normality. This allows us to utilize the widely used and fairly robust statistical tests based on the normality assumption.

Summarizing the above, this study first assumes that the market for stocks is efficient with respect to all publicly traded information (semi-strong form). It also assumes that the two-parameter CAPM adequately explains security returns and that these return distributions are normally distributed. Finally, information or information cont

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content is manifested as the difference between probability distributions of monthly security returns.

4.5 Test Design

The approach used here is similar to the design first developed and formulated by Gonedes. A comparison is made between the total realized returns of two groups of matched firms, which have the same systematic risk as measured by Beta, and therefore the same equilibrium return value.

Let R_{it}, i = 1,2,...,N, be the rate of return on asset i from t-1 to t, where N is the total number of assets. Let $\tilde{\theta}_{it}$ be a random variable conveying new information pertinent to valuing firm i at time t. Also, let $\underline{\tilde{R}}_t$ = $(\tilde{R}_{1t}, \tilde{R}_{2t}, \ldots, R_{Nt})^T$ and $\underline{\theta}_t = (\tilde{\theta}_{1t}\ \tilde{\theta}_{2t}, \ldots, \tilde{\theta}_{Nt})^T$ where the underlined notation refers to vectors, in this case Nxl vectors.

In this study, let $\underline{R}_1/\underline{\theta}_1$ represent the Nxl vector of returns of electric utilities conditional on AFUDC. Here N will vary depending on the specific classification of firms into separate groups based on some aspect of AFUDC disclosure. Let $\underline{R}_2/\underline{\theta}_2$ represent a corresponding vector of returns for control firms conditional on no AFUDC or on a different accounting treatment of AFUDC (method II firms).

If the realization of $\tilde{\theta}_i$ becomes available after capital market equilibrium is established at time t, then Gonedes[14] and Gonedes and Dopuch[15] have shown that the information content of $\tilde{\theta}_i$ can be assessed by comparing the

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distribution function of $\tilde{\underline{R}}_t$ conditional on a value of $\tilde{\underline{\theta}}_i$ to the unconditional distribution function of $\tilde{\underline{R}}_t$. Also, one can compare the distribution functions of $\tilde{\underline{R}}_t$ conditional on different values of $\tilde{\underline{\theta}}_i$. If either of these comparisons indicates that the compared distributions are not equal, then one can infer that $\tilde{\underline{\theta}}_i$ has information content in the same sense that some realizations of $\tilde{\underline{\theta}}_i$ induce probability reassessments.[16]

A basic premise of financial theory is that investors are likely to base their investment decisions on their perceived notion of the expected return and the riskiness of this return distribution. As noted earlier in this chapter, one of the basic conclusions drawn from the empirical tests on the CAPM is that the only relevant risk of a security is the systematic risk represented by B_i. Therefore, if $B_1 = B_2$ then the $E(R_1) = E(R_2)$ because R_m and R_z are constant for all securities i during any period t.

If one assumes that all conditional and unconditional distribution functions are multivariate normal then the inequality of distribution functions can be tested by either testing for the inequality of mean vectors or for the inequality in variances. In formal terms, the inequality $F(\underline{R}_1/\underline{\theta}_1) \neq G(\underline{R}_2/\underline{\theta}_2)$ is implied by $\bar{\underline{R}}_1/\underline{\theta}_1/ \neq \bar{\underline{R}}_2/\underline{\theta}_2$. The inequality of mean vectors is sufficient for concluding there is an inequality of distribution functions. Therefore, one may infer that θ_i has information content if at least one component of the nx1 vector $\bar{R}_1/\Theta_1$ differs from its corresponding component of $\bar{R}_2/\Theta_2$.

The time period for studying the difference in the mean return vectors must be a period when the information variable affects the market behavior of those security returns under study. This study will examine a time period beginning six months before and six months after the disclosure of electric utility earnings in the 10-K report. Earlier, it has been pointed out that this time frame will enable us to study both the market reaction and market anticipation to the disclosure of AFUDC earnings in the annual report and in the quarterly reports. The latest date for public disclosure of the entire annual report as represented by the 10-K report is ninety days after the fiscal year end when it is required by the Security and Exchange Commission (SEC).[17] The annual report to stockholders is issued close to this filing with the SEC. Therefore, it seems reasonable to assume that investors have information concerning AFUDC available to them sometime during the first three months after the fiscal year-end.

Following the practice adopted by Harrison,[18] month 0 was uniformly identified as three months after the fiscal year-end of all the firms in the sample. All firms in this study had fiscal year-ends of December 31. Choosing March as the month of disclosure does not correctly identify the exact month when all investors would be aware of each firms' disclosure of AFUDC, but in a homogeneous group such as electric utilities it would seem to be the average case. Disclosure of AFUDC is minimal and it is only in the 10-K reports that even this minimal disclosure of the specific practices concerning the calculation of AFUDC is commonly available to the average investor. Therefore, letting month 0 equal the third month after fiscal year-end seems to be a reasonable approximation of when the average investor has available information concerning AFUDC. The total time period for testing is the twelve months around the month of disclosure for each of the years 1970-1977. This time period will be broken down into a number of separate sub-periods which are used to test specific questions concerning AFUDC disclosure. T = -6 to T = -1 represents the anticipation period, and T = 0 to T = +6 represents the reaction period. T = -2 to T = +2 and T = -3 to T = +3 represent sub-periods concentrating more closely on the 10-K disclosure date. It was thought that these more closely defined sub-periods would eliminate any noise or events not related to the accounting event being tested.

There is a trade-off involved in the choice of the number of months used for testing. A smaller number of months implies a loss of statistical power, but a larger time period may contain noise which biases the test results. In this case, a number of different sub-periods are used to provide validation for the results. Thus, five individual tests are performed on each set of treatment and contro

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control portfolios. These tests are not independent tests, but they will allow one to examine different time periods.

The key concept is that if the relative risks as represented by Beta are equal, then the $E(R_1/\Theta_1) = E(R_2/\Theta_2)$ if Θ_i contains no information content. In this study the test period is from T = -6 to T = +6 with T = 0 being March of that year. In order to equate $B_1 = B_2$, a sixty month period ending in August (T = -7) of each year from 1970 to 1977 was used. The return generating function can be expected to change over the time period of this study. Therefore, simultaneously twelve months were dropped from the beginning of the Beta estimation period and twelve months were added.

This moving average procedure allows us to recalculate the beta with the most recent sixty months of data. This should eliminate any factors that may not be constant from year to year. Any factor that does change should be impounded in the new beta that was calculated. This will allow a meaningful comparison of stock returns in each year and these stock returns can then be used to test for any information content contained in the event under consideration. This is true since $\tilde{R}_{zt}$ is independent of the two groups of firms (treatment and control), and $B_1 = B_2$ for each of the years examined.

Formation of the actual treatment portfolio based on the information variable, which is AFUDC, is discussed in a later section. But once the portfolios are formed,

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monthly returns are computed on each of the control and treatment portfolios from T = -6 to T = +6. The actual market returns on each of the portfolios are then averaged over the eight years of the study period (1970-1977) for each of the thirteen months. The hypothesis concerns the conditional mean return difference vector $\underline{\bar{d}}/\Theta$, $(\underline{R}_1/\underline{\Theta}_1-\underline{R}_2/\underline{\Theta}_2)$ which is used to estimate the true mean difference vector, $\underline{\mu}_d/\underline{\Theta}$. This mean difference vector, $\underline{\mu}_d/\underline{\Theta}$, represents the difference in average monthly returns between the treatment and control portfolios.

This is a two step process. First, a treatment portfolio is formed each year and the mean return for each month is calculated. This means that the firms which make up the treatment portfolio are different from year to year, even though within a given year and over all eight years, all the firms have the same characteristics for the variable under study. There are now thirteen mean monthly returns for each year. Second, these thirteen mean monthly returns are now averaged over the eight years. This leaves just thirteen mean monthly returns. This blocking procedure should eliminate any bias that may be due to individual year differences. This is a different procedure than the one employed by Gonedes in his studies.[19] Gonedes treated each month-year as an independent observation. The procedure used here follows more closely Harrison's work.[20]

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In summary, the estimation of $\underline{\bar{d}}/\underline{\Theta}$ is achieved; first, by taking the average return over the eight-year period for each of the thirteen months for both the treatment and the control firms. Second, the mean difference return vector, $\underline{\bar{d}}/\underline{\Theta}$ is then computed by taking $\underline{R}_1/\underline{\Theta}_1 - \underline{R}_2/\underline{\Theta}_2$ for each of the thirteen months. These mean return differences are then used in tests of the mean vectors for each of the five test periods, T = -6 to T = +6, T = -6 to T = -1, T = 0 to T = +6, T = -2 to T = +2, and T = -3 to T = +3.

The use of $\underline{\bar{d}}/\underline{\Theta}$ is a special case of testing mean returns. It is used here due to the nature of the test design. The portfolios are matched pairs, which indicates the use of the matched pairs t-test is the appropriate test. The t-test may also be used to test for the equality of means, where no matching of the portfolios takes place. Instead of testing the mean differences, the means are tested to see if $\mu_1 = \mu_2$. This does not change the assumptions or the nature of the statistical tests. But it does allow the researcher to be more flexible in the application of either the univariate or multivariate test. This study uses both forms of the t-test when it is appropriate, but for purposes of exposition the following discussion will be limited to tests of mean differences.

Five tests corresponding to the five individual test periods are performed on each specific hypothesis. Each test is concerned with the estimated conditional mean return difference vector, $\underline{\bar{d}}/\underline{\Theta}$, which is used to estimate the true

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true mean difference vector, given by $\underline{\mu}_d/\underline{\Theta}$, where Θ represents the information variable to be examined, that is, AFUDC.

A general form of the hypothesis is given below:

$$H_0: \underline{\mu}_d/\Theta = \underline{\mu}_0 = 0 \qquad \text{(Eq 4.2)}$$

$$H_1: \underline{\mu}_d/\Theta \neq \underline{\mu}_0 = 0 \qquad \text{(Eq 4.3)}$$

Hypothesis 4.2 and 4.3 represent the null hypothesis and the alternative hypothesis, respectively. The null hypothesis states that if the relative risks of two portfolios are equated ($B_1 = B_2$), there should be no difference between the expected monthly market returns observations.

The testing of this hypothesis can be accomplished by: (1) finding the average monthly return for each portfolio in each year; (2) averaging these monthly returns over the eight years of the test period, so that each month is an average mean return from eight observations; and (3) finding the difference in these monthly returns between the treatment and control portfolios. This difference can then be statistically tested using a standard t-test or the multi-variate form of the test, to examine whether the difference is equal to zero, depending on whether it is a single matched pair or a vector of matched pairs.

4.6 Statistical Tests

Tests of Means - Two different statistical tests are utilized in this study. The majority of cases are univariate and the simple t-test can be utilized. The t-test can

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can be used to test for differences in means for a single portfolio pair, that is, treatment and control. When more than one test pair is formed, conditioned on the information variable, in this case AFUDC, multiple t-tests performed on each pair of portfolios are not the appropriate tests. This is due to the fact that the dependent variable (security returns) is correlated thereby leading to tests which are not statistically independent. This study has a few situations where this is true. Therefore, for this multivariate case, a simple analog to the t-test between means is the Hotelling T^2. The advantage of Hotelling T^2 is that a single probability statement about the null hypothesis, which takes into account the dependency between the security returns, can be made. As Bock and Haggard point out:

> No exact probability that at least one (portfolio formed on AFUDC) of them will exceed some critical level on the null hypothesis can be calculated. The multivariate tests, on the other hand, are based on sample statistics which take into account the correlations between variable and have known exact sampling distributions from which the required probabilities can be obtained.[21]

In more formal terms, the univariate hypothesis, given the usual assumptions of a normal distribution and homogeneity of variances, can be tested by the t-test where the observed value of the t-statistic is given by:

$$t(W_p) = \frac{W_p^T\ (\tilde{\mu}_1 - \tilde{\mu}_2)\ \sqrt{N}}{\sqrt{W_p^T\ S_{wp}}} \qquad \text{(Eq 4.4)}$$

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where $\tilde{\mu}_1$ and $\tilde{\mu}_2$ use the estimates of $E(R_1/\Theta_1)$ and $E(R_2/\Theta_2)$, respectively; S is the estimated conditional variance - covariance matrix of $\tilde{R}_1 - \tilde{R}_2$; N is the number of observations used for estimation; and W_p is the weight, in the univariate case equal to 1.0.[22]

In the univariate case, the test statistic is given by:

$$T = \frac{(\mu_1 - \mu_2) - E(\mu_1 - \mu_2)}{\text{est. } \sigma \text{ difference}} \qquad \text{(Eq 4.5)}$$

where est. σ difference is the estimated standard error of the difference between the independent sample means which are estimates of μ_1 and μ_2.[23] T is a random variable with N-1 degrees of freedom where N is the number of monthly observations. The decision rule is to accept the null hypothesis if the observed t-value is less than the critical t-value taken from the t-distribution corresponding to one's desired level of significance (α). If the t-value is greater, then reject the null hypothesis and infer that Θ_i has some information content.

In the multivariate case all values of Wp must be tested jointly. The multivariate analog is then the Hotelling T^2 of the form:

$$T^2 = \max_{W_p} t^2(W_p) = N(\underline{\mu}_1 - \underline{\mu}_2)\ S^{-1}\ (\underline{\mu}_1 - \underline{\mu}_2) \qquad \text{(Eq 4.6)}$$

The weight vector W_p can take on any set of values so desired but the T^2 statistic uses the value of Wp which maxi

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maximizes the value of T^2. Thus, the multivariate T^2 is really the maximum spread univariate t(Wp)-statistic.[24]

When the null hypothesis is true,

$$F = \frac{N - P}{(N-1)P} T^2 \qquad \text{(Eq 4.7)}$$

is distributed as F(P, N-P), an "F" random variable with p, and N-p degrees of freedom, where p is the number of groups and N is the number of monthly observations.[25] Departures from the null hypothesis $(E(R_1/\Theta_1) = E(R_2/\Theta_2))$ increase the expected value of T^2. The decision rule is to accept the null hypothesis if the observed F-value falls beneath the area of the F distribution corresponding to one's desired level of significance (α). If the F-value falls outside the area, reject the null hypothesis and infer that Θ_i has some information content. In other words, AFUDC earnings do have some information content that effects the company's security returns.

More specifically in some cases, since portfolios within each treatment group are matched to some criteria (for example, high and low percentages of AFUDC) then the test is a multivariate t-test. In this case the T^2 statistic has the form:[26]

$$T^2 = N(\underline{\bar{d}} - \mu_o)^1 \; S_d^{-1} \; (\underline{\bar{d}} - \mu_o) \qquad \text{(Eq 4.8)}$$

All terms are analogous to the terms given in (Eq 4.6) except in this formulation $\underline{\bar{d}}$ represents the estimated mean difference vector, $(\underline{\bar{R}}_1/\underline{\Theta}_1 - \underline{\bar{R}}_2/\underline{\Theta}_2)$. This is used to estimate the true mean difference vector, given by μ_d/Θ.

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Also S_d is the sample covariance matrix of the mean difference vector $\underline{\bar{d}}$. The elements of S_d are defined below in Eq. 4.9, where H denotes a high percentage of AFUDC and L denotes a low percentage. It should be pointed out here that the classification into two distinct portfolios will vary in this study. This does not change the statistical test. The chapter where the results are discussed will inform the reader as to the specific classification used to stratify the sample firms into portfolios. For purposes of clarity, the example given above will be used throughout this chapter, even though other classifications schemes will be employed.

$$S_d = \begin{bmatrix} Var(d_H) & Cov(d_H, d_L) \\ & \\ Cov(d_H, d_L) & Var(d_L) \end{bmatrix} \qquad \text{(Eq 4.9)}$$

The sample size N is the number of monthly observations, which in this study is five, six, seven or thirteen, used for calculating $\underline{\bar{d}}/\underline{\Theta}$. The majority of statistical tests require that the sampling units be independent of each other. The use of monthly return observations ensures that this study meets this requirement, since weak form tests of market efficiency provide substantial evidence that monthly successive return observations are serially independent. A further discussion of this point can be found in Fama and Miller.[27]

An important point is that the monthly return observations in this study and in virtually all studies of this type

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type are portfolios, rather than individual firms. This is for two reasons. First, the use of portfolios reduces sampling error and thereby increases the power of the statistical tests.[28] Second, the use of portfolios betas to match firms on relative risk has much more support in financial theory than individual firm betas.[29] In the discussion of the capital asset pricing model, it was pointed out that the basic conclusions hold where portfolios were used for the empirical tests and no such conclusions can be drawn when individual firms were used.[30]

These portfolios, since they consist only of firms from one industry are not minimum variance portfolios. This means that each of the portfolios formed here is not properly diversified across industries. Thus, the total variance of the portfolio is not the minimum variance that could be obtained if a sample of firms from many different industries were used. The total variance of a portfolio consists of two components. These components are the systematic risk and the unsystematic risk. If a portfolio is properly diversified the unsystematic risk component will be zero and the total variance of the portfolio will be comprised of only the systematic risk, therefore, the variance is minimized. Numerous researchers have shown the only relevant risk, the only risk rewarded by the market, is this systematic risk.[31] Therefore, in any portfolio, such as the ones formed in this study, even though they have not been properly diversified and thus contain some element of unsystematic risk, the market return is still only a function of their systematic risk. Beta is the proper measure of this systematic risk as defined in capital market theory. Then by matching these portfolios so that the betas of the portfolio are equivalent, this aspect of improper diversification can be safely ignored in any tests on mean returns. But it is true that the total variance of the portfolio will be greater and therefore the power of the test will not be maximized. Since the power of tests is less, any significant results will have been conservatively estimated.

4.7 Specific Hypotheses and Formation of Portfolios

This section details the specific hypotheses that are tested in this study. A number of different ways of dealing with the question of AFUDC disclosure may be proposed. But as outlined in previous chapters, a specification that overcomes the obstacles of confounding variables, which have been prevalent in this area of research, may be somewhat harder to formulate.

This is the first time AFUDC has been examined with the specific idea of testing for the information content of AFUDC. Numerous methods of classifying firms into portfolios based on some aspect of AFUDC disclosure were developed here. Some of these methods were consequently found to face similar problems of confounding variables or were eliminated due to a lack of sufficient number of firms to adequately form portfolios. The specific hypotheses

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presented here reflect the advantages of controlled experimental design free from any bias that has been inherent in previous cited empirical research on AFUDC.[32] These hypotheses are of two different designs. The first is a comparison of monthly security returns in a homogeneous sample, that is, method I firms only. The second is different in that the hypothesis concerns method I and method II firms. The later design is particularly important because it has been tested sparingly and the results have not been consistent.[33]

The previous chapters outline mathematically why AFUDC earnings are thought to be of lesser quality than earnings from operations. Implicit in this assessment is the fact that, lesser quality is due to the timing and amount of the cash flows from these earnings. A longer time lag and a lower cash flow figure likely implies a higher risk to stockholders. The disclosure of AFUDC to the market, especially the large magnitudes and changes in AFUDC percentages, that many firms have had during this time period might result in a negative reaction by the market. The information content of AFUDC disclosure can then be tested by examining whether $E(\underset{\sim}{R}_1/\underset{\sim}{\Theta}_1) = E(\underset{\sim}{R}_2/\underset{\sim}{\Theta}_2)$ during the months surrounding the disclosure date. As discussed previously the market is assumed to be efficient and the test here is concerned with the effects of accounting information. The first two sets of hypotheses described here are used to test for any differences in market returns that may occur

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in a homogeneous sample of firms (method I only) where the only difference among these firms is the amount of AFUDC.

4.7.1 Percent AFUDC

1) A threshold effect has been suggested,[34] whereby, the percentage of income represented by AFUDC may be ignored by the market participants until this percentage reaches a certain level. The implication here is that since AFUDC earnings are of inferior quality the market should react in a negative fashion to firms that have 30-40% of their earnings represented by AFUDC in comparison with firms that report only 5% of those earnings represented by AFUDC. To test this hypothesis a sample containing only method I firms is used. This is done to ensure all other factors besides AFUDC are held constant. It is felt this will minimize any confounding variables. This scenario was formulated to examine AFUDC earnings, without regard to the regulatory process giving rise to these earnings, that is, method I versus method II.

A number of researchers have provided empirical evidence supporting the hypothesis that the forecast error or earnings per share affects the market return of securities around the announcement date.[35] For this reason a two stage process is used to eliminate any possibility of bias due to this factor. The first stage consists of ranking method I firms on the forecast error of EPS. This is accomplished by taking the forecast of EPS from the

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Value Line Investment Survey in November (T = -4) of each year. There is empirical evidence supporting the contention that Value Line is as good or better than most other methods that may be used in the forecasts of EPS.[36] It provides a convenient month for these forecasts since not only are all utilities found in the November issue, which will eliminate any bias due to different forecast intervals, but this month also comes closest to the start of the testing period. The actual procedure is as follows:

Let F_{iT} be the forecast of EPS for each firm i in any period T. Let A_{iT} be the actual EPS for each firm i in any period T. Then let $F_{iT} - A_{iT} = E_{iT}$ where E_{iT} represents the forecast error of EPS for each firm in any period T.

To eliminate any bias,[37] whereby the forecast error may be a function of the size of the actual EPS, the percentage error is calculated as follows:

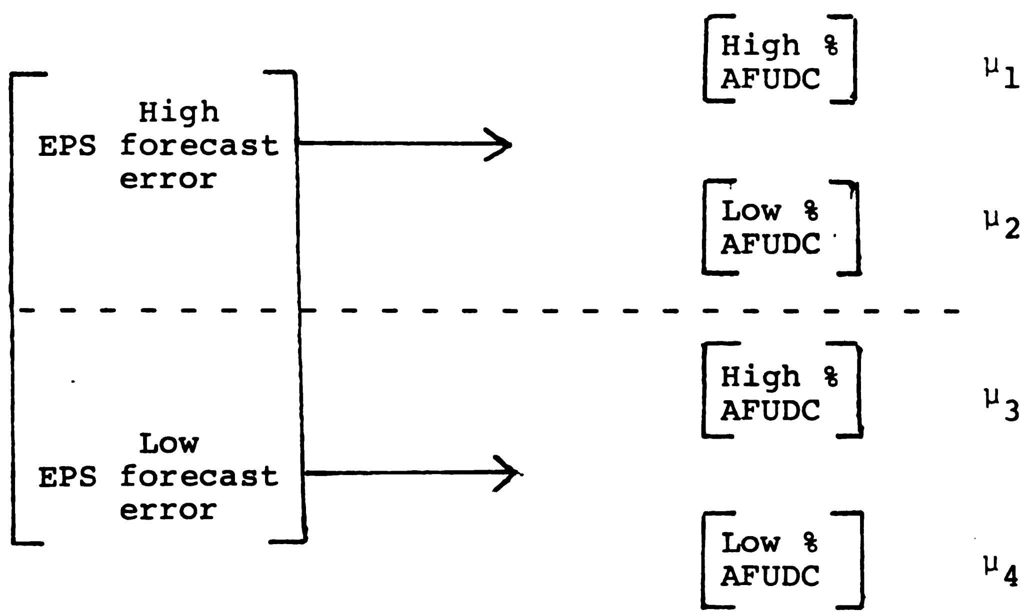
$$\frac{E_{iT}}{A_{iT}} - 1$$

This percentage forecast error is then used as the basis for ranking firms.

Two different procedures for using this ranking of the EPS forecast error now are presented. Both are used as the start of the second stage in forming portfolios.

a) Rank the firms from the highest to lowest percentage forecast error. Then split these firms into two separate groups, with one group containing the largest positive forecast error and the second group the lowest negative forecast error. There are now two distinct groups of approximately twenty-one firms each. Designate the first group the "High" forecast error and the second group the "Low" forecast error.

The next stage in the actual portfolio construction is to rank each firm in each of the two groups by the percentage of AFUDC. This percentage is calculated by dividing AFUDC earnings by total earnings for each firm. Then one can rank these firms from highest to lowest percentage AFUDC. Each group, consisting of twenty-one firms is now split into two portfolios of approximately ten firms each. This now leaves four distinct portfolios, which can be designated; High-High, High-Low, Low-High, and Low-Low. A diagram illustrating these portfolios follows:

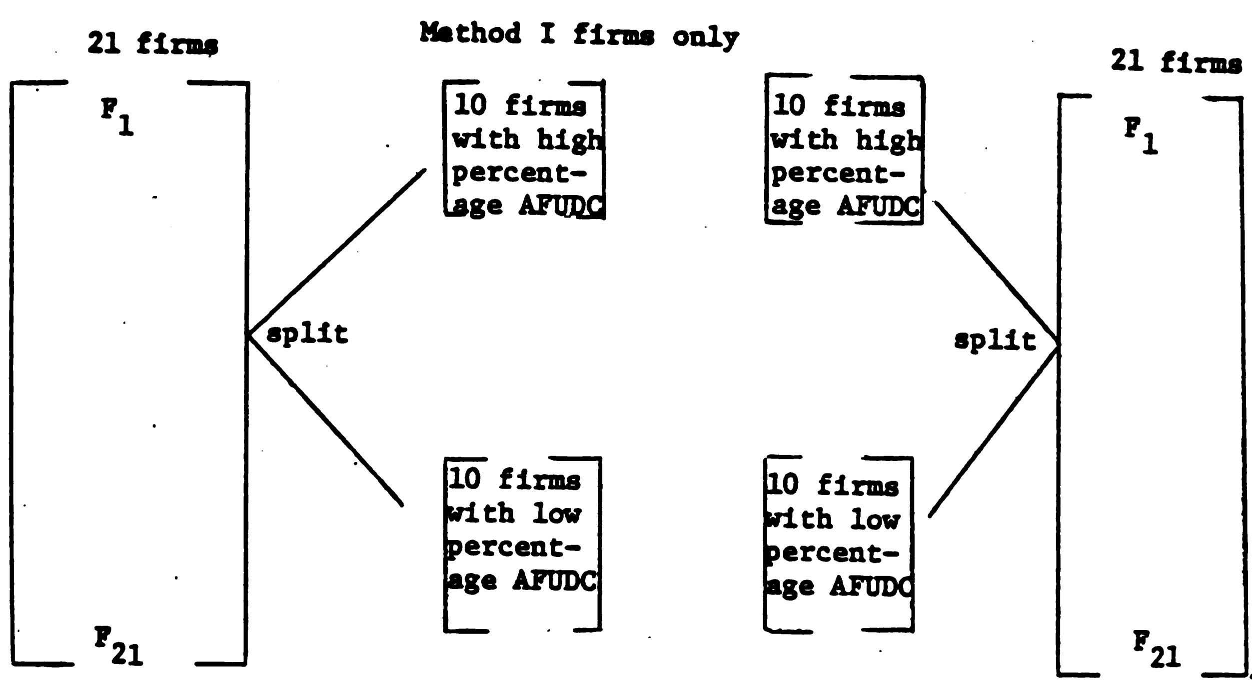


These four portfolios are independent and will result in four sets of mean monthly return observations which can be tested in either of two ways. The multivariate test, Hotelling T^2, can be used to test for the equivalency of the four means simultaneously. A significant T^2 statistic implies at least one of the means is not equivalent to the other means. If this test is significant then individual contrasts can be used to test more specific questions using the simple t-test. In this case, it might be hypothesized that the means of the high forecast error portfolios are not equivalent to the means of the low forecast error portfolios. An additional question can also be examined, that is, is there some difference between the high and low AFUDC portfolios within either the high or low forecast error groups. This design allows us to use both the univariate and multivariate version of the t-test to examine mean return differences in portfolios depending on the specific hypothesis that is to be tested.

b) Rank the firms from the highest to lowest percentage forecast error. Then split these firms into two separate groups by choosing every other firm for each group. This should provide as close a matching as possible for this specific attribute. There are now twenty-one firms in each group. The groups should be as similar as possible, given that they are all method I firms and they have been matched on the earnings forecast error.

The next stage in the actual portfolio construction is to rank each firm in each of the two groups by the percentage of AFUDC. The balance of this discussion is identical to the previous design and to discuss it here would be redundant. The end result is that four portfolios are formed. In this case though, any differences due to the forecast error has been controlled by matching the groups based on the EPS forecast error so that each group of twenty-one firms is nearly identical.

This is not a multivariate test. It is two separate univariate tests, in which the simple t-test is used to test for differences in mean monthly returns for two portfolios. In one case the portfolios are high percentage AFUDC versus low percentage AFUDC and in the second case, it is low percentage AFUDC versus high percentage AFUDC. All firms are method I firms. A diagram may facilitate understanding.



It is true that this design really tests the same hypothesis. That is; is there some difference between high percentage AFUDC portfolio and low percentage AFUDC portfolios. The fact that four distinct portfolios are formed does not change this hypothesis. It just allows one to test this hypothesis in two separate tests.

4.7.2 Changes in the Percent AFUDC

This next section concerns changes in the percentage of income represented by AFUDC. The first stage is identical to the previous section. The method I firms were ranked on EPS forecast error. Then by either of the two methods outlined previously, the total group of method I firms is split into two distinct groups. In one case the groups were formed to be as identical as possible based on the forecast error. In the other case, the groups were formed so that one group contained high forecast error firms and the other group contained low forecast error firms.

The second stage is different. Here the firms were stratified into portfolios based on the change in percentage of income represented by AFUDC, not just the percentage AFUDC. For example, if the percentage of AFUDC increased from 10% to 20%, this is classified as a 100% change in AFUDC percentage.

The premise in this case is that the percentage of income which is represented by AFUDC can be thought of as a quality index. It can be thought of as a quality index because for method I firms the present value of the AFUDC earnings is less than the income reported. Therefore, the larger the percentage of income represented by AFUDC earnings, the lower the quality index of that income. In other words, the ratio of cash or near cash (near cash represents other utility income such as depreciation and deferred taxes, which is discussed in Chapter Two) to the total reported income is decreasing.

Let the allowance factor represent the percentage of total income represented by AFUDC in any year. Then when one considers the year to year percentage change in earnings with the year to year percentage change in the allowance factor, four distinct possibilities arise:[38]

A) If both the allowance factor increases and income increases compared to the previous year, the actual increase in income is less than the reported increase in income. This is true because the reported income has decreased in quality. It includes a bigger component of AFUDC earnings.

B) If the reported income increases and the allowance factor decreases, the actual increase in income is greater than the reported increase in income. In this case, reported income becomes higher quality because the percentage of earnings represented by AFUDC declines.

C) If reported income decreases and the allowance factor increases, the actual decrease in income is greater than the reported decrease in income. This is true because not only does reported income decrease, but it is also of lower quality since AFUDC represents a larger percentage of those earnings.

D) If the reported income decreases and the allowance factor decreases, the decrease in actual (real) income is smaller than the decrease in reported income. This is true because even though reported income decreased, a smaller percentage was represented by AFUDC and therefore it is a higher quality.

In algebraic form, a percentage change in income can be represented by

$$\frac{I_T}{I_{T-1}} - 1.$$

Also recognize that to find the real change in earnings the allowance factor must be subtracted from both the numerator and the denominator. When the allowance factor increases, proportionately more is subtracted from the numerator. Therefore, the percentage change in income is less than reported. When the allowance factor decreases, proportionately more is subtracted from the denominator. Therefore, the percentage change in income will then be greater than reported.

A numerical example will help illustrate this concept. Let $I_T = 1.00$, $I_{T-1} = .50$, allowance factor T = 20% and the allowance factor T-1 = 10%. The change in reported income is

$$\frac{1.00}{.50} - 1 = 100\%$$

The change in actual income is

$$\frac{1.00 - .20(1.00)}{.50 - .10(.50)} - 1$$

which is equal to

$$\frac{.80}{.45} - 1 = 77.8\%$$

In the second case, let the allowance factor T = 10% and the allowance factor T-1 = 20%. The change in reported income is still 100%. But the change in actual income is

$$\frac{1.00 - .10(1.00)}{.50 - .20(.50)} - 1 = \frac{.90}{.40} - 1 = 125\%$$

The same example can be extended to the case when reported income decreases. Let $I_T = .50$, $I_{T-1} = 1.00$, $AF_T = 20\%$, and $AF_{T-1} = 10\%$. The change in reported income is

$$\frac{.50}{1.00} - 1 = -50\%.$$

The change in actual income is

$$\frac{.50 - .20(.50)}{1.00 - .10(1.00)} - 1 = \frac{.40}{.90} - I = -55.5\%.$$

Under the second scenario when reported income decreases and the allowance factor decreases, the actual decrease should be less.

Let $I_T = .50$, $I_{T-1} = 1.00$, $AF_T = 10\%$, $AF_{T-1} = 20\%$. The change in reported income is

$$\frac{.50}{1.00} - 1 = -50\%.$$

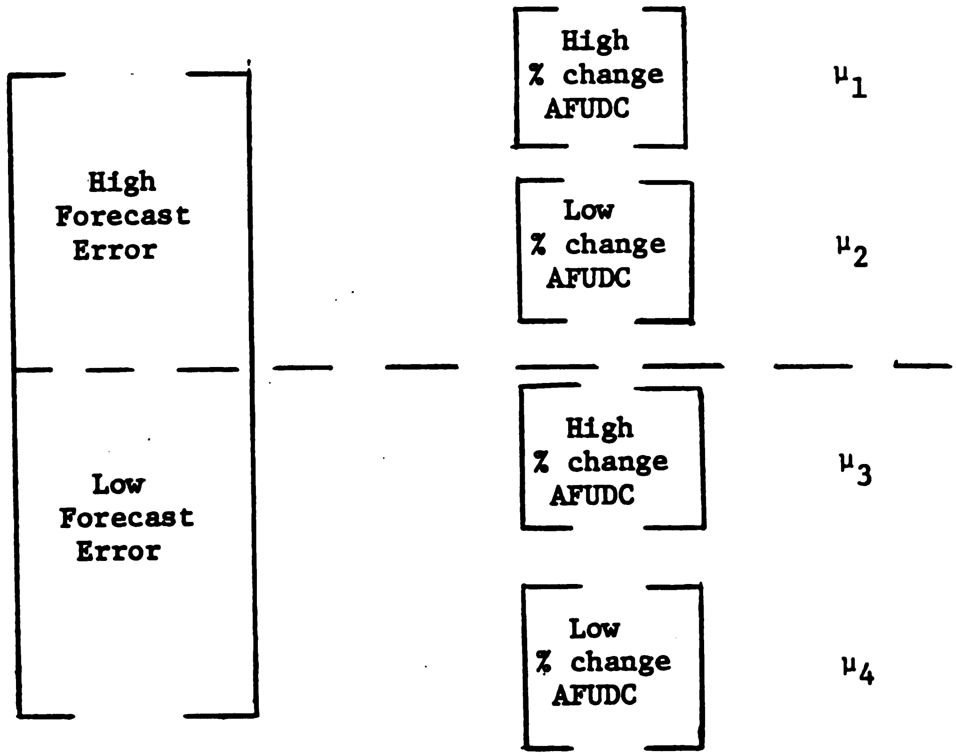
The change in actual income is

$$\frac{.50 - .10(.50)}{1.00 - .20(1.00)} - 1 = \frac{.45}{.80} - 1 = -43.75\%$$

These four cases can be combined into two for our purposes. Whether income increases or decreases, if the allowance factor increases, the actual increase or decrease in income is less than reported. In the second scenario, whether income increases or decreases, if the allowance factor decreases, the actual increase or decrease in income is greater than reported.

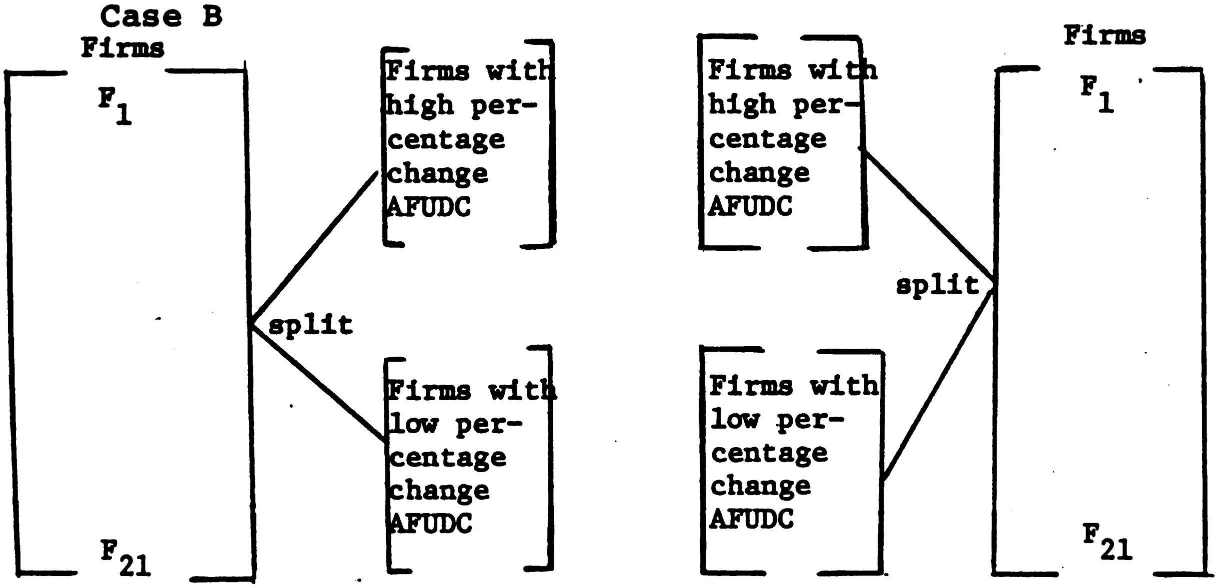
This allows one to stratify both forecast error groups into two portfolios based on whether the allowance factor increases or decreases. Once the firms are grouped according to percentage forecast error in EPS, they are ranked from highest positive change in the allowance factor to lowest negative change and then split into two portfolios for both the high and low portfolio. These two portfolios are then matched, whereby the positive change portfolio is compared against the negative change portfolio and vice versa. The hypothesis is that the positive change portfolio should have a lower market return relative to the negative change portfolio if AFUDC provides some information which is used by the market to assess security returns. Of course, as in the previous hypothesis, the betas for each portfolio are weighted to that they are equivalent. A diagram of these designs follows:

Case A - Firms ranked on Forecast error



Case A above can be tested in an identical fashion to Case A in Section 4.6.1.

Case B



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Case B above is also tested in an identical fashion to Case B in Section 4.6.1.

Summarizing, the above designs deal exclusively with method I firms. A number of designs are formulated to examine the question of information content of AFUDC for method I firms. There are two stages with each stage having two alternatives. This means there are four separate designs which are used to test AFUDC.

Stage 1 is the use of EPS forecast error to split the total number of method I firms into two groups.

A) Split into high and low groups

B) Split into nearly identical groups

Stage 2 is the use of AFUDC characteristics to split each of the above groups into two portfolios.

A) Portfolios based on the percent AFUDC

B) Portfolios based on the percent change in AFUDC

These four designs are then tested using either the univariate t-test, the multivariate version of the test, Hotelling T^2, or a combination of both. Also the tests are used for mean differences (μ_d) or for the means (μ) depending on the design.

4.7.3 Method I versus Method II Firms

The next basic grouping of hypotheses concerns a comparison of method I firms with method II firms. The differences in income streams for method I and method II are presented in Chapter I. The next step is to test whether there is any difference in the market reaction to the announcement of earnings. In this case total earnings consist of two different methods of accounting for AFUDC. A major problem with any research into the differential market valuation of method I and method II firms is the confounding variables attributed to regulatory climate. A second problem is that any differences in market returns attributable to the announcement of AFUDC earnings may in fact be due to differences in the percentage forecast error or to differences in earnings changes from year to year.

It is felt that any differences in regulatory climate should already be impounded in the relative risk measure, beta. Also any changes in this regulatory climate should be captured by the beta since a progressive moving average beta estimation period is employed in this study. Therefore, the equivalence of betas between the two portfolios of firms, method I and method II, implies the equivalence of all factors that are already public information which might have some effect on the market returns. This allows us to examine any event that might become known after capital market equilibrium has been established. For example, the disclosure of AFUDC earnings and any changes in this policy which actually occurs.

A number of points must again be emphasized to provide some justification for the tests performed here. First, empirical work on the differential market valuation of method I and method II firms is sparse. None of the previous empirical work has examined the instantaneous market reaction to the disclosure of AFUDC earnings and the differences between method I and method II. Second, disclosure of which firms are method I and which are method II is not found in the typical accounting reports of the company, nor in widely used investment advisory services, such as Value Line and Standard and Poors. In fact, the classification of firms must be made by individual investors from information provided in reports from the National Association of Regulatory Utility Commissioners. It is conceivable that some firms could be classified as either method I or method II depending on how these reports are used. Third, it is not at all clear that people familiar with AFUDC recognize that there is major differences in the income streams which accrue to these firms.[39] As noted in previous chapters much of the empirical research on AFUDC does not make any distinction between these two methods. Therefore, any empirical evidence on this particular comparison may be of special interest to a number of groups.

4.7.4 Procedure for Testing Method I vs. Method II

To eliminate the second problem, that is; the difference in market return may be influenced by differences in the forecast error of EPS, a matching procedure for individual firms is implemented. The percentage forecast error of earnings per share is calculated for method II firms. Method I firms are then matched with these firms on the basis of this percentage forecast error. To ensure eno

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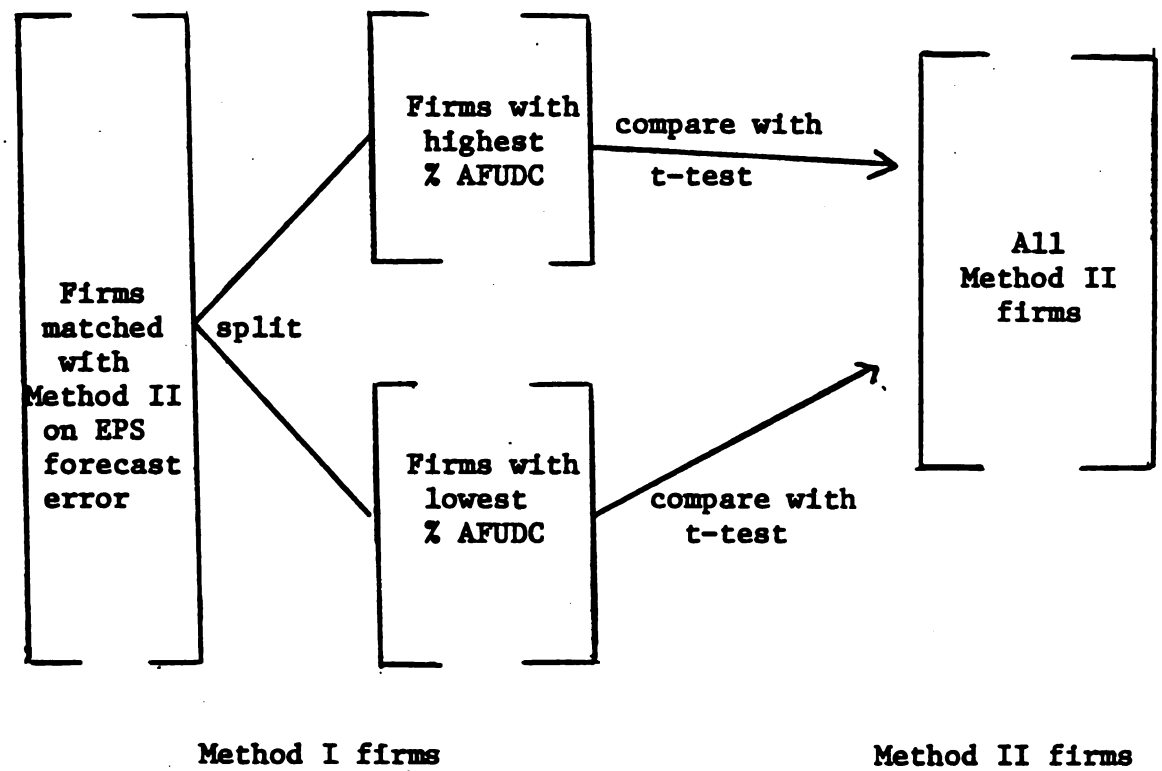
enough firms for the formation of portfolios a range of $\pm$ 3% is used when matching method I with method II firms. It is felt that this range serves as a reasonable matching criteria for this particular attribute.

Two specific designs are used to test for differences between method I and method II firms. Each of these designs is the second stage of the two-stage process, whereby the first stage involves the matching of these firms on the percentage forecast error of earnings per share in the manner discussed above. Let the method II portfolio act as the control portfolio and let the method I portfolio act as the treatment portfolio. Since only thirteen method II firms are available for testing, only one portfolio for both the treatment and control is testable at any time, but this does not preclude the use of the same method II portfolio as a control portfolio in other tests.

4.7.5 Method I versus Method II: Percentage AFUDC

This section details the designs used to test for differences between method I and method II when method I firms are selected based on the percentage AFUDC. Method I firms are chosen so that the firms with the highest percentage of total income represented by AFUDC are formed into one treatment portfolio and the lowest percentage firms are formed into a separate treatment portfolio. We now have two independent treatment portfolios, but only one control portfolio. This allows one to test for differences in method I and method II firms using the univariate t-test in two separate, but not independent, procedures. The first is a comparison of the highest percentage method I firms with method II firms. The second is a comparison of the lowest percentage method I firms with the method II firms. This allows one to test for any differential market reaction between method I and method II firms, inherent in the quality of those earnings as represented by either high or low percentages of AFUDC. A diagram follows:

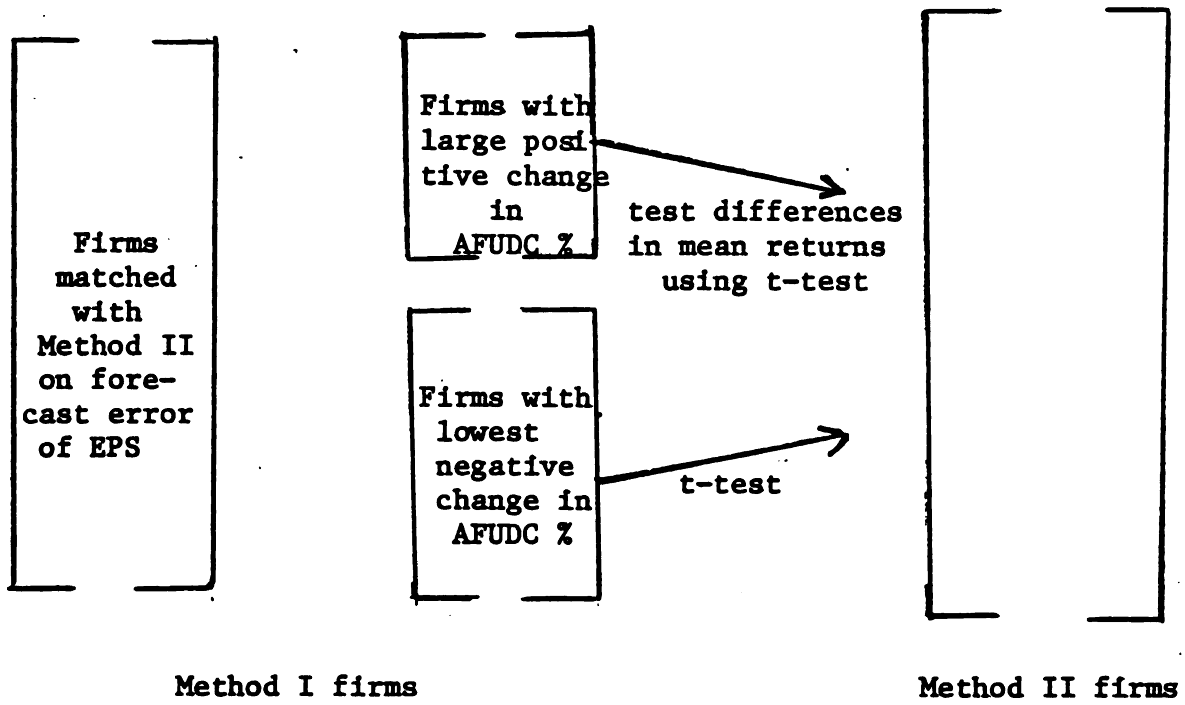


Summarizing, method I firms are formed into portfolios in a two-setp procedure. First, these firms are matched to method II firms according to the percentage forecast error of EPS. This leaves approximately thirty firms from the total of forty-five which are then split into two groups. Second, only the thirteen firms that have the highest percentage of AFUDC are formed into one portfolio. The thirteen firms that have the lowest percentage of AFUDC are formed into another portfolio. Again, the multivariate test is not appropriate here because the two tests are not independent, One can only perform the univariate t-test on each of the two treatment-control matched pairs. The hypothesis is that there should be a negative market reaction for method I firms relative to method II firms for the higher percentage treatment group, but no such relationship should exist for the lower percentage treatment. This is so because in the later case, it is a comparison of firms with essentially equivalent earnings, rather than a comparison of firms, where one portfolio consists of large amounts of earnings thought to be of inferior quality, as in the former case.

4.7.6 Method I vs. Method II: Percentage Change in AFUDC

The next design is similar to the design developed for method I firms, whereby the change in the AFUDC percentage is used to stratify firms into the treatment portfolios. As in the previous designs for method I and method II firms, method I firms are matched to method II firms on the basis of the percentage forecast error in EPS within a range of + 3%. The next stage is identical to the previous design except for one modification. The method I firms are divided into two separate treatment groups based on the change in the AFUDC percentage, not just the percentage of AFUDC. The two extremes of this attribute (the change in AFUDC percentage) are used to form portfolios. The firms with the highest positive percentage change in the AFUDC percentage compose one treatment group. While the firms with the lowest negative percentage change in the AFUDC percentage compose the other treatment group.

Since these firms are matched on the percentage forecast error of EPS, an increase in the AFUDC percentage from year to year implies the actual EPS and therefore the forecast error is not the same for method I firms as it is for method II firms. A positive percentage change in AFUDC for method I firms should have a negative market reaction relative to method II firms.[40] In the case of negative percentage change in AFUDC, the relationship should be the opposite. In any case a difference in the actual market return between method I and method II firms, where these firms have been formed into portfolios, which are essentially identical except for the method of accounting, would imply some information content to AFUDC earnings. A diagram follows:



The test procedure is identical to the previous design developed for method I and method II. Two separate t-tests are performed on the difference in mean monthly returns. One t-test is a test of high positive percentage changes in AFUDC for method I with method II firms. The other t-test is a test of low negative percentage changes in AFUDC for method I firms compared with method II firms.

4.7.7 Test Design: Quarterly Reports

The test period used in this study encompasses not only the disclosure of AFUDC in the annual report, but also the quarterly announcements of earnings. The quarterly earnings reports, especially the first quarter reports, may contain information on AFUDC that may be used to assess the impact of AFUDC on firm valuation before the annual report is available. For this reason similar tests of mean returns are performed on the months surrounding the disclosure of first quarter reports. In essence, the sub-period, T = 0 to T = +6 is also a test of the disclosure of first quarter results. These results imply no basis for rejection of the null hypothesis in any of the designs used here. Nevertheless, the author feels a six month time period may bias these results by including other factors which could effect the market return for these firms. Therefore, a slightly different procedure is used in this situation, which enables one to focus more closely on the disclosure of the first quarter earnings and the amount of AFUDC.

The first quarter ends on March 31, for all firms in this study since all firms have a December 31, fiscal year-end. A problem occurs in that the time when the first quarter reports are publicly available varies from firm to firm and year to year. The first quarter results are unaudited statements but they are reviewed by the company's auditors. This should ensure their accuracy and the fact that they are unaudited implies these reports are publicly available rather quickly. An examination of the date of the auditor's statement may give an approximate date when these reports are publicly available. There should be no reason to delay releasing these reports after the auditor has reviewed the statements. The SEC also puts some pressure on companies to release financial statements as quickly as possible. A random sampling of a few of these

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quarterly reports reveals two to five weeks after March 31 as a reasonable approximation for the release of the first quarter financial statements. Therefore, to test the disclosure of AFUDC in the first quarter reports, a time period consisting of April and May, months T = 1 and T = 2 in each year is used as a reasonable approximation to the average time of disclosure for these companies. The procedure used here differs from the preceding in that the monthly returns are not averaged over the eight years. Each month of each year serves as an independent observation. This allows a total of sixteen observations for each treatment and control portfolio.

In the use of this procedure, two observations about the power of the test became apparent. First, the use of a larger sample size, in this case sixteen versus thirteen or less as in the previous procedure, means the test will be more powerful. In general as sample size increases power also increases.[41] Second, the use of monthly returns not averaged over some year to year period will decrease the power of the test. This is true because these monthly returns are not as homogeneous as if they had been averaged over years to eliminate any variation due to year to year differences. Since these two effects are opposite in direction it is not clear whether this procedure is more or less powerful than the previous procedure. Nevertheless, it should provide some validation of the results presented so far.

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The specific test designs used for the quarterly earnings are identical to the designs used on the annual earnings except for the aforementioned differences. A further discussion of these designs would be redundant and add very little to the understanding of this research. Therefore, the designs on quarterly earnings are not discussed again.

4.8 Data Selection and Validation

The initial universe of firms used in this study consisted of all electric service utilities contained on the Compustat tapes. This includes two groups of electric utilities. First, there are those firms which derive all their income from electric power generation. Second, there are those firms whose primary source of income is electric power generation, but these firms also derive some minor portion of their income from other services such as sales of natural gas. This initial sample consisted of one hundred forty-seven companies. A number of companies were then eliminated for various reasons. The first criteria used to eliminate firms was the dichotomization of firms into either method I or method II. This classification was made using the 1974 and 1977 annual reports of the National Association of Regulatory Utility Commissioners. Every attempt was made to keep these groupings of firms into method I and method II as homogeneous as possible. Firms were then eliminated for the following reasons: 1) firms that had more than one state with jurisdiction over their regulatory environment and where those states differed in the application of method I or method II; 2) firms that had some limits on the use of either method I or method II such as, only a certain amount of AFUDC was allowed, or only a certain amount of CWIP was allowed in the rate base.

This filter left approximately fifty-four method I firms and eighteen method II firms. The next stage was to eliminate firms that did not have the proper data available. Beta is used to match the relative risks of firms, therefore, at least sixty months of monthly security returns had to be available on the CRSP tapes before the start of the test period. The test period started on September, 1969, thus monthly returns must have been available from August, 1964 to September, 1978. Also data must be available on the Compustat tapes for the calculation of earnings per share and calculation of the percentage of income represented by AFUDC. Therefore, data items on the Compustat tapes must be available form 1969 to 1978. This left a sample set consisting of firty three method I firms and thirteen method II firms. This sample set of firms is given in Tables 5 and 6, In Johnson's study, firms were also classified into method I and method II, but since a different set of criteria was used for data availability, the sample set was not exactly the same as this study. Nevertheless, a majority of the firms were the same. The previous author called a number of firms to

Table 5

METHOD I COMPANIES

Boston Edison
Carolina Power Light
Central Maine Power
Cincinnati Gas
Cleveland Electric Power
Columbus & Southern Ohio Electric Co.
Commonwealth Edison
Duke Power
Eastern Utilities
Florida Power Light
Florida Power Corp.
Hawaiian Electric
Idaho Power
Indianapolis Power
Nevada Power
New England Electric
Northeast Utilities
Ohio Edison
Pennsylvania Power
Portland Electric
Public Service Indiana
Public Service New Hampshire
Puget Sound Power
Southern Cal Edison
Tampa Electric
Union Electric
United Illuminating
Utah Power
Arizona Public Service
Central Illinois Light
Central Illinois Public Service
Iowa Electric Light & Power Co.
Iowa Illinois Gas & Electric Co.
Iowa Power & Light Co.
Iowa Public Service
Missouri Public Service
Montana Dakota Utilities
Montana Power
Northern Indiana Public Service Co.
Northern States Power Co.
Philadelphia Electric
San Diego Gas
Sierra Power
Southern Indiana Gas
Tucson Gas & Electric Co.
Washington Water Power
Wisconsin Electric Power
Wisconsin Public Service

Table 6

METHOD II COMPANIES

Atlantic City Electric Power
Baltimore Gas
Central Southwest
Consumers Power
Delmarva Power
Detroit Edison
Gulf States Utilities
Kentucky Utilities Co.
Public Service Colorado
Savannah Electric
South Carolina Electric & Gas Co.
Southwestern Public Service
Virginia Electric & Power Co.

validate his classification and verify that the firms are indeed method I or method II. In this study, the 1974 and 1977 National Association Regulatory Commissioners annual report were used, and these reports were consistent with each other and the previous validation, therefore it was not thought necessary to validate again this classification scheme. This classification of firms into method I and method II was thought to represent as homogeneous a grouping of firms as possible.

This study makes exclusive use of both the CRSP and Compustat data bases. These tapes are used extensively for empirical research by a large number of researchers. Thus, validation of those actual figures taken from these tapes was not necessary. Nevertheless, a number of random figures were checked against Value Line, especially with regards to EPS calculations which were crucial to this research. All figures were found to be consistent with the data on the Compustat tapes.

Summary

This chapter first briefly outlines the four theoretical areas which serve as the basis for this research. These are: information content, market efficiency, capital asset pricing model and the distribution of security returns. These are then integrated into the specific application of research methodology that is used here. A general statement of the hypothesis and the appropriate statistical tests was also presented in that section. The next section detailed the specific hypotheses to be tested. Problems with confounding variables in previous research were discussed and the proposed solutions to those problems that this research methodology hopes to eliminate was also presented. The last section presented the data selection techniques used to obtain the sample for this research.

Footnotes

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[3]Gonedes and Dopuch, p. 50-54.

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Michael Jensen, "Capital Markets: Theory and Evidence," Bell Journal of Economics and Management Science 3 (Autumn 1972), pp. 357-398.

[9]Ibid.

[10]Eugene F. Fama, "The Behavior of Stock Prices," Journal of Business 28 (January 1965), pp. 34-105.

[11]Ibid.

[12]Eugene F. Fama and Merton H. Miller, The Theory of Finance (Hinsdale, Illinois, Dryden Press, 1972), p. 264.

[13]N. J. Gonedes, "Risk Information, and the Effects of Special Accounting Items on Capital Market Equilibrium," Journal of Accounting Research (Autumn 1975), pp. 220-256.

[14]Ibid., p. 221-230.

[15]Gonedes and Dopuch, pp. 48-169.

[16]Ibid., p. 50-55.

[17]Louis H. Rappaport, SEC Accounting Practice and Procedure, 3rd edition (New York: Ronald Press Co., 1972), p. 145.

[18]Walter Thomas Harrison, unpublished dissertation, "The Information Content of Accounting Changes," Michigan State University, 1976, p. 24.

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Also Jeremy Finn, A General Model for Multivariate Analysis, Holt, Rinehart & Winston, p. 150-155 and 315-319.

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[24]Timm, p. 226-229.

[25]Ibid.

[26]Ibid.

[27]Fama and Miller, Chapter 7.

[28]M. E. Blume, "Portfolio Theory: A Step Toward Its Practical Application," Journal of Business (April 1970): 152-73.

[29]Ibid.

[30]Jensen, 1972, p. 357-398.

[31]Fama and MacBeth, "Risk, Return and Equilibrium: Empirical Tests," Journal of Political Economy (May/June 1973):607-636.

[32]See empirical evidence cited in Chapter 3.

[33]See Johnson's dissertation, Chapter 5.

[34]Conversation with Z. Lew Melynck, utility industry consultant, Chairman, Department of Finance, University of Cincinnati, January 14, 1980.

[35]Lawrence D. Brown and Michael S. Rozeff, "The Superiority of Analyst Forecasts as Measure of Expectations; Evidence from Earnings," Journal of Finance, March 1978, pp. 1-16.

[36]Ibid.

[37]Ibid.

[38]Johnson first formulated this procedure for use in a different statistical design.

[39]The author is aware of people employed in the finance and accounting functions of method II firms who do not recognize these differences.

[40]See examples, p. 147-150.

[41]William L. Hays, p. 360-362.

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CHAPTER 5

EMPIRICAL RESULTS: DISCUSSION OF STATISTICAL TESTS

This chapter reports the results of the empirical tests performed on the set of hypotheses outlined in Chapter 4. The statistical designs are both univariate and multivariate. Therefore, both the univariate and multivariate forms of the t-test were used when it was appropriate. The first two sets of hypotheses which are concerned with method I firms only, were tested with both the univariate and multivariate tests. In the discussion of the results from these tests, Case A refers to a multivariate test design where two matched pairs are tested simultaneously. Case B refers to a simple univariate test design. As discussed in Chapter 4 the formation of the portfolios is slightly different in each case leading to the use of these different tests. The univariate tests could have been eliminated since the results are consistent with the multivariate tests in all time periods. But it was thought useful to include them here to verify the multivariate results in a slightly different design.

The set of null and alternative hypotheses that are tested in this research are first presented in summary form.

1) Ho: There is no difference in expected monthly rates of return between portfolios of method I firms, one consisting of high amounts of AFUDC as represented by the percentage of net income, and the other consisting of low amounts of AFUDC.

   Ha: There is a difference in expected monthly market rates of return.

2) Ho: There is no difference in expected monthly market rates of return between portfolios of method I firms, one consisting of high percentage changes in the amount of AFUDC as represented by the percentage of net income, and the other consisting of low percentage changes.

   Ha: There is a difference in expected monthly market rates of return.

3) Ho: There is no difference in expected monthly market rates of return between a portfolio consisting of method I firms with high amounts of AFUDC as represented by the percentage of net income and a portfolio consisting of method II firms.

   Ha: There is a difference in the expected monthly market rates of return.

4) Ho: There is no difference in expected monthly market rates of return between a portfolio consisting of method I firms with low amounts of AFUDC as represented by the percentage of net income and a portfolio of method II firms.

   Ha: There is a difference in the expected monthly market rates of return.

5) Ho: There is no difference in expected monthly market rates of return between a portfolio consisting of method I firms with a positive percentage change in

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the amount of AFUDC as represented by the percentage of net income and a portfolio of method II firms.

Ha: There is a difference in the expected monthly market rates of return.

6) Ho: There is no difference in expected monthly market rates of return between a portfolio consisting of method I firms with a negative percentage change in the amount of AFUDC as represented by the percentage of net income and a portfolio of method II firms.

Ha: There is a difference in the expected monthly market rates of return.

At this point there are two hypotheses that refer to comparisons between method I firms only and four hypotheses that are concerned with method I versus method II comparisons. Recall from Chapter 4 that there are two different designs for each hypotheses that concerns method I firms. This allows one to test two hypotheses in different ways, which should provide some verification of the results. The four hypotheses that concern method I versus method II comparisons use the same method II portfolio as a control portfolio. Nevertheless, the hypotheses are separate and independent and the simple t-test will be used to test each one. This might be stated better as a general hypothesis, that is:

Ho: There is no difference in expected monthly rates of return between a portfolio of method I firms and a portfolio of method II firms.

This general hypothesis can be examined more thoroughly through the use of the four hypotheses given above.

5.1 Tests of Percentage AFUDC: High EPS Forecast Error vs. Low EPS Forecast Error

There are six hypotheses given above. Five specific tests corresponding to different sub-periods are performed using each hypothesis. Each sub-period test is discussed separately. The results for the first hypothesis are given in Table 7. Table 7 and all future tables which show the multivariate results also include the separate univariate statistics. The first test is the total time period of T = -6 to T = +6. In this case the first univariate test is a comparison of a portfolio of high EPS forecast error high percentage AFUDC (for ease of understanding and future reference, signified high-high) and a portfolio of high EPS forecast error low percentage AFUDC (high-low). The t-statistic is -.58. The second univariate comparison is a portfolio of low EPS forecast erorr high percentage AFUDC (low-high) and a portfolio of low EPS forecast error low percentage AFUDC (low-low). The t-statistic is .09. Finally, the multivariate T^2 statistic which is a simultaneous test of High-High vs. High-Low and Low-High vs. Low-Low is .6807. All of these values given so far imply that the null hypothesis of no difference in monthly returns can be accepted at the .10 level.

The two sub-periods, T = -3 to +3 and T = -2 to +2, focus more closely on the time period immediately around the disclosure month, T = 0. The univariate t-statistics are -.60 and .30 for the high-high vs. high-low and low-high

Table 7

Percentage AFUDC: Method I Firms High EPS Forecast Error Versus Method I Firms Low EPS Forecast Error
Case A

Total Period 13 Months (Time = -6 to +6)

	Mean	σ	t	T^2
High Forecast High %	.0044	.018	-.58	.6807
High Forecast Low %	.0089	.017		
Low Forecast High %	.0086	.017	.09	
Low Forecast Low %	.0082	.018		
7 Months (Time = -3 to +3)				
High Forecast High %	.0044	.024	-.60	6.18**
High Forecast Low %	.0108	.019		
Low Forecast High %	.0085	.026	.30	
Low Forecast Low %	.0043	.021		
5 Months (Time = -2 to +2)				
High Forecast High %	-.0009	.027	-.577	6.86**
High Forecast Low %	.0082	.022		
Low Forecast High %	.0020	.029	.263	
Low Forecast Low %	-.0021	.021		
Anticipation Period 6 Months (Time = -6 to -1)				
High Forecast High %	.0141	.016	-.34	.36
High Forecast Low %	.0180	.018		
Low Forecast High %	.0179	.021	.04	
Low Forecast Low %	.0176	.017		
Reaction Period 7 Months (Time = 0 to +6)				
High Forecast High %	-.0039	.015	.52	1.0468
High Forecast Low %	.0010	.012		
Low Forecast High %	.0007	.016	.08	
Low Forecast Low %	.0001	.015		

Critical Values for T Statistic, α = .10

t, 12 = 1.356
t, 6 = 1.440
t, 5 = 1.476
t, 4 = 1.533

**Significant at the .10 Level

vs. low-low portfolios, respectively, for T = -3 to T = +3. Both values are well within the bounds for acceptance of the null hypothesis. The multivariate T^2 statistic shows quite different results. The value is 6.18, which is significant at $\alpha = .10$. At first glance this might seem important, but significance may be due to the attribute that is not of interest here, that is; high EPS forecast error versus low EPS forecast error. Therefore, a second test was performed by rearranging the portfolios so that the AFUDC component was held constant and the EPS forecast erros was tested. This comparison was then high-high vs. low-high and high-low vs. low-low. The test statistic in this case was virtually identical and of course significant at $\alpha = .10$. This implies that the significance was more probably due to the EPS forecast error rather than the percentage of AFUDC. This is also consistent with the results and discussions given by a number of other researchers concerned with EPS forecast error, which is outlined in Chapter 4.

The time period, T = -2 to +2, gives similar results. The univariate t-statistics are -.577 and .263 which of course are not significant. The T^2 statistic is 6.86 which is significant at $\alpha = .12$. But again rearranging the portfolios as in the previous case gives the same results. The significance is apparently due to differences in the EPS forecast error rather than differences in the percentage of AFUDC.

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The anticipation sub-period, T = -6 to T = -1 yields results similar to the total period. The t-statistics in the univariate cases are -.34 and .04, respectively. The T^2- statistic in the multivariate case is .36. These values are well within the limits needed for accepting the null hypothesis.

The reaction sub-period, T = 0 to T = +6, has results consistent with the above. An interesting aspect is that mean monthly return for the high-high portfolio is negative. This should be expected since a high EPS forecast error and high amounts of AFUDC should imply a negative view by the market. In any case the t-statistics are .52 and .08, respectively. The T^2- statistic is 1.046. All the values imply the null hypothesis can be safely accepted at the .10 level.

5.2 Tests of Percentage Changes in AFUDC: High EPS Forecast Error vs. Low EPS Forecast Error

This next hypothesis is concerned with changes in the percentage of income represented by AFUDC. The formation of these portfolios is described in detail in the previous chapter. Briefly, a portfolio of method I firms with increases (high percentage change) in the percentage of net income represented by AFUDC is compared with a portfolio of method I firms with decreases (low percentage change) in the percentage of net income represented by AFUDC. The results are summarized in Table 8. This scenario is analogous to the previous discussion, in that,

Table 8

Percentage Change AFUDC: Method I Firms High EPS Forecast Error Versus Method I Firms Low EPS Forecast Error Case A

Total Period 13 Months (Time = -6 to +6)

	Mean	σ	t	T^2
High Forecast High % Change	.0066	.017	-.02	.127
High Forecast Low % Change	.0068	.019		
Low Forecast High % Change	.0075	.018	-.17	
Low Forecast Low % Change	.0088	.021		
7 Months (Time = -3 to +3)				
High Forecast High % Change	.0050	.021	-.10	.049
High Forecast Low % Change	.0062	.023		
Low Forecast High % Change	.0038	.023	-.16	
Low Forecast Low % Change	.0060	.027		
5 Months (Time = -2 to +2)				
High Forecast High % Change	.0035	.026	.19	.927
High Forecast Low % Change	.0004	.025		
Low Forecast High % Change	-.0007	.025	-.07	
Low Forecast Low % Change	.0004	.031		
Anticipation Period 6 Months (Time = -6 to -1)				
High Forecast High % Change	.0182	.015	.09	.659
High Forecast Low % Change	.0173	.020		
Low Forecast High % Change	.0176	.019	-.33	
Low Forecast Low % Change	.0214	.021		
Reaction Period 7 Months (Time = 0 to +6)				
High Forecast High % Change	-.0034	.013	-.15	.241
High Forecast Low % Change	-.0023	.013		
Low Forecast High % Change	-.0012	.013	.10	
Low Forecast Low % Change	.0020	.016		

a 2 x 1 vector of mean returns is examined. Each element of this vector can be tested using the univariate t-test, but a simultaneous test of both means requires the use of Hotelling's T^2 test. The 2 x 1 vector represents the pairings of portfolios as follows: high EPS forecast error high percentage changes in AFUDC (High-High) vs. high EPS forecast error low percentage change (High-Low) and the second element is low EPS forecast error high percentage change in AFUDC (Low-High) vs. low EPS forecast error low percentage change in AFUDC (Low-Low). In the vast majority of cases a high percentage change in AFUDC actually meant an increase in the percentage from year to year and low percentage change actually meant a decrease in the percentage from year to year.

As in the previous case the first time period to be discussed is the total period, T = -6 to +6. The t-statistics for the univariate cases are -.02 and -.17, respectively. The T^2- statistic is .127. All of these values indicate that one fails to reject the null hypothesis at the .10 significance level. The two sub-periods, T = -3 to +3 and T = -2 to +2 give similar results. For T = -3 to +3, the t-statistics are -.10 and -.16, respectively and the T^2- statistic is .049. For T = -2 to +2, the t-statistics are .19 and -.07, respectively and the T^2-statistic is .927. Again, all these values imply an acceptance of the null hypothesis at the .10 level.

The anticipation period, T = -6 to -1 provides results consistent with the above. The t-statistics are .09 and -.33, respectively, and the T^2- statistic is .659. The reaction sub-period is also similar. The t-statistics are -.15 and .10 and the T^2- statistic is .241. All these values are well within the area of acceptance of the null hypothesis. As in the previous design the average monthly return is negative in the reaction period, in this case for three of four portfolios. This can be compared against the anticipation period where the monthly returns are positive. Even though no statistical significance can be attached to this observation it may provide some basis for further research. This reaction period also includes the disclosure of the first quarter earnings and any negative reaction in this time period may be influenced by this initial disclosure of AFUDC, even though the disclosure is limited. In later sections of this chapter, further tests are performed that focus on just the first quarter.

5.3 Percentage AFUDC: Method I Firms Matched on EPS Forecast Error, Case B

This is a slightly different design from the design discussed in section 5.1. This case tries to eliminate any differences in mean monthly returns that may be due to differences in the EPS forecast error. As it was pointed out in Chapter 4, two distinct portfolios of method I firms are formed so as to match as closely as possible the EPS forecast error. The second step is to compare high percentage AFUDC portfolios versus low percentage portfolios. There were actually two portfolios for both high and low percentage AFUDC firms. This allows two separate univariate tests, which are essentially identical. Therefore, to prevent redundancy only one result is reported in Table 9. The results are entirely consistent with the preceding results given in Section 5.1. All the t-statistics are below the critical value and the null hypothesis can be accepted at the .10 level.

5.4 Percentage Change in AFUDC: Method I Firms Matched on EPS Forecast Error, Case B

This design is identical to the design given in Section 5.3 except the portfolios are formed on the AFUDC variable in a different way. Here the change in the AFUDC percentage rather than the absolute percentage is used to form portfolios. The results are given in Table 10. The results are again consistent with results given in Section 5.2 and 5.3. All the t-statistics are insignificant, implying acceptance of the null hypothesis at the .10 level.

Summarizing the tests to this point, there appears to be no basis for rejecting the null hypothesis, where the null hypothesis as briefly stated is as follows: there is no information content in AFUDC earnings as disclosed in the annual report among portfolios consisting of method I forms. Any information concerning AFUDC

Table 9

Percentage AFUDC:
Method I Firms Matched on EPS Forecast Error
Case B

Total Period 13 Months (Time = -6 to +6)

	Mean	σ	t
High Percentage	.0080	.019	.17
Low Percentage	.0067	.020	

7 Months (Time = -3 to +3)

	Mean	σ	t
High Percentage	.0070	.023	.18
Low Percentage	.0046	.025	

5 Months (Time = -2 to +2)

	Mean	σ	t
High Percentage	.0000	.028	.03
Low Percentage	.0005	.025	

Anticipation Period (Time = -6 to -1)

	Mean	σ	t
High Percentage	.0174	.019	-.21
Low Percentage	.0152	.020	

Reaction Period (Time = 0 to +6)

	Mean	σ	t
High Percentage	-.0026	.014	.24
Low Percentage	-.0006	.015	

Table 10

Percentage Change AFUDC:
Method I Firms Matched on EPS Forecast Error
Case B

Total Period 13 Months (Time = -6 to +6)

	Mean	σ	t
High % Change	.0059	.021	.09
Low % Change	.0066	.020	

7 Months (Time = -3 to +3)

	Mean	σ	t
High % Change	.0019	.024	.30
Low % Change	.0057	.025	

5 Months (Time = -2 to +2)

	Mean	σ	t
High % Change	-.0020	.026	.22
Low % Change	-.0009	.027	

Anticipation Period 6 Months (Time = -6 to -1)

	Mean	σ	t
High % Change	.0159	.019	.16
Low % Change	.0176	.019	

Reaction Period 7 Months (Time = 0 to +6)

	Mean	σ	t
High % Change	-.0012	.011	.16
Low % Change	-.0025	.017	

earnings, that is, whether a firm has higher or lower amounts of AFUDC or whether a firm decreases or increases the amount of net income represented by AFUDC is apparently of little value in assessing the future market returns for these firms. At least for differences between these method I firms for the time period, 1970-1977, the disclosure of AFUDC in the annual report is already impounded in the relative risk measure, beta. The beta of the firms in this sample apparently incorporates any information about AFUDC that may be of use in investors' judgment of future security returns. In this sense the market is efficient. AFUDC earnings are already reflected in stock values for method I firms or the process of adjustment to these earnings is too fast for investors to act on this information in a profitable manner.

5.5. Method I Low Percentage AFUDC Versus Method II

The following discussion is concerned with the differential market reaction to the two methods used for AFUDC. In the following designs, only one portfolio of method II firms can be formed, therefore this portfolio is used as a control portfolio in all future designs. Thus, the appropriate statistical test is the univariate t-test. The first hypothesis concerns a comparison of a method II firm with a matched groups of method I firms, where these firms contain low percentages of AFUDC. The results are contained in Table 11. A test of the mean difference for the total time period, T = -6 to T = +6, gives a t-statistic of -.25. The results for the anticipation sub-period, T = -6 to T = -1, and the reaction sub-period, T = 0 to T = +6 are consistent with the total period. The t-statistics are -.02 and -.43, respectively. All of these values are well within the limits needed for acceptance of the null hypothesis at the .10 level. As in the previous tests of method I firms, further tests are performed with the time period focusing more closely on the disclosure month. These results are similar to the above. The seven month period, T = -3 to T = +3, and the five month period, T = -2 to T = +2, result in t-statistics of -.21 and .02, respectively. Again, the null hypothesis can be accepted at a α significance level of .10. None of the time periods tested for these groups of firms, offer any evidence for rejection of the null hypothesis. In fact, a closer examination of Table 17 reveals the actual market return for method II firms is actually less than the actual market return for method I firms in four of five test periods. These differences are extremely small. Nevertheless, the direction may have some significance since the previous chapters imply method II firms' earnings are of higher quality and therefore the actual market return should be greater than the returns for method I firms.

Table 11

Low Percent Method I Versus Method II

Total Period 13 Months (T = -6 to T = +6)

	Mean	σ	t
II	.0067	.022	-.25
I Low % AFUDC	.0086	.017	
Anticipation Period (T = -6 to T = -1)			
II	.0181	.024	-.02
I Low % AFUDC	.0183	.017	
Reaction Period (T = 0 to T = +6)			
II	-.0031	.015	-.43
I Low % AFUDC	.0003	.014	
7 Months (T = -3 to T = +3)			
II	.0032	.027	-.21
I Low % AFUDC	.0059	.021	
5 Months (T = -2 to T = +2)			
II	-.0012	.031	.02
I Low % AFUDC	-.0016	.019	

5.6 Method I High Percentage AFUDC Versus Method II Firms

The next hypothesis compares method I firms containing high percentages of AFUDC with a portfolio of method II firms. It should be noted that the firms used to form either the high percentage portfolio or the low percentage portfolio are mutually exclusive. This, a completely different group of firms serves as the basis of comparison for the portfolio of method II firms. Therefore, these are separate tests even though the control portfolio is the same in all cases.

The test results are contained in Table 12. The thirteen month time period, T = -6 to T = +6, reveals results similar and consistent with the previous hypothesis. In this case the t-statistic is -.08. The average monthly returns for the anticipation sub-period, T = -6 to T = -1, are equivalent, thus the t-statistic is .00. The reaction sub-period, T = 0 to T = +6, gives a t-statistic of -.15. As in the previous cases, the average monthly returns for the reaction period are negative for both portfolios. This reaction period contains both the disclosure of first quarter earnings and annual earnings. The negative monthly returns while not significant may imply a small market reaction to this disclosure even though it is unclear which disclosure may be important. Further tests of the first quarter results are provided in a later section of this chapter.

Table 12

High Percent Method I Versus Method II

	Mean	σ	t-Value
Total Period 13 Months (T = -6 to T = +6)			
II	.0066	.022	-.08
I High % AFUDC	.0073	.020	
Anticipation Period (T = -6 to T = -1)			
II	.0183	.024	.00
I High % AFUDC	.0183	.021	
Reaction Period (T = 0 to T = +6)			
II	-.0034	.015	-.15
I High % AFUDC	-.0021	.016	
7 Months (T = -3 to T = +3)			
II	.0030	.027	.02
I High % AFUDC	.0027	.023	
5 Months (T = -2 to T = +2)			
II	-.0017	.031	-.07
I High % AFUDC	.0004	.027	

The tests of the two sub-periods of T = -3 to T = +3 and T = -2 to T = +2 reveals t-statistics of .02 and -.07, respectively. All of the t-statistics for this hypothesis imply an acceptance of the null hypothesis at a α significance level of .10. In fact, as in the previous case, the actual monthly returns for the method II portfolio is less than the method I portfolio in three of the five test periods. For this hypothesis and the previous hypothesis, there appears to be little evidence for rejection of the null hypothesis in favor of the alternative hypothesis. That is, there is no difference in actual monthly returns for a portfolio of method I firms containing either low percentages of AFUDC or high percentages of AFUDC in comparison with a portfolio of method II firms. The hypothesis of no information content for AFUDC earnings can be accepted.

5.7 Method I Positive Percentage Change AFUDC Versus Method II

The next two hypotheses compare method I firms that have changes in the percentage of AFUDC with method II firms. The author feels this procedure is perhaps the best design for testing the market reaction to the disclosure of AFUDC. This is due to the fact, that if AFUDC is important in the investors' assessment of the proper market valuation of these firms' common stock, any change in AFUDC should also be reflected in changes in common stock values. The first hypothesis concerns a comparison of method I firms, which have an increase in the percentage of net income represented by AFUDC, with method II firms. The results for this hypothesis are summarized in Table 13.

The first test is of the total time period, T = -6 to T = +6. The t-statistic in this case is -.17. The anticipation sub-period, T = -6 to T = -1 and the reaction sub-period, T = 0 to T = +6 give similar results. The t-statistics are .14 and -.53, respectively. These values indicate that the null hypothesis can be accepted at a α significance level of .10. The tests of T = -2 to T = +2, and T = -3 to T = +3 offer identical conclusions. The t-statistics are -.20 and -.03, respectively. The results indicate no significant market reaction to a change in the amount of net income represented by AFUDC. This is surprising in view of the fact that many firms had the percentage of net income represented by AFUDC change substantially during this test period. In fact, for a number of cases the percentages doubled or tripled from year to year.

Even though there is no statistically significant differences between the two portfolios, the biggest difference does occur during the reaction period when any market reaction to a change in accounting numbers may be expected to occur. The results here also confirm previous results that the average monthly return for method II firms is lower than the return for method I firms in three of the five time periods. This may have some significance.

Table 13

Positive Percent Change: Method I Versus Method II

Total Period 13 Months (T = -6 to T = +6)

	Mean	σ	t
II	.0065	.022	-.17
I Positive % Change	.0078	.015	
Anticipation Period (T = -6 to T = -1)			
II	.0149	.024	.14
II Positive % Change	.0134	.017	
Reaction Period (T = 0 to T = +6)			
II	-.0034	.015	-.52
I Positive % Change	.0002	.011	
7 Months (T = -3 to T = +3)			
II	.0029	.027	.03
I Positive % Change	.0026	.018	
5 Months (T = -2 to T = +2)			
II	-.0018	.031	-.20
I Positive % Change	.0016	.021	

If method II earnings are actually considered to be of superior quality when compared to method I earnings as previous chapters imply, then the results here do pose some question as to the underlying reason. One would not expect the method II portfolio to have an average monthly return less than the method I portfolio. This is especially true since the method I portfolio consists of a random selection of method I firms which would be different in each year. This difference cannot be attributed to a static group of method I firms. The firms change from year to year based on the criteria previously mentioned. Thus, though these differences are not statistically significant and fall well within the range for acceptance of the null hypothesis, the fact that the direction of the difference is the opposite of what theory may imply is interesting and perhaps a fruitful area for further research.

5.8 Method I Negative Percentage Change Versus Method II

The next hypothesis concerns a portfolio of method I firms, where those firms have a decrease in the percentage of net income represented by AFUDC, compared with a portfolio of method II firms. Again, if AFUDC does have some information content, a portfolio containing firms with changes in the amount of AFUDC compared to a portfolio composed of firms, where the amount of AFUDC is not relevant and therefore any changes in AFUDC should not be relevant, appears to offer best design for testing AFUDC.

The results are given in Table 14. The results of these tests on this hypothesis are consistent with the discussion of the previous hypothesis. The null hypothesis can be accepted at the .10 significance levels for all test periods. The total time period, T = -6 to T = +6, has a t-statistic of -.25. The anticipation sub-period, T = -6 to T = -1, again has the lowest t-statistic, -.03 and the reaction sub-period, T = 0 to T = -6, has the highest t-statistic, -.42. The two sub-periods which focus more closely on the disclosure date, T = -3 to T = +3, and T = -2 to T = +2 reveal similar results. The t-statistics are -.34 and -.21, respectively. There is no basis for rejection of the null hypothesis. There is no difference in average monthly returns between method I firms and method II firms when those firms have equivalent relative risks.

There may be some problem with using parametric tests on small samples. Siegel states non-parametric tests may be the appropriate statistical tests when the sample sizes for testing are $N \leq 6$.[1] Thus, the Walsh test is performed on the five-month sub-period. The results are identical to the parametric test.

5.9 <u>Tests of Quarterly Earnings Announcements</u>

The results are summarized in Table 15. These results are consistent and supportive of the null hypothesis, that is; there is no information content contained in the disclosure of AFUDC earnings. These results hold for both

Table 14

Negative Percent Change: Method I Versus Method II

Total Period 13 Months (T = -6 to T = +6)

	Mean	σ	t
II	.0066	.023	-.25
I Negative % Change	.0086	.019	
Anticipation Period (T = -6 to T = -1)			
II	.0180	.026	-.03
I Negative % Change	.0184	.018	
Reaction Period (T = 0 to T = +6)			
II	-.0032	.015	-.42
I Negative % Change	.0002	.016	
7 Months (T = -3 to T = +3)			
II	.0029	.027	-.34
I Negative % Change	.0075	.023	
5 Months (T = -2 to T = +2)			
II	-.0017	.031	-.21
I Negative % Change	.0020	.026	

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Table 15

1st Quarter Results

	Mean	σ	t-Value
Method II	-.022	.048	
Method I Negative % Change	-.0143	.046	
Difference	-.00786	.022	-.34
Method II	-.0227	.048	
Method I Positive % Change	-.0122	.043	
Difference	-.01027	.020	-.52
Method II	-.0228	.048	
Method I High % Change	-.0179	.050	
Difference	-.00497	.026	.19
Method II	-.0232	.047	
Method I Low % Change	-.0121	.049	
Difference	-.0059	.016	-.36
Method I High % Change	-.0219	.044	
Method I Low % Change	-.0217	.036	
Difference	.0033	.025	.13
Method I Low % Change	-.0145	.049	
Method I High % Change	-.0217	.048	
Difference	.0046	.027	.17

the comparison of method I firms with a similar group of method I firms differing only in the information variable, AFUDC, and for the comparison of method I firms with method II firms. Table 15 contains the mean and standard deviation for the sixteen monthly observations for both the treatment and control portfolio, as well as, the mean and standard deviation for the differences in the monthly returns. Also included is the t-statistic which is used to test whether the mean difference is statistically significantly different from zero.

A detailed discussion of these results would be redundant and add very little to any conclusions that might be inferred from the results on the annual reports. An examination of Table 21 reveals all the results on the first quarter disclosure are consistent with the results of the annual disclosure of AFUDC. In each case the null hypothesis can be accepted at the .10 level.

One additional observation should be discussed at this point. One may notice that the mean monthly returns, for the months of April and May, over this eight-year period were consistently negative in all cases. In fact in most cases the return averaged around negative 2%. As a point of reference the mean monthly return for the market index taken from the CRSP tapes were .0065 for these same months. Since, the monthly market return for the market index is quite small, it could be due to chance that the monthly return for utility stocks is negative in this eight year p

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period. On the other hand, the controversy that surrounds AFUDC and the disclosure of AFUDC in the first quarter may have some effect on the monthly return for all utility stocks in comparison with stocks in general. This is an empirical question that must wait for future research to answer. It certainly bears further scrutiny in light of the differences of opinion among followers of the electric utility industry concerning the use of AFUDC.

5.10 Summary

The results of this chapter offer no basis for rejection of the null hypotheses. As financial theory would indicate the semi-strong form of market efficiency implies that all publicly available information should be impounded in stock prices. Therefore, the equivalence of two portfolios' relative risks as measured by beta should imply the expected market returns are also equivalent. Any information content contained in the disclosure of AFUDC is already impounded in this risk assessment.

These results hold for comparisons of portfolios of method I firms. The results also are consistent for comparisons of method I and method II firms. Differences that in the past have been attributed to AFUDC earnings may in fact have been due to some other attribute, for example, differences in EPS forecast error. The conclusion here is that the market is efficient with respect to disclosure of AFUDC earnings. This does not imply that AFUDC does not affect the equity risk. It merely suggests the disclosure of AFUDC earnings is properly impounded in the systematic risk of a security as reflected in that security's beta.

CHAPTER 6

CONCLUSIONS AND SUMMARY

The idea of lower quality of earnings is shown to involve both the risk of future cash flows and the discrepancy between the income reported and the present value of the income stream actually received. A mathematical development first proposed by Johnson is used here to show why AFUDC earnings should actually be considered of lower quality when compared to other utility earnings. This development is also used to describe the differences between the present value of the cash flows reported by method I firms and those cash flows reported by method II firms. Briefly stated, for method I firms in the normal situation of no compounding interest, there is a discrepancy between the income reported in the annual reports and the present value of the income actually earned. In the competitive environment, the reporting of earnings should signal the market that the present value of the firm has increased by an identical amount. This is not true of AFUDC earnings in the electric utility industry. This is due to the fact that the income is reported in

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the current period, but it does not actually increase the value of the firm through additional cash flows until a much later date when the plant is completed and included in the rate base. Therefore, due to this time lag, method I firms report income in the current period that can be substantially greater in present value terms than the cash which is actually received by the firm in later periods.

Method II firms are different from method I firms in one aspect. The construction work-in-progress account is included in the rate base, which then earns the same rate of return as the firm's other assets. Method II firms then report an amount, equivalent to the increase in the present value of the firm, as income. For method II firms, no discrepancy exists between the income reported and the present value of the cash flows the firm actually receives. This leads to two observations.

First, an increase in the percentage of net income represented by AFUDC for method I may be viewed unfavorably by the market. Therefore, any increase in the absolute amount of AFUDC, if the percentage is held constant, may be viewed favorably. This is true because an increase in AFUDC implies higher cash flows at some later date compared to the situation where there is no AFUDC. Given the efficiency of security markets, there certainly may be some anticipation of future AFUDC amounts. However, finding the exact percentage of earnings represented by AFUDC may be quite difficult to forecast. This may be due to two reasons. The disclosure of AFUDC and the affects it may have on both the income statement and balance sheet are extremely limited and certainly unclear. In fact, as discussed in earlier chapters, two different researchers looking at the same set of numbers may draw different conclusions as to the affects AFUDC may have on the value of the firm.

Second, forecasting AFUDC percentages requires both a forecast of earnings from operations and a forecast of AFUDC earnings. Again, either or both forecasts may be wrong. The fact that two separate forecasts have to be made only compounds the chances of error in the final anticipated percentage. An examination of the percentages represented by AFUDC suggests substantial instability. The percentages change often and by large magnitudes. These two factors, which are difficulty in forecasting and difficulty of interpretation, indicate that unanticipated changes in AFUDC may be a factor in security valuation. The statistical design employed here is essentially a test of differences in mean monthly rates of return of portfolios. These portfolios were comprised of firms where each firm had similar attributes of the AFUDC variable. The firms within each portfolio were weighted so that the betas of the two portfolios in the matched pair were equivalent. The extensive empirical and theoretical literature concerning the efficient market hypothesis and the capital asset pricing model suggest portfolios with equivalent betas will have equivalent rates of return. The theory implies that only unanticipated changes or levels of AFUDC should cause some reaction from the security markets. The above observations hold for method I firms but they may not be true for method II firms for the following reason.

AFUDC earnings are the same as other utility earnings for method II firms. Therefore, any increase in the percentage of net income or an increase in the absolute amount of AFUDC may be viewed favorably by the market. The question of anticipating the percentage of earnings represented by AFUDC is a moot point since both sets of earnings are indentical. The question of anticipation is one of forecasting total earnings and is not one of forecasting AFUDC percentages. The above observations lead to the statistical designs developed in this research. The basic premise is that the market does not adequately anticipate changes in AFUDC and perhaps does not fully understand the difference between method I and method II firms. Preliminary attempts to forecast AFUDC have been abandoned due to the difficulties of formulating adequate forecasting models. Thus, the test results from the portfolios formed from the forecast model are not reported here due to the problems mentioned above. The results of these tests, even though few in number, show no statistical differences in market returns due to AFUDC.

The empirical tests consist of two basic strategies. The first concerns comparisons of monthly rates of return for only method I firms; the other examines method I firms in comparison to method II firms. Each strategy has two separate designs. The designs test for any information content in the disclosure of AFUDC numbers found in the company's financial statements. One design is concerned with tests of portfolios differing in the absolute percentages of income represented by AFUDC. In other words, high percentage firms are compared against low percentage firms. The second design examines firms with differences in the increases or decreases in the AFUDC percentages. The tests are concerned with any information content contained in AFUDC earnings and changes in AFUDC earnings which may be unanticipated.

If this information is useful to investors, changes in AFUDC levels may imply changes in the market valuation of electric utilities. The change in market valuation may be anticipatory or reactionary depending on the efficiency of investors' perceptions of this information. For this reason the test period is separated into two sub-periods, consisting of before and after the disclosure date.

The semi-strong form of the efficient market hypothesis indicates that any new information will be impounded rapidly in stock prices. In this research, new information may be considered any unanticipated changes in AFUDC levels. If there is no information content in the disclosure of AFUDC earnings, and if all other publicly available information

is already impounded in the market assessment of the systematic risk of these electric utilities, then the expected returns from the two portfolios of each matched pair should be equivalent.

Any significant difference between the market returns of portfolios, identical except for the specific attributes concerning AFUDC, should be the result of information contained in the disclosure of AFUDC which the market has not adequately anticipated. The market returns are calculated around this disclosure date, which is the date of public availability of the annual or quarterly reports. The empirical results presented in the first sections of Chapter Five, which are concerned with method I firms only, indicate that there is no information content in the disclosure of AFUDC. Apparently any information contained in AFUDC disclosure which might be used to assess market returns for securities is already impounded in the measure of systematic risk, beta, as financial theory indicates. This does not imply that AFUDC does not affect security risk. It merely suggests that if AFUDC affects security risk, it is already impounded in the beta. The results suggest there may be some slight reaction to this information as disclosed in the quarterly reports. However, the reaction is too small to develop any trading strategy which might use the disclosure of this accounting information to earn abnormal profits.

Tests of market rate of return differences between method I and method II firms yield similar conclusions. The market is apparently efficient in the assessment of the quality and risk of the earnings for these two groups of companies though no such distinction exists in the financial statements. The disclosure of these earnings apparently contains no information that may be used to judge market performance of method I firms relative to method II firms.

There is some evidence suggesting there are significant differences in rates of return between method I and method II firms. Upon closer examination, the differences may be attributed to another factor and are not a result of AFUDC disclosure. When tests are performed to separate the affect of total earnings changes from changes in AFUDC, the results indicate differences in rates of return may be due to the total earnings changes and not due to AFUDC. Failure to take into account this factor may have biased previous tests of AFUDC regarding method I and method II firms.

The research conducted here may have some implications for both accounting and rate-making. Through SEC and FERC pressure, the accounting profession has required more information concerning the disclosure of AFUDC. The information provided has changed over the time period examined here, apparently to the benefit of investors. Assume that the dominant, price-setting investors are the sophisticated investors who understand the nuances of utility accounting which includes AFUDC. Then, even though the disclosure of AFUDC is still minimal and there is no delineation of the differences between method I and method II firms, these investors are apparently not fooled by AFUDC earnings. Any information pertaining to AFUDC is impounded in the security risk measure, Beta. On the other hand, unsophisticated investors need only concern themselves with published Beta as a guide to future security returns. It is doubtful whether unsophisticated investors have both the time and technical skills necessary for an accurate understanding of the implications for market rates of return that AFUDC earnings disclosure might have. Again, this does not indicate that AFUDC does not affect security risk. It merely suggests enough investors understand any affects AFUDC might have on security risk; they price the securities properly; and they respond to any changes in AFUDC quite rapidly. Further disclosure of the practices concerning AFUDC may help unsophisticated investors better assess the security risk of electric utilities. However, the research done here implies the market is semi-strong efficient with respect to this information. Additional disclosure may be both unnecessary and an added cost that the utility's customers will eventually have to bear.

The rate-making implications are harder to assess. Evidence implies changes in rates of return for method I firms is not significantly different from method II firms. A hypothesis is now presented which may account for these findings: the market treats all firms as if they use the method I approach and method I earnings have been shown to be of lesser quality. Thus, method II firms are penalized and since they comprise only a small minority of the firms in this industry, they become lost in the confusion and controversy surrounding AFUDC.

The solution may be twofold. One, since the cash implications to the firm are greatly improved by using the method II approach, the regulatory agencies should allow all firms to use method II. Secondly, there should be a concerted effort to educate investors about the method II approach being utilized and to convince the investors that method II AFUDC earnings are exactly equivalent to all other utility earnings in their cash flow implications. This approach will, at the very least, stop all the arguments about AFUDC earnings quality which as acted as a detriment to the market valuation of these companies over the last fifteen years.

In summary, the primary question this study addresses is whether there is any information contained in the disclosure of AFUDC, which may be unanticipated, and therefore of use to investors in properly adjusting to changes in common stock values. In conclusion, there is no information contained in the disclosure of AFUDC as stated in the financial statements. Apparently, any information concerning AFUDC has already been impounded in security risk measures. The disclosure in the financial statements furnishes no additional information.

No information content may be the result of any of the following reasons. First, security analysts may be privy to information concerning AFUDC before the disclosure in the financial statements. They use this information to perfectly forecast any AFUDC and the effects AFUDC may have on market valuation. Second, AFUDC may be totally ignored by the market. The market considers AFUDC earnings worthless and therefore ignores AFUDC in the assessment of market valuation. Third, AFUDC earnings are considered the same quality as other utility earnings. Therefore, the disclosure of AFUDC and any changes in AFUDC are considered to be the same as other utility earnings. The results given in Chapter Five support the conclusion that changes in earnings are significant and used by investors to reassess market value. Since this effect was eliminated in examining AFUDC earnings, then differences in AFUDC earnings should have no market reaction or change in market valuation.

The evidence and theoretical justification presented in previous chapters indicates, there is some quality differential. Therefore, the author must conclude that the first premise given above is the most logical and reasonable result of no information content to AFUDC earnings. That is, sophisticated investors are able to perfectly forecast AFUDC and there is no unanticipated information which the market may use to reassess market valuation.

6.2 Limitations of Research

Two primary limitations can be identified. First, the use of monthly data may not have been appropriate especially since the reaction to the disclosure may have been in terms of days, not weeks.[1] Since a number of other factors may affect stock returns during monthly intervals, daily intervals may allow a closer examination of the event under study.

Secondly, tremendous changes in the environment in which electric utilities operate may have obscured and overwhelmed any differences that may have been due to AFUDC. A number of factors may have affected the results. These factors include the oil embargo, the rapid rise in oil prices, and the increased controversy over nuclear power in the later 1970's. The problems stated above may have affected some utilities quite differently. For example, electric utilities that heavily relied on either oil, nuclear power, or both may have suffered declines in market value during this time period of increasing consumer awareness regarding these issues.

Another problem is the volatile and rapid rise in interest rates which affected how and when utilities financed their huge capital outlays for new plants. The militancy of consumers within a state and the attitudes of the public service commissions also may have affected utility

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values. For example, the problem of regulatory lag differed from state to state.

All of these problems certainly affected utilities' risk, the market perception of that risk and therefore, the values the market places on these firms. Given that the problems were ever changing, shifts in the market perceptions regarding which problems were most important for a particular utility could certainly have affected market risk and therefore, market value. For these reasons, the tests performed here did not focus on market risk as a static quality which may have been affected by policies concerning AFUDC. Too many other factors may have affected market risk to attribute any differences to AFUDC. Instead, every attempt was made to hold market risk constant and then to form portfolios in such a way as to isolate any information content that may be the result of solely AFUDC disclosure. Nevertheless, a problem arises in that the researchers can never be sure that the examination of AFUDC disclosure is not biased by some other factor.

6.3 Areas for Future Research

One area for future research has already been suggested in Chapter Five; a closer examination of the quarterly earnings announcements using daily return data may be beneficial. This is different from the research done here in that only daily returns around the disclosure of the quarterly reports is examined. Quarterly reports may give the first indication of what AFUDC may be in relation to other utility earnings. The use of daily returns would allow an examination of a time period more closely centered around the disclosure of this information. The problem does arise, however, in attributing any market reaction in the daily return figures to the disclosure of AFUDC. A number of factors first disclosed in the quarterly reports may influence daily returns.

A second possible area of research is to develop a model based on cash flow Betas and try to isolate and quantify the effects of AFUDC earnings on the systematic or unsystematic cash flows for a firm. This may be further refined by separating the portion of AFUDC attributed to debt and the portion attributed to equity into two distinct cash flow components.

A third area to be contemplated is the possible adaption of Bowen's valuation model for AFUDC earnings.[2] The firms can be separated into groups of method I and method II. Then the model can be used to examine whether or not method II earnings are actually valued differently by the market.

Footnotes

[1]Stewart Brown, "Earnings Changes, Stock Prices, and Market Efficiency," The Journal of Finance, (March, 1978), pp. 17-28 and Ronald W. Masulis, "The Effects on Capital Structure Change on Security Prices," Journal of Financial Economics, (May, 1980), pp. 139-177.

[2]Robert M. Bowen, "Valuation of Earnings Components in the Electric Utility Industry," The Accounting Review, Vol. 56, No. 1, January, 1981, pp. 1-22.

APPENDICES

APPENDIX A: EMPIRICAL TESTS OF PRICE EARNINGS RATIOS AND MARKET-TO-BOOK RATIOS

This appendix contains both a description of the non-parametric tests, their advantages and limitations, and a replication of Johnson's work on P/E ratios and market-to-book ratios. Since Johnson's work on the difference between method I and method II firms is one of the very few works on this specific topic, it was thought beneficial to replicate his work using more current data.

The non-parametric test used here is the Wilcoxon Rank Sum test. The advantage of any non-parametric test is that no assumption is made about the underlying distribution. Therefore, statistical tests can be performed on distributions which are not normally distributed. Second, instead of comparing the mean or standard deviations of two samples using the t-test or F-test, the order relations among observations in a set of data can be tested.[1] The only assumptions needed for a non-parametric test is that the observations are independent and the variable under study must be continuous.[2] A distinct disadvantage of non-parametric tests is that they are not as powerful as the parametric tests. The Wilcoxon Rank Sum test for the sample sizes used here has a power efficiency of 95 percent. It is therefore an excellent alternative of the t-test.[3] A short discussion of the types of errors in statistical hypothesis testing will make power and power efficiency more understandable.

There are two types of errors in hypothesis testing. Type I error, represented by the α level, is the probability of rejecting the null hypothesis when it is in fact true. Type II error, represented by β, is the probability of accepting the null hypothesis when it is in fact false. The higher the α level the higher the probability of falsely rejecting the null hypothesis. A α level equal to .10 means there is a 10% probability of rejecting the null hypothesis when it is true. In the context of this study, the null hypothesis can be stated as follows; there is no difference between the market valuation of firms where valuation is represented by either the P/E ratio or market-to-book ratio. Since the research here is primarily designed to discover any differences between the market valuation of method I and method II firms, a small α level appears desirable. Type II error is also important in the context of this design. Type II error is the probability of accepting that there is no difference in market valuation between these two groups of firms when there actually is a difference. The relationship between power and type II error can now be stated. Power is equal to 1-probability of Type II error. Therefore, the power of a test can then be defined as the probability of rejecting the null hypothesis when it is in fact false. Of course, this is exactly what any researcher would hope to do, therefore the researcher will strive to maximize the power of his test. The use of non-parametric tests may then create a problem since these tests are not as powerful as the parametric tests. The non-parametric test used here has a power efficiency of 95 percent. This implies that there is an increasing danger of rejecting the hypothesis of no market valuation when there actually is no difference in market valuation. Referring to the results given later in this section, the α levels for the acceptance of the null hypothesis are quite high, it then appears safe to conclude that there is no difference in the market valuation between method I and method II firms. Johnson's study on the other hand used α levels of .074 and .123 for the P/E ratio and market-to-book ratio, respectively, to reject the null hypothesis. The α levels appear quite high given the fact that these tests are less powerful than parametric tests. Most significant results in statistical testing are reported at levels of .10 or less for parametric tests. Johnson's results do not appear to be highly significant given the high α levels and the nature of the statistical tests. Therefore, further tests on a different time period using the same statistical procedure may offer additional insights into the relationships of market valuation between these two methods of accounting for AFUDC.

The results of the statistical tests in the research, which are presented here, are not consistent with Johnson's work. The null hypothesis given here; there is no difference in total market valuation, where this valuation is represented by the P/E ratio or the market-to-book ratio between method I and method II firms, can be accepted at the .15 significance level. These calculations are presented in Table 21. This procedure does differ from Johnson's in two ways. First, the sample of companies is different. A slightly different group of method I firms is used as the basis for testing. Also, three companies are added to the method II group. Second, the time period used here was 1968-1977, not 1965-1974 as in Johnson's work. Even though the results are not the same, the only conclusions the author may offer can only be inferred to the specific sample and time period of this study. No such conclusions can be inferred to a different sample or to other time periods. That is, any conclusions that may be offered from this research cannot be associated with Johnson's sample and time period. A number of factors are now presented which may account for the different conclusions.

The period of 1968-1977 was substantially different from 1965-1974. The 1968-1977 period included the oil crisis, and a severe recession then followed by extremely high interest rates. Any one of these occurrences and especially the combination of these factors may have affected the electric utility industry and the market value of electric utilities during this period in a very different fashion than Johnson's test period. A number of corollary factors may have reacted with these economic events to submerge any differences between method I and method II due to AFUDC. A strong case can be made that these factors affected electric utilities and thereby biased any results using P/E ratios and market-to-book ratios. These factors include; the proportion of a firm's generating capacity supplied by oil versus other sources. The oil embargo may have affected firms with high proportions much differently during this time period as opposed to Johnson's testing period. The capital structure of the firms in each group. Differences in capital structure may affect the market valuation of firms, particularly during a severe recession and periods of extremely high interest rates. Different areas of the country, fast growth areas versus slow growth areas, may effect any value the market places on these firms. The fact that no attempt was made to equalize any of these factors between the two groups of firms may have biased these statistical tests. Finally, a factor of major importance during a period of high and rising inflation rates is the concept of fair value rate base.

A large proportion of firms that use fair value rate base as opposed to a low percentage could influence the results. The method I group contained eleven firms or about 25%, which used fair value rate base. While the method II group contained only 1 firm. During a period of high inflation you would expect firms that use the fair value rate base for revenue determination to be valued higher than firms that use book value. Fair value rate base refers to the concept of using the current or replacement cost of the assets in the rate base. In practice this current or replacement cost of the assets may be quite different from state to state depending on the views of the public service commission in each state. Nevertheless, the fair value rate base will be higher than the historical cost rate base. Therefore, since an utility is allowed to earn some rate of return times its rate base, a higher rate base due to using fair values would allow that utility to collect more revenues from consumers. In the context of this study, a higher proportion of firms in the method I group using fair value rate base should bias their market valuation upward compared to method II firms. Yet, Johnson still found the total market value of method I firms to be lower than method II firms.

The level of significance was .07 and .12 for the P/E ratios and market-to-book ratios, respectively. The time period for this study, 1968-1977, had much higher inflation rates in the later years. Then it may not be surprising to find that the average market value of method I firms moved up relative to method II firms, since a much higher proportion of method I firms were allowed to use fair values for their rate base. Also, any factor or some combination of factors mentioned previously may have caused this same upward movement. Therefore, the acceptance of the null hypothesis at the .15 level seems to be consistent with a number of factors existing during this time period that were not apparent during the 1965-1974 time period.

The actual calculations and test results are contained in Table 21. The market-to-book ratios, P/E ratios, and the ranking for both method I and method II firms are also provided in Tables 16 to 19. Each ratio is an average of ten years from 1968-1977. The data was taken from the Compustat tapes. The market prices used to calculate the ratios were end of the year prices. It is felt that there could be better techniques for calculating these ratios, perhaps using some average of the market prices over the year. But all firms had year-end prices readily available on the Compustat tapes and therefore all calculations were then internally consistent. For purposes of comparison between groups of firms, it was thought these year-end prices would serve as good surrogates for the "true" P/E ratio or market-to-book ratio. Also, to be consistent with respect to the replication of Johnson's work, the same method of calculating these ratios was performed.

The specific null hypothesis: there is no difference in market value, where market value is represented by the P/E ratio or the market-to-book ratio can be accepted at the α significance level of .15. In fact the exact probabilities are .19 and .40 for P/E ratios and market-to-book ratios, respectively.

Table 20 provides some summary statistics relating to the market-to-book ratio and P/E ratio for both method I and method II firms in the years 1970-1977. It also provides a measure of risk, the standard deviation of monthly market returns in each year. An examination of the table does not reveal any major differences in any of these measures between method I and method II firms. Included in the table is the standard deviation for each year and ratio. An examination of these standard deviations reveals that there is a substantial range among firms in each group for any of the measures given here. Overall, though, there does not appear to be any evidence for differences between method I and method II firms. There is no reason to conclude that method I firms are valued differently than method II firms.

Table 16

Market-to-Book Ratio for Method I Firms

	Mkt/Book
Arizona Public Service Co.	1.105
Boston Edison	1.09
Carolina Power	1.51
Central Illinois Light Co.	1.202
Central Illinois Public Service	1.474
Central Maine Power	1.14
Cincinnati Gas & Electric	1.58
Cleveland Electric Illuminating	2.315
Columbus & Southern Ohio Electric	1.24
Commonwealth Edison	1.499
Duke Power Co.	1.38
Eastern Utilities Co.	1.235
Florida Power & Light	2.77
Florida Power Co.	1.847
Hawaiian Electric Co.	1.312
Idaho Power	1.327
Indianapolis Power & Light	1.520
Iowa Electric Light & Power	1.169
Iowa-Illinois Gas & Electric	1.167
Iowa Power & Light	1.249
Iowa Public Service	1.118
Missouri Public Service	1.526
Montana Power	1.50
Northern Indiana Public Service	1.713
Nevada Power	1.369
New England Electric Co.	1.078
Northeast Utilities Co.	1.161
Northern States Power	1.335
Ohio Edison	1.599
Pennsylvania Power & Light	1.152
Philadelphia Electric Co.	1.131
Portland General Electric	1.168
Public Service of Indiana	2.55
Puget Sound Power & Light Co.	1.906
San Diego Gas & Electric	1.353
Sierra Power Co.	1.346
Southern California Edison	1.056
Southern Indiana Gas	2.720
Tampa Electric	1.988
Tucson Gas & Electric	1.391
Union Electric	1.203
United Illuminating	1.183
Utah Power	2.225
Washington Water Power	1.131
Wisconsin Electric Power Co.	1.085

Table 17

Market-to-Book Ratios for Method II Firms

	Mkt/Book
Atlantic City	1.433
Baltimore Gas	1.224
Consumers Power	1.125
Delmarva Power	1.355
Gulf States	1.733
Kentucky Utilities	1.1487
Public Service of Colorado	1.308
Savannah Electric	1.189
South Carolina Electric & Gas Co.	1.579
Southwestern Public Service	2.095
Virginia Electric & Power Co.	1.398

Table 18

P/E Ratio for Method I Firms

	P/E
Arizona Public Service Co.	10.792
Boston Edison	10.825
Carolina Power	14.329
Central Illinois Light Co.	10.523
Central Illinois Public Service	10.916
Central Maine Power	10.715
Cincinnati Gas & Electric	11.623
Cleveland Electric Illuminating	11.122
Columbus & Southern Ohio Electric	10.570
Commonwealth Edison	11.988
Duke Power Co.	13.056
Eastern Utilities Co.	11.227
Florida Power and Light	14.08
Florida Power Co.	13.998
Hawaiian Electric Co.	11.885
Idaho Power	12.137
Indianapolis Power & Light	10.838
Iowa Electric Light & Power	10.788
Iowa-Illinois Gas & Electric	9.597
Iowa Power & Light	9.94
Iowa Public Service	10.014
Missouri Public Service	10.428
Montana Power	11.908
Northern Indiana Public Service	11.909
Nevada Power	11.575
New England Electric Co.	10.337
Northeast Utilities Co.	10.237
Northern States Power	10.583
Ohio Edison	11.576
Pennsylvania Power & Light	9.777
Philadelphia Electric Co.	10.865
Portland General Electric	9.977
Public Service of Indiana	12.983
Puget Sound Power & Light Co.	9.89
San Diego Gas & Electric	10.744
Sierra Power Co.	11.76
Southern California Edison	10.213
Southern Indiana Gas	9.476
Tampa Electric	15.28
Tucson Gas & Electric	11.080
Union Electric	10.520
United Illuminating	9.637
Utah Power	10.103
Washington Water Power	10.762
Wisconsin Electric Power Co.	10.915

Table 19

P/E Ratios for Method II Firms

	P/E
Atlantic City	11.606
Baltimore Gas	10.405
Consumers Power	10.857
Delmarva Power	11.077
Gulf States	13.465
Kentucky Utilities	10.058
Public Service of Colorado	10.896
Savannah Electric	10.238
South Carolina Electric & Gas Co.	12.523
Southwestern Public Service	13.029
Virginia Electric & Power Co.	11.25

Table 20

Market-to-Book, P/E Ratio and Standard Deviation of Monthly Returns

Year	I						II					
	Mkt/Book		Std. Dev.		P/E		Mkt/Book		Std. Dev.		P/E	
	$\bar{\bar{x}}$	σ	$\bar{\bar{x}}$	σ	$\bar{\bar{x}}$	σ	$\bar{\bar{x}}$	σ	$\bar{\bar{x}}$	σ	$\bar{\bar{x}}$	σ
1970	1.66	.613	7.16	1.44	12.25	2.08	1.74	.77	5.45	2.12	12.63	1.74
1971	1.69	.645	8.67	1.26	12.77	2.04	1.76	.88	7.11	2.29	12.96	1.92
1972	1.54	.549	5.05	1.75	12.28	2.47	1.61	.83	5.41	2.23	12.26	1.57
1973	1.45	.432	4.51	1.41	11.06	1.51	1.50	.85	9.20	20.00	11.24	1.78
1974	1.049	.38	5.48	2.03	8.53	1.92	1.00	.23	5.51	23.31	8.56	1.33
1975	.695	.325	7.59	1.79	5.68	1.83	.65	.24	8.27	2.76	6.32	1.16
1976	.987	.311	9.26	2.60	8.03	1.58	.91	.25	9.59	2.32	7.76	1.30
1977	1.13	.365	4.80	1.16	8.97	1.21	1.03	.26	4.79	1.64	8.94	1.26

Table 21

Calculations for P/E Ratios and Market-to-Book Ratios

Let T_1 = Σ ranks

N_1 = number of firms in group 1

N_2 = number of firms in group 2

$$U = N_1 \cdot N_2 + \frac{N_1(N_1+1)}{2} - T$$

$$\sigma_u^2 = \frac{N_1 \cdot N_2(N_1 + N_2 + 1)}{12}$$

$$E(U) = \frac{N_1 \cdot N_2}{2}$$

For P/E ratios

$T_1 = 356$

$$U = 11.45 + \frac{11+12}{2} - 356 = 205$$

$$E(U) = \frac{11 \cdot 45}{2} = 247.5$$

$$\sigma_u^2 = \frac{11 \cdot 45(11+46)}{12} = 2351.2$$

$\sigma_u = 48.5$

$$Z = \frac{E(U)-U}{\sigma_u} = \frac{205-247.5}{48.5} = .876 \quad \text{Probability } .19$$

For Market-to-Book Ratios

$T_1 = 325$

$$U = 11.45 + \frac{11+12}{2} - 325 = 236$$

$E(U) = 247.5$

$\sigma_u = 48.5$

$$Z = \frac{236-247.5}{48.5} = .237 \quad \text{Probability} = .40$$

Footnotes

[1]William L. Hays, Statistics for the Social Sciences, 2nd Ed., New York, Holt Rinehart and Winston, Inc., pp. 760-765.

[2]Sidney Siegel, "Non-Parametric Statistics, New York, McGraw-Hill, 1956, p. 31.

[3]Ibid., p. 126.

APPENDIX B: EARNINGS CHANGES AND EFFECTS ON STOCK RETURNS

A final test design is utilized here to provide some evidence on earnings changes in the electric utility industry. This test provides some evidence that the changes in earnings from year to year may influence the market value. This test also provides evidence that differences in market values attributed to differences in AFUDC may in fact be due to some other variable. This design is a comparison of method I firms which have large percentage changes in earnings from year to year with method II firms. The procedure is as follows:

1) Calculate the percentage change in total earnings from T to T+1 for all firms. Let E_T be total earnings in year T and E_{T+1} be total earnings in year T+1. The percentage change is calculated as $\frac{E_{T+1}}{E_T} - 1$.

2) Split each of the two groups (method I and method II) into two portfolios. One portfolio contains firms with high positive percentage changes in earnings and the other portfolio contains firms with low negative percentage changes in earnings. Since there is only a limited number of method II

firms, portfolios were formed with only about seven firms in each portfolio. The number of firms varies slightly each year depending on the number of firms which have increases in earnings and how many have decreases. The method I portfolios are constrained to include only ten firms with the largest percentage changes, either positive or negative.

3) Equate the relative risks for each set of treatment and control (method II) portfolios as in previous procedure. This effectively rebalances and weights the portfolios each year.

4) The statistical tests and the process that generates the monthly returns is now similar to the previously discussed designs. The univariate and multivariate forms of the t-test will be used to test for differences in mean monthly returns.

Table 22 gives the results for this hypothesis. In this case, there exists a 2x1 vector of mean returns which can be tested using Hotelling's T^2. The first element of the vector is a comparison of firms with increases in earnings from year to year. The second element is a comparison of firms with decreases in earnings from year to year. There are then two matched pairs which can be tested simultaneously using Hotelling's T^2. The time period, T = -6 to T = +6, which is an examination of the total time period has an T^2-value of 74.92. The anticipation sub-period,

Table 22

Percentage Change in Annual Earnings:
A Comparison Between Method I and Method II Firms

Total Period (T = -6 to T = +6) 13 Months

	Mean	σ	t-Value	T^2-Value
Positive % in Earnings I	.0052	.020	-.10	74.92
Positive % in Earnings II	.0060	.022		
Negative % in Earnings I	-.0677	.016	-10.34	
Negative % in Earnings II	.0073	.021		
Anticipation Period (T = -6 to T = -1)				
Positive % in Earnings I	.0146	.024	-.32	30.61
Positive % in Earnings II	.0187	.021		
Negative % in Earnings I	-.0667	.019	-6.49	
Negative % in Earnings II	-.0152	.024		
Reaction Period (T = 0 to T = +6)				
Positive % in Earnings I	-.0029	.012	.820	114.36
Positive % in Earnings II	-.0049	.019		
Negative % in Earnings I	-.0685	.014	-8.56	
Negative % in Earnings II	.0006	.016		

Critical Values of the t-Distribution, α = .01

t,12 = 2.681
t,6 = 3.143
t,5 = 3.365

T = -6 to T = -1, and the reaction sub-period, T = 0 to T = -6, have similar results. The T^2 values are 30.61 and 114.36, respectively. These values imply that the null hypothesis, of no differences between method I and method II, can be rejected at the .01 level.

Once the null hypothesis has been rejected, further univariate tests can be performed to examine more closely why these differences do exist. The tests are two independent T-tests are each matched pair. The first test examines whether there is any difference between method I and method II firms, when those firms have increases in earnings. The t-test is performed on each of the time periods, T = -6 to T = +6, T = -6 to T = -1, T = 0 to T = +6. The t-statistics are -.10, -.32, and .82, respectively. These values imply the null hypothesis of no differences can be accepted at the .10 significance level. This may not be surprising given the nature of utility regulation. Increases in earnings for a utility are constrained on the upper limit by the rate of return an utility is allowed to earn. Any increase in earnings may be apparent long before the annual reports are issued. In fact, a close examination of the commission hearings, where rate increases are approved, may allow investors to formulate and therefore anticipate any increase in revenues and earnings. If there are no vast differences among firms based on the percentage increase in earnings, then no difference in market returns may be expected. In the context of this study, the author proposes that earnings which contain a large component of inferior quality earnings (method I AFUDC earnings) may imply that the increase in earnings is actually different than reported. Therefore, one might expect a portfolio of method I firms to have market returns less than a portfolio of method II firms. At least for increases in earnings, this is apparently false. The market values are not significantly different.

The second univariate test examines if there is any difference between portfolios of firms which have decreases in earnings. The results in this case are highly significant. The time period, T = -6 to T = +6, has a T-statistic of -10.34. The anticipation sub-period, T = -6 to T = -1, and the reaction sub-period, T = 0 to T = -6, have T-statistics of -6.49 and -8.56, respectively. All these values imply the null hypothesis of no differences between method I and method II firms, can be rejected at the .01 level. At first glance a researcher may be tempted to explain this significance as resulting from differences in AFUDC earnings between method I and method II firms. But since all other tests have shown non-significant results, perhaps some other explanation is necessary.

This design made no attempt to match firms on the percentage decrease in earnings. Also, no attempt was made to ensure that the average percentage change for each portfolio was equivalent. Since utilities are regulated then any increase in earnings may not only be anticipated but it might also be expected to fall within a narrow range for most utilities. The same may not be true of decreases in earnings. In fact, decreases in earnings may be both unanticipated and widely disparate. This disparity may be expected to be wider for a larger group of firms. The method II group has a very limited number of firms, consequently the range of percentage changes in earnings may not be as large as for method I firms. Since only method I firms with the largest decrease in earnings were chosen for that portfolio, one may expect to have more firms with larger decreases in earnings in this group than in the method II group. This may account for the significant results obtained in this case. Perhaps there may be other reasons. The point being, a design that does not properly account for other information may imply significant results when there are none.

These results are not presented here as evidence opposing the large number of tests discussed earlier. Rather, they are presented here as evidence showing that significant results implying differences between the market valuation of method I and method II firms may be due to some confounding variable that has not been controlled in the design. The experimental design discussed earlier is an attempt at eliminating any bias which may influence the results. Once this has been done, one finds that there is no significant information content to the disclosure of AFUDC earnings. Apparently, the market is efficient, that is, the beta correctly anticipates and reacts to AFUDC earnings some months before the actual disclosure.

Footnotes

[1]Sidney, Siegel, "Non-parametric Statistics," McGraw-Hill, New York, N.Y., 1956.

[2]The non-parametric test was again performed for the sub-period, T = -2 to T = +2. The results are consistent with the parametric tests. In fact there may be some disagreement whether the data does meet the assumptions needed for a parametric test. The principal criticism may be that the mean monthly returns are not normally distributed. For this reason the author has verified with the appropriate non-parametric tests the results given here. The results are consistent with parametric results. Any results for any of the test periods which are not consistent will be discussed in this chapter.

[3]Siegel, p. 10.

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